Final Groundwater Feasibility Study Nosedocks/Apron 2 Chlorinated Plume

Former Griffiss Air Force Base
Rome, New York

August 2006

FINAL

Groundwater Feasibility Study
Nosedocks/Apron 2 Chlorinated Plume
Former Griffiss Air Force Base
Rome, New York

Revision 1.0

August 2006

Contract No. W912DQ-06-D-0012

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LIST OF ACRONYMS AND ABBREVIATIONS

ACL	Alternate Concentration Limits
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFRPA	Air Force Real Property Agency
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
AS	Air Sparging
AWQC	USEPA Ambient Water Quality Criteria
bgs	below ground surface
BMP	Bimetallic Particle
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	contaminant of concern
CSM	Conceptual Site Model
CLU-IN	USEPA Hazardous Waste Clean-Up Information
DCE	dichloroethylene/dichloroethene
DO	dissolved oxygen
DOD	Department of Defense
DOT	Department of Transportation
E&E	Ecology and Environment, Inc.
EPR	Enhanced Passive Remediation
ERP	Environmental Restoration Program
FPM	FPM Group, Ltd.
FS	Feasibility Study
FRTR	Federal Remediation Technologies Roundtable
gpd	gallons per day
GRA	General Response Action
GWRTAC	Groundwater Remediation Technologies Analysis Center
H_2O_2	hydrogen peroxide
HRC®	Hydrogen Release Compound
IC	Institutional Controls
IRP	Installation Restoration Program

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

ISCO	In-Situ Chemical Oxidation
Kd	soil-water partition coefficient
Koc	organic carbon partition coefficient
$KMnO_4$	potassium permanganate
LCP	lateral control pit
LTM	long-term monitoring
LUC	Land Use Control
MCL	Maximum Contaminant Level
MCLG	MCL Goals
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation
MnO_2	manganese dioxide
MTBE	methyl tert-butyl ether
NAPL	non-aqueous phase liquids
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NYCRR	New York Environmental Conservation Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and Maintenance
ORC®	Oxygen Release Compound®
ORP	oxygen-reduction potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
OWS	oil/water separator
PAH	polynuclear aromatic hydrocarbons
PEER	PEER Consultants, P.C.
PEL	Permissible Exposure Limit
PRB	Permeable Reactive Barrier
PSI	pounds per square inch
QC	quality control
RACER	Remedial Action Cost Engineering and Requirements
RAO	Remedial Action Objective
RBC	risk based concentration

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

RCRA	Resource Conservation and Recovery Act of 1976
REACHIT	Remediation and Characterization Innovative Technologies
RI	Remedial Investigation
RO	reverse osmosis
ROD	Record Of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SCG	New York State Standards, Criteria and Guidelines
SDWA	Safe Drinking Water Act
SI	Supplemental Investigation
STARS	Spill Technology and Remediation Series
SVE	Soil Vapor Extraction
TAGAM	Technical and Administrative Guidance Memorandum
TBC	to be considered
TCE	Trichloroethene
TDS	total dissolved solids
TLV	Threshold Limit Values
TOC	total organic carbon
TOGS	Technical and Operational Guidance Series
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VC	Vinyl Chloride
VISITT	Vendor Information System for Innovative Treatment Technologies
VOC	volatile organic compound
µg/L	micrograms per liter

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1 INTRODUCTION

FPM Group, Ltd. (FPM) and Ecology and Environment Engineering, P.C. (EEEPC), under contract with Parsons Infrastructure and Technology Group, Inc., has prepared this Feasibility Study (FS) for the purpose of selecting remedies for cleanup of chlorinated hydrocarbon groundwater contamination which is associated with the Griffiss AFB Aprons Site located at the former Griffiss Air Force Base (AFB) in Rome, New York (see Figure 1-1). The chlorinated groundwater contamination at the Griffiss AFB Aprons Site consists of dissolved chlorinated hydrocarbons in the vicinity of the five Nosedocks and Apron 2 [primarily identified as trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC)]. The Nosedocks/Apron 2 Chlorinated Plume at the Griffiss AFB Aprons Site (Site1) is an Operable Unit (OU) of the On-Base Groundwater Area of Concern (AOC), also known as Installation Restoration Program (IRP) Site SD-52.

This FS report was prepared as part of the United States Air Force (USAF) IRP in accordance with the United States Environmental Protection Agency's (USEPA's) Guidance for Conducting Remedial Investigations and Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (EPA, 1988a); the New York State Department of Environmental Conservation's (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM) #4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC, 1990); the NYSDEC regulation 6 New York Environmental Conservation Rules and Regulations (NYCRR) Part 611, Environmental Priorities and Proecedures in Petroleum Cleanup and Removal (NYSDEC, 1998); and other applicable regulations and guidance documents. The purpose of the USAF IRP is to assess past hazardous waste disposal and spill sites at USAF installations and to develop remedial actions consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and/or other applicable regulatory remedial programs (e.g., NYSDEC spill response and remediation program) for sites that pose a threat to human health and welfare or the environment.

1.1 Purpose and Objectives of the FS

The purpose of this FS is to identify, develop, screen, and evaluate a range of remedial alternatives which address contamination at the Site. The FS is an iterative process that interacts with the Site Remedial Investigation (RI). As the FS develops, additional data gaps and field investigation requirements may be identified to complete the study. Unexpected findings may result in defining new tasks outside the original scope of work. The RI has already been completed for the Nosedocks/Apron 2 Chlorinated Plume Site (FPM, 2004) with continuing groundwater monitoring.

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1 The Griffiss AFB Aprons Site at the former Griffiss AFB includes the Nosedocks/Apron 2 Chlorinated Plume as well as other dissolved and free-product petroleum plumes that are, except at a few locations, distinctly separated from the chlorinated plume with minimal or no overlap. However, since the subject of this FS is only the Nosedocks/Apron 2 Chlorinated Plume, which can be considered for remediation independently of the other plumes without adverse impacts, therefore, for the purpose of this FS the definition of "Site"is limited to the chlorinated plume.

The overall objectives of the FS are to:

- Develop and evaluate a range of potential remedies that permanently and significantly reduce the risks resulting from Site contamination to public health, welfare, and the environment;

- Perform a detailed analysis of the remedial alternatives and select a cost-effective remedial action alternative that mitigates the threat(s); and

- Achieve consensus among the USAF, USEPA, NYSDEC, the public, and local authorities regarding the selected response action and the concurrence of USEPA in the case of NPL sites.

The purpose of this FS report is to document the basis and procedures used in conducting the FS. The primary objective of this report is to provide USAF, USEPA, and NYSDEC with sufficient data to select a feasible and cost-effective remedial alternative that protects public health and the environment from the potential risks posed by contamination in groundwater, soils, surface water, and sediments associated with the Site.

1.2 Organization of the FS Report

This FS report is comprised of six (6) sections as described below.

Section 1.0 (Introduction), includes a statement of the primary objective of this report and defines the evaluation criteria used.

Section 2.0 (Environmental Setting), provides a summary of site background information including the site environmental setting and physical characteristics of the study area, and site description, history, previous source removal/remedial actions, and current groundwater contamination conditions. Drawings depicting current boundaries of the groundwater contamination plumes (as prescribed by the NYSDEC Class GA groundwater standards) and tables containing groundwater monitoring well data and plume delineation data are also included.

Section 3.0 (Identification of Site-specific Applicable or Relevant and Appropriate Requirements [ARARs] and To Be Considered requirements [TBCs]), discusses the regulatory impetus for the FS and presents the potential Site ARARs and TBCs. This section also establishes the Remedial Action Objectives (RAOs) and cleanup goals, and compares the maximum contaminant concentrations within given plumes with preliminary screening levels for groundwater cleanup, which are identical with the NYSDEC Class GA groundwater standards. Site risk assessments were prepared for the Nosedocks/Apron 2 Chlorinated Plume AOC during the RI (FPM, 2004); however, the risks estimated under the RI are not used in the current document to set cleanup goals or to identify contamination extent, as this is adequately addressed by ARARs and TBCs.

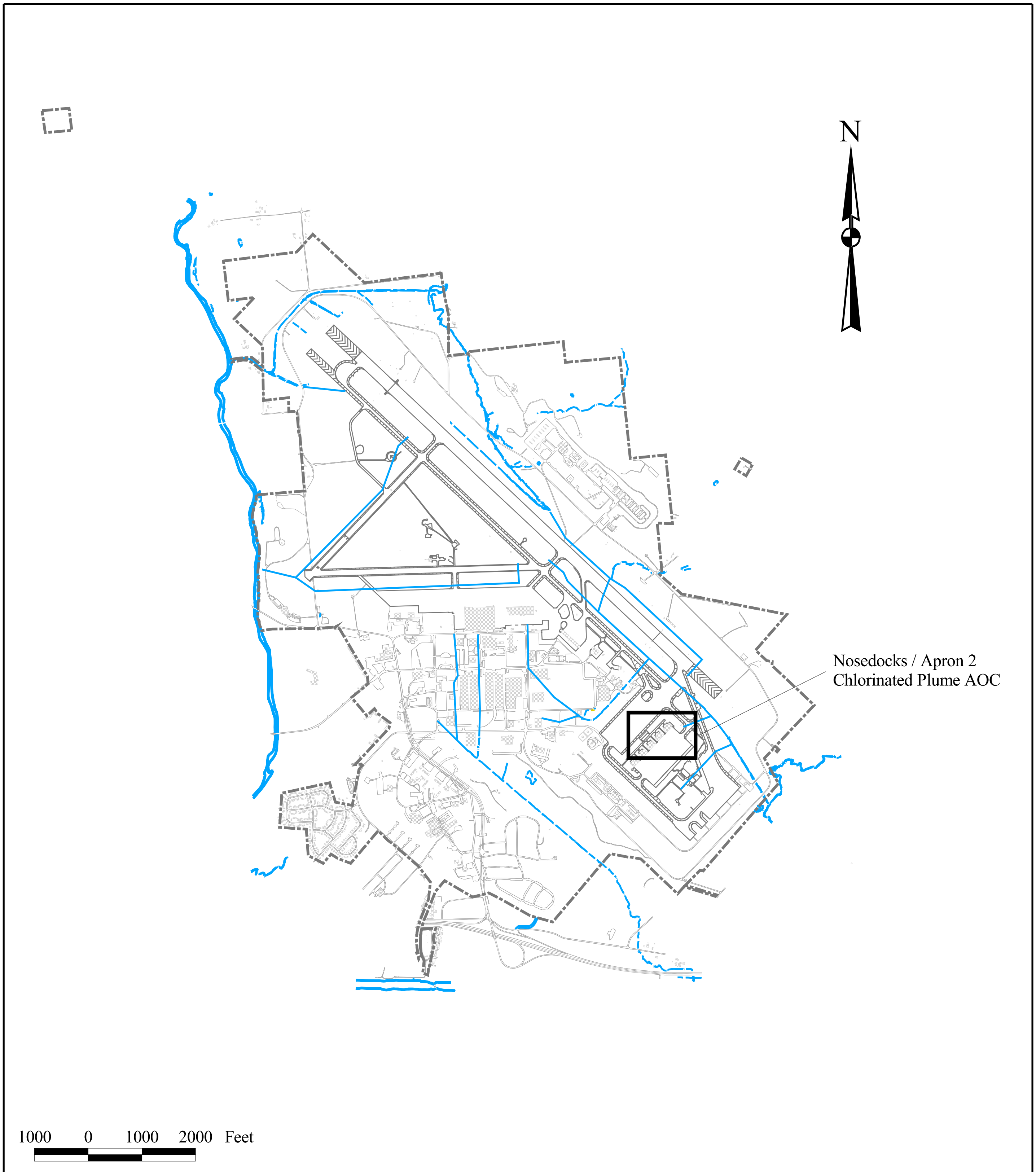

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Figure 1-1
Nosedocks / Apron 2 Chlorinated Plume Location Map

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Section 4.0 (Engineering Basis of the Feasibility Study), evaluates the groundwater contamination data included in Section 2.0 and quantifies the nature and extent of contamination, including estimating the contamination volumes and amounts potentially requiring cleanup in the various groundwater contamination plumes (which are preliminarily defined by the NYSDEC Class GA groundwater standards). The fate and transport of the groundwater plumes is also evaluated in Section 4.0 to the extent of estimating potential cleanup volumes and cleanup times under no action and active remediation scenarios.

Section 5.0 (General Response Actions [GRAs] and Initial Screening of Remedial Technologies), identifies GRAs that are potentially applicable to groundwater remediation at the Site, and identifies and screens remedial technologies and process options for each category of GRAs based on the screening criteria of implementability, effectiveness, and relative cost; and presents the evaluation and selection of representative technologies and process options, with consideration given to innovative technologies.

Section 6.0 (Development and Evaluation of Remedial Alternatives for the Nosedocks/Apron 2 Chlorinated Plume), presents the remedial alternatives developed by combining (as appropriate) feasible technologies, and performs a detailed evaluation of each alternative with respect to the following nine evaluation criteria described in the National Contingency Plan (NCP) for Oil and Hazardous Substances2: (i) overall protection of human health and the environment; (ii) compliance with ARARs; (iii) long-term effectiveness and permanence; (iv) reduction of toxicity, mobility, or volume through treatment; (v) short-term effectiveness; (vi) implementability (including technical feasibility, administrative feasibility, and availability of services and materials); (vii) cost (including total investment for each alternative and benefit for each alternative); (viii) state (i.e., agency) acceptance; and (ix) community acceptance. Upon completion of the evaluation(s) and overall comparison of the various remedial alternatives, this section recommends primary and contingency remedial alternatives and associated implementation measures for the chlorinated plumes at the site based on the findings in the FS.

1.3 Evaluation Criteria

This FS follows the basic methodology outlined in the NCP with consideration of the requirements outlined in Section 121 of the Superfund Amendments and Reauthorization Act (SARA).

The EPA has issued additional RI/FS guidance that includes the following nine criteria for detailed evaluation of remedial alternatives (EPA, 1988b):

- Two (2) Threshold Criteria [i.e., any alternative to be considered in the final evaluation must meet these threshold criteria]
  1. Overall Protection of Human Health and the Environment
  2. Compliance with ARARs

2 The last two evaluation criteria, namely state (i.e., agency) acceptance and community acceptance, were not evaluated in this FS; instead, they will be formally addressed in the Record of Decision (ROD) after comments are received on the RI/FS report and the Proposed Remedial Action Plan (PRAP or Proposed Plan).

- Five (5) Balancing Criteria [potential tradeoffs between the alternatives are identified during the evaluation using these criteria]
  3. Long-term Effectiveness and Permanence
  4. Reduction of Toxicity, Mobility or Volume through Treatment
  5. Short-term Effectiveness
  6. Implementability
  7. Cost

- Two (2) Modifying Criteria [tentatively evaluated as part of the FS and formally evaluated during the Record of Decision (ROD) process after the alternatives have been presented to the public[3]]
  8. State Acceptance
  9. Community Acceptance

It should be noted that before performing a detailed analysis of alternatives, an initial screening of technologies and alternatives is performed on the basis of evaluating them for the following three (3) criteria: effectiveness, implementability, and cost. The effectiveness criterion during the screening stage relates to the first five of the nine criteria above during the detailed analysis stage.

Brief discussions for each of the above nine detailed analysis criteria are presented below.

Overall Protection of Human Health and the Environment

This threshold criterion determines whether a specific alternative provides adequate protection of human health and the environment. It is evaluated for each exposure pathway and draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs

Under this threshold criterion, alternatives are assessed to determine whether they attain ARARs, including, as appropriate:

- Chemical-specific ARARs [e.g., Maximum Contaminant Levels (MCLs)],
- Location-specific ARARs [e.g., restrictions on actions in vicinity of wetlands],
- Action-specific ARARs [e.g., effluent discharge limits], and
- Compliance with other criteria, advisories, and guidelines.

SARA provides for waivers under six situations where all ARARs cannot be met, which are discussed in Section 3.0 of this report.

3 Please see footnote 2.

Long-term Effectiveness and Permanence

Alternatives are assessed for the long-term effectiveness and permanence criterion to evaluate their potential to maintain protection of human health and the environment after response objectives have been met. Factors which might be considered, according to the USEPA guidance for conducting RI/FS under CERCLA, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01 (EPA, 1988a), include:

- Magnitude of residual risks in terms of amounts and concentrations of wastes remaining following implementation of a remedial action, considering the persistence, toxicity, mobility and propensity to bioaccumulate, of such hazardous substances and their constituents, and

- Long-term reliability and adequacy of the engineering and institutional controls, including uncertainties associated with land disposal of untreated wastes and residuals.

Reduction of Toxicity, Mobility or Volume through Treatment

The degree to which alternatives employ treatment that reduces toxicity, mobility, or volume are also to be assessed. According to OSWER Directive 9355.3-01 (EPA, 1988a), factors that might be relevant include:

- The treatment processes that the remedies employ and the materials they will treat,

- The amount of hazardous materials that will be destroyed or treated,

- The degree of expected reduction in toxicity, mobility, or volume,

- The degree to which the treatment is irreversible,

- The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility and propensity to bioaccumulate of such hazardous substances and their constituents, and

- Whether the alternative would satisfy the statutory preference for treatment as a principal element.

Short-term Effectiveness

The short-term effectiveness of an alternative in protecting human health and the environment during the construction and implementation of a remedy until response objectives have been met is assessed considering appropriate factors, including:

- Protection of the community during remedial actions,
- Protection of the workers during remedial actions,
- Mitigation of adverse impacts during construction, and
- Time until remedial response objectives are achieved.

Implementability

The guidance also specifies that the ease or difficulty of implementing the alternatives should be assessed by considering the following types of factors:

- Technical Feasibility
  - Degree of difficulty associated with constructing and operating the technology,
  - Expected operational reliability of the technologies,
  - Ease of undertaking additional remedial actions, if necessary, and
  - Ability to monitor the effectiveness of the remedy.

- Administrative Feasibility
  - Need to coordinate with and obtain necessary approvals from agencies and/or easements from property owners.

- Availability of Services and Materials
  - Availability of necessary equipment and specialists,
  - Availability of adequate capacity and location of needed treatment, storage and disposal services,
  - Availability of prospective technologies, and
  - Availability of services and materials, plus the potential for obtaining competitive bids.

Cost

The types of costs that need to be assessed during the FS include the following:

- Capital costs,
- Annual operation and maintenance costs, and
- Present worth analysis.

The typical cost estimate made during the FS is expected to provide an accuracy of +50 percent to -30 percent. Also, when necessary, a sensitivity analysis may be performed to assess the effect that specific assumptions associated with an alternative can have on the estimated cost.

State (Support Agency) Acceptance

This assessment evaluates the technical and administrative issues, preferences, and concerns which the State (or support agency in the case of State-lead sites) may have regarding each of the alternatives. As was mentioned earlier, this criterion will be addressed in the ROD once comments on the RI/FS report and Proposed Plan have been received.

Community Acceptance

This assessment evaluates the issues and concerns the public may have regarding each of the alternatives. As was mentioned earlier, this criterion will be addressed in the ROD once comments on the RI/FS report and Proposed Plan have been received.

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2 ENVIRONMENTAL SETTING AND SITE BACKGROUND

2.1 Environmental Setting

2.1.1 Geology

Unconsolidated sediments at the former Griffiss AFB consist primarily of glacial till with minor quantities of clay and sand and significant quantities of silt and gravel. Investigations at the Site (Figure 2-1) identified unconsolidated soils to be predominantly silty sands and gravel mixtures to a depth of approximately 55 feet. Basewide, the unconsolidated sediments range in thickness from 12 feet in the northeast portion to more than 130 feet in the southern portion of the former Base. The average thickness of the unconsolidated sediments is 25 to 50 feet in the central portion and 100 to 130 feet in the south and southwest portions of the former Base. The bedrock beneath the former AFB generally dips from the northeast to the southwest and consists of Utica Shale, a gray and black carbonaceous unit with a high/medium organic content (RI, Law Engineering and Environmental Services, Inc.[LAW] (LAW, 1996)).

2.1.2 Hydrogeology

Numerous randomly spaced silt and clay lenses exist within the predominantly sandy aquifer and appear to have created several separate perched aquifers with limited recharge at the Site. During site quarterly groundwater sampling, groundwater elevations ranged between 18 and 30 feet below ground surface (bgs), with perched water tables ranging between 6 and 16 feet bgs. The shallow water table aquifer lies within the unconsolidated sediments, where depth to groundwataer ranged from just below ground surface to 63 feet below ground surface during synoptic basewide water-level measurements. Several surface water creeks act as discharge areas for shallow groundwater, and drainage culverts and sewers intercept surface water runoff.

A comprehensive description of regional and local geology, hydrogeology, lithology, and hydrology for the former Griffiss AFB was given in the RI (LAW, December 1996), and in the Supplemental Investigation (SI) prepared by Ecology and Environment, Inc. (E&E, 1998). Detailed site descriptions and the hydrology for each chlorinated plume Site are presented with each site-specific section. Groundwater contours for the Site area are shown in Figure 2-2.

2.2 Site Background

2.2.1 Nosedocks / Apron 2 Chlorinated Plume

2.2.1.1 Site Background

Five former Nosedocks are located between Apron 1 and Apron 2. A wash-waste system that was installed in 1959 originated from the Lateral Control Pits (LCP) sump pits. The system collected drainage from the five Nosedocks and a washrack that was set up in the corner of Building 786, and drained to Manhole 19, where the effluent was pumped to former oil/water separator (OWS) 5730. In 1997, the drain lines from the nosedocks and aprons were cleaned and either removed or sealed (PEER Consultants, P.C. [PEER] Peer, 1998). The complete removal of the OWS 5730-2, lift station, and underground storage tank (UST) was performed in the summer of 2001. The source of the chlorinated plume appears to be the former Nosedocks Wash Waste System. The plume originates in the vicinity of Building 786 and migrates beneath Apron 2 approximately 2,800 feet northeast/east towards Six Mile Creek (FPM, 2004). Figure 2-3 illustrates the chlorinated hydrocarbon contamination at the site along with associated site features. Table 2-1 summarizes the chlorinated hydrocarbon plume analytical groundwater monitoring results. This plume is being managed as an OU of the On-Base Groundwater AOC.

2.2.1.2 Previous Source Removal/ Remedial Actions

The following summarizes previous source removal/remedial actions associated with the Nosedocks/Apron 2 Chlorinated Plume:

- PEER conducted closure activities on the Wash Waste System in 1996 (Figure 2-1). The wash waste pipeline was flushed and closed. Along with the capping of the pipeline,

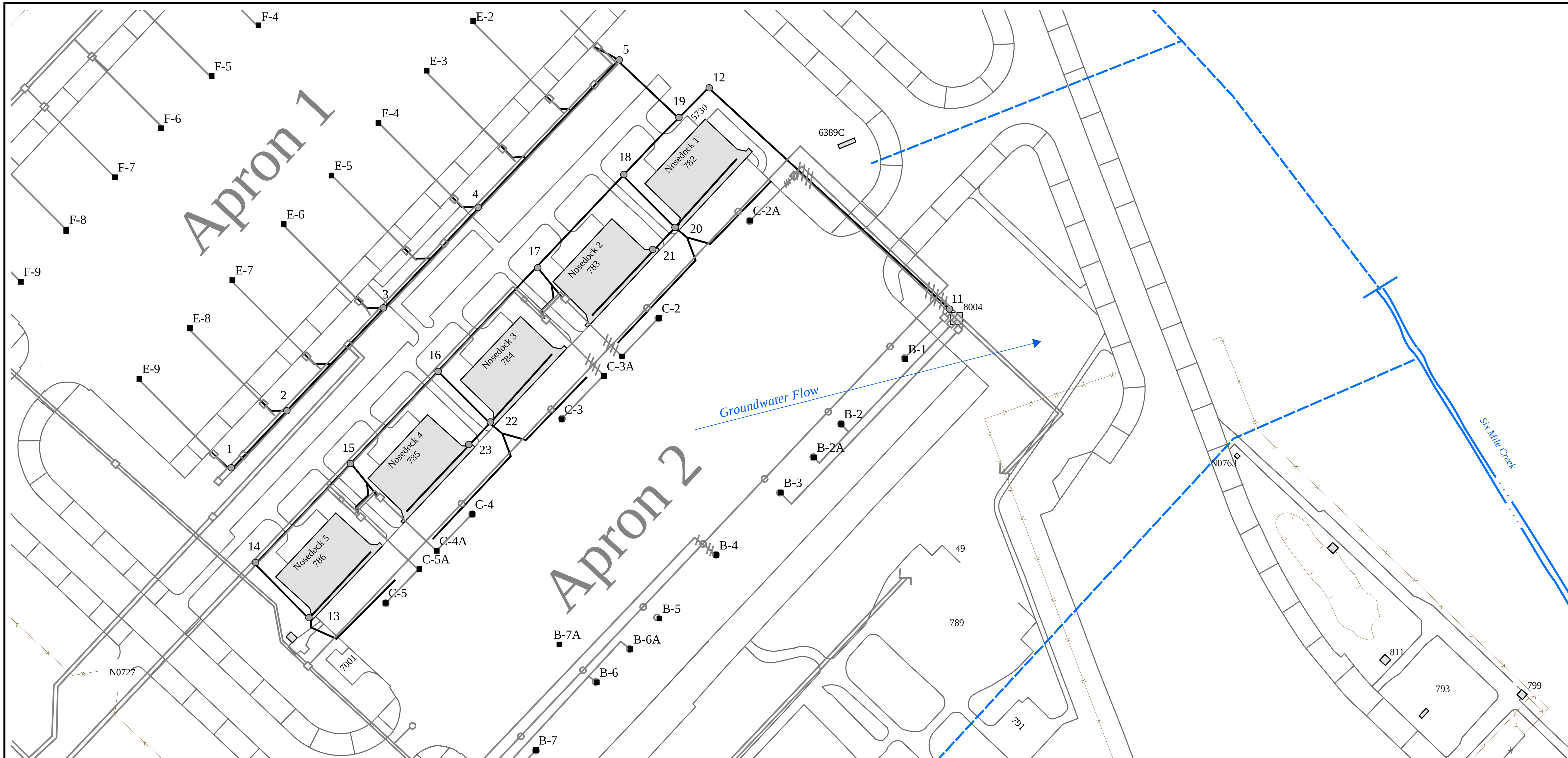
- Manholes 13 through 18 and 21 through 23 were removed and excavated. Endpoint sampling was performed at each manhole excavation. Samples collected at the bottom of the excavations from manholes 13, 21, 22, 23, and a section of pipeline downstream of manhole 15 indicated VOC exceedances of STARS Guidance Values.

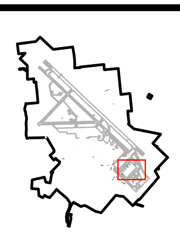
- OWS 5730-2, located north of Building 782, was also removed along with 954 cy of contaminated soils surrounding the area in the summer of 2001.

2.2.1.3 Groundwater Conditions

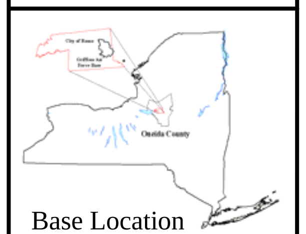
FPM performed an RI and subsequent quarterly monitoring from February 2003 to September 2004. The On-Base groundwater long-term monitoring (LTM) monitoring wells are shown in Figure 2-4. The original results indicated that there were five chlorinated plumes associated with the site as shown in Figure 2-5. These five separate plumes were the northern TCE, the southern TCE, the southern DCE, the northern DCE, and the VC plume. However recent data from groundwater monitoring has indicated that the northern TCE and DCE plumes have attenuated to levels below groundwater standards. The three plumes now encompass monitoring well 782VMW-83 and extend northeast following groundwater flow towards Six Mile Creek to encompass monitoring well 782VMW-88 in the eastern end of the site with an area of 2,113,500 square feet. The depth of this plume ranged from 433 to 456 ft MSL.

The chlorinated hydrocarbon VOCs identified in the groundwater samples include TCE, cis-1,2-DCE, trans-1,2-DCE (to a lesser extent than cis-1,2-DCE), and vinyl chloride. TCE and its daughter contaminants of concern (COCs) were only reported dissolved in the groundwater samples. Vinyl chloride contamination at the site appears to be peripherally commingling





Site Location



Base Location

Key to Features

- Manhole
- Hydrant
- Airfield
- Roads
- Washwaste system
- Surface Water
- Culvert/Ditch
- Pipeline
- Fence

Facilities

- Existing
- Demolished

N

100 50 0 100 200 300

Feet

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Figure 2-1
Nosedocks / Apron 2 Site Features

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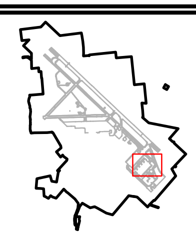
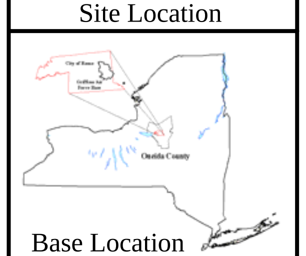


Site Location



Base Location

Key to Features

- Hydrant
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/Ditch
- Groundwater Elevation
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Decommissioned MW
- Existing Monitoirng Wells
- Groundwater Monitoring well
- Temporary Vertical Profile Well 2001-02

N

100 50 0 100
Feet

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Figure 2-2
Groundwater Elevation Contour Map
(2004)

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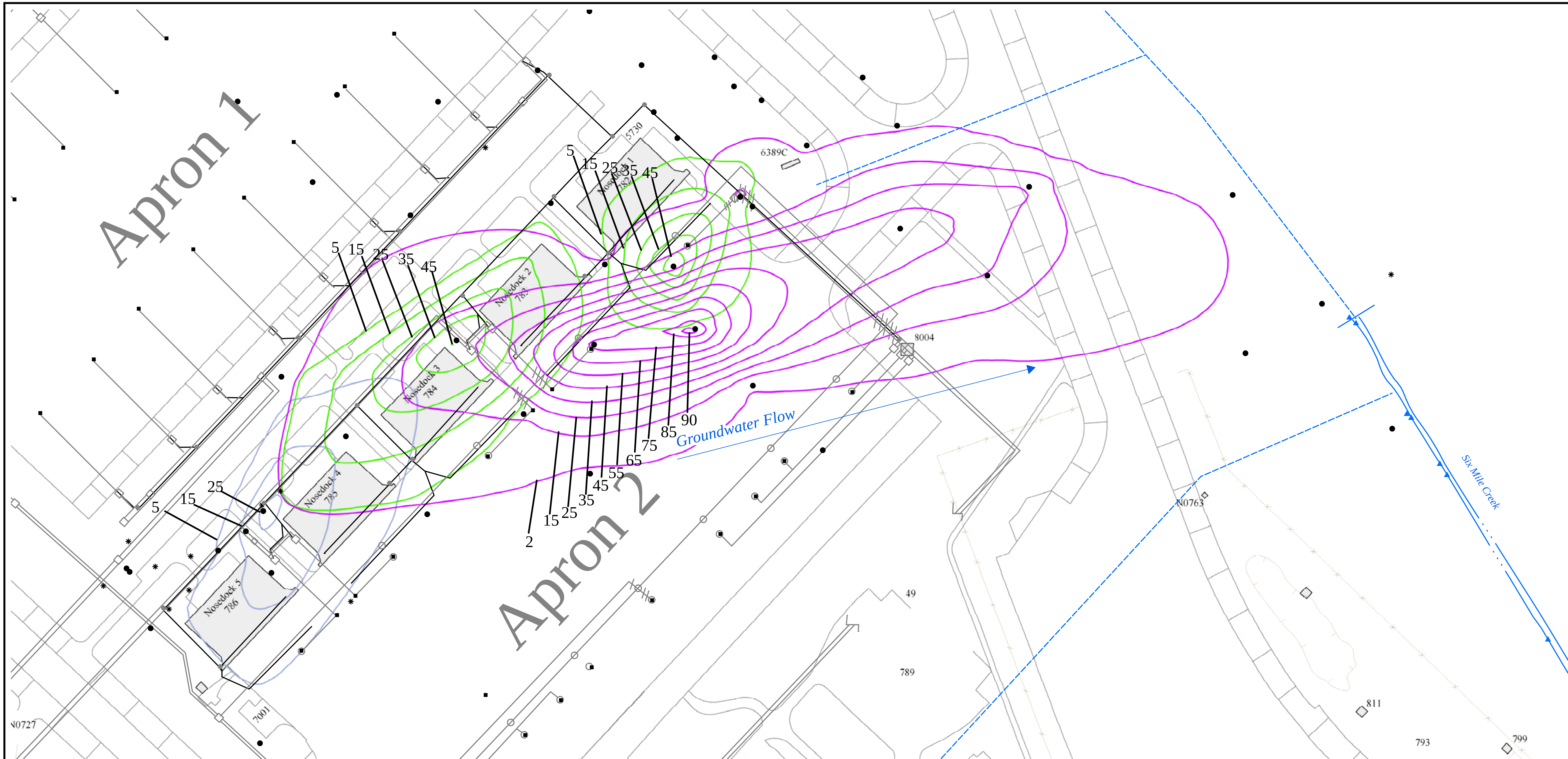

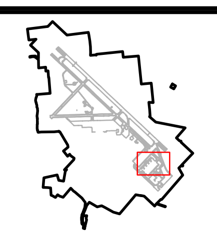
Site Location


Base Location

Key to Features

Hydrant	**Facilities**
Manhole	Demolished
Airfield	Existing
Washwaste System	Non Lease Qualify
Stream/ Creek	Monitoring Wells
Streamdrain	Soil Sample Locations
Pipeline	Surface Water Sample Locations
Fence	TCE Contamination µg/L
	DCE Contamination µg/L
	VC Contamination µg/L

N

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Feet

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Figure 2-3
Nosedocks / Apron 2
Chlorinated Hydrocarbon Contamination
(September 2004)

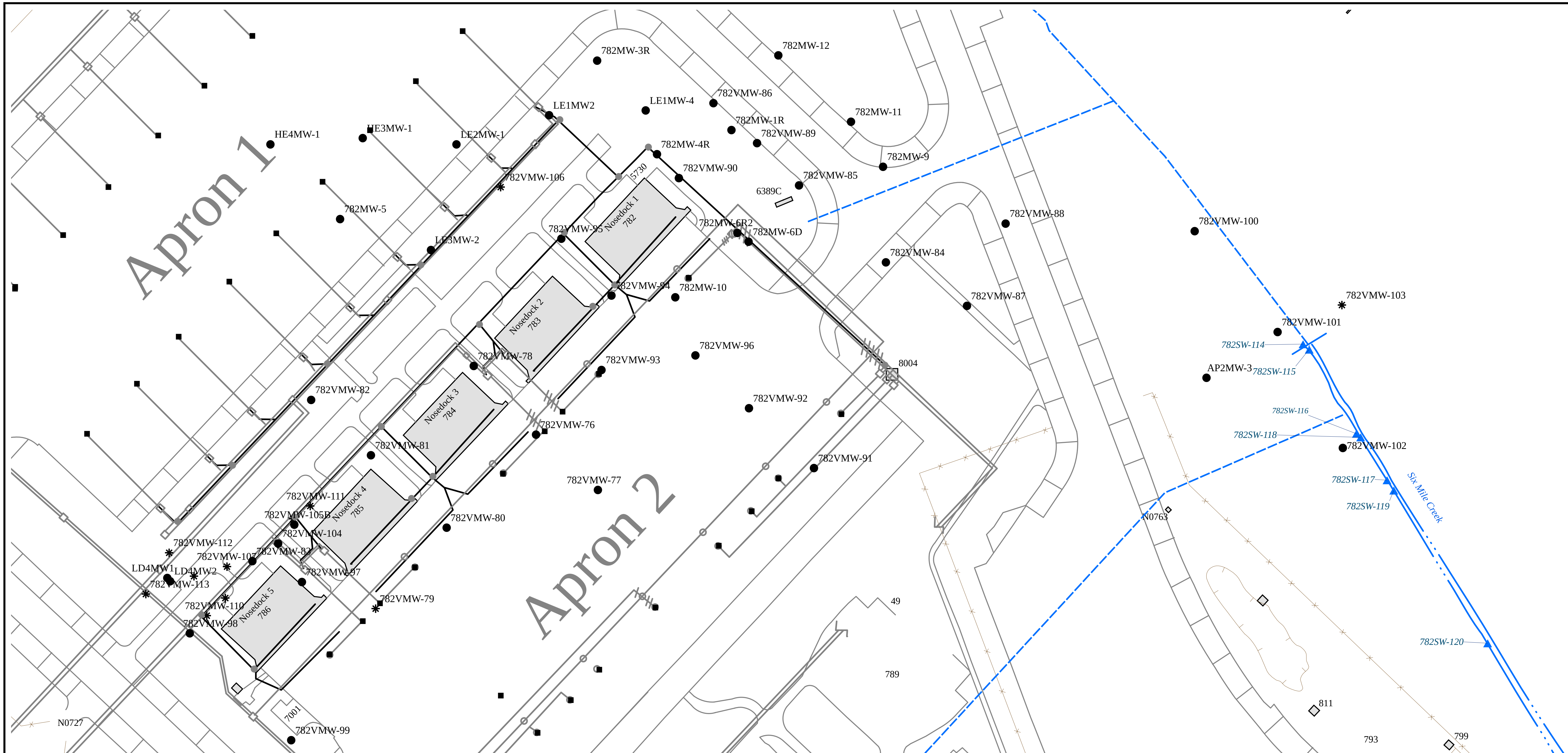
FPM group

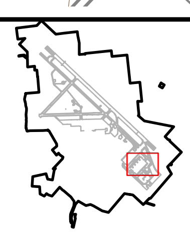
Table 2-1

Nosedocks / Apron 2 Chlorinated Plume Analytical Groundwater Monitoring Results

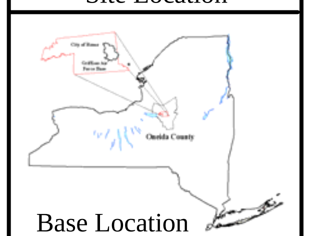
Site	Plume Name	COC	Max COC (µg/L)	Min Elevation (MSL)	Max Elevation (MSL)	Plume Length (ft)	Plume Width (ft)	Plume Area (ft)	Comments
Chlorinated Plume	TCE Plume	TCE	29	433.6	456.1	700	330	231,000.000	Highest concentration of TCE found at 782VMW-105B at 29 µg/L.
	DCE Plume	DCE	56	433.57	450.5	1250	330	412,500.00	Highest concentration of DCE found at 782MW-10 at 56 µg/L.
	Vinyl Chloride Plume	VC	96	433.6	450.5	2100	700	1,470,000.000	Highest concentration of VC was found at 782VMW-96 at 96 µg/L.

Note: The water-table elevation at the Aprons is 430-465' (MSL). Perched groundwater may be encountered at 470' (MSL).





Site Location



Base Location

Key to Features

- Hydrant
- Manhole
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Monitoring Wells
- Soil Sample Locations
- Surface Water Sample Locations

N

100 50 0 100 200 300

Feet

FPM Group Ltd.
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was produced on 7/11/2005 at 12:22:18 PM

UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 2-4
Nosedocks / Apron 2
Groundwater Monitoring Wells

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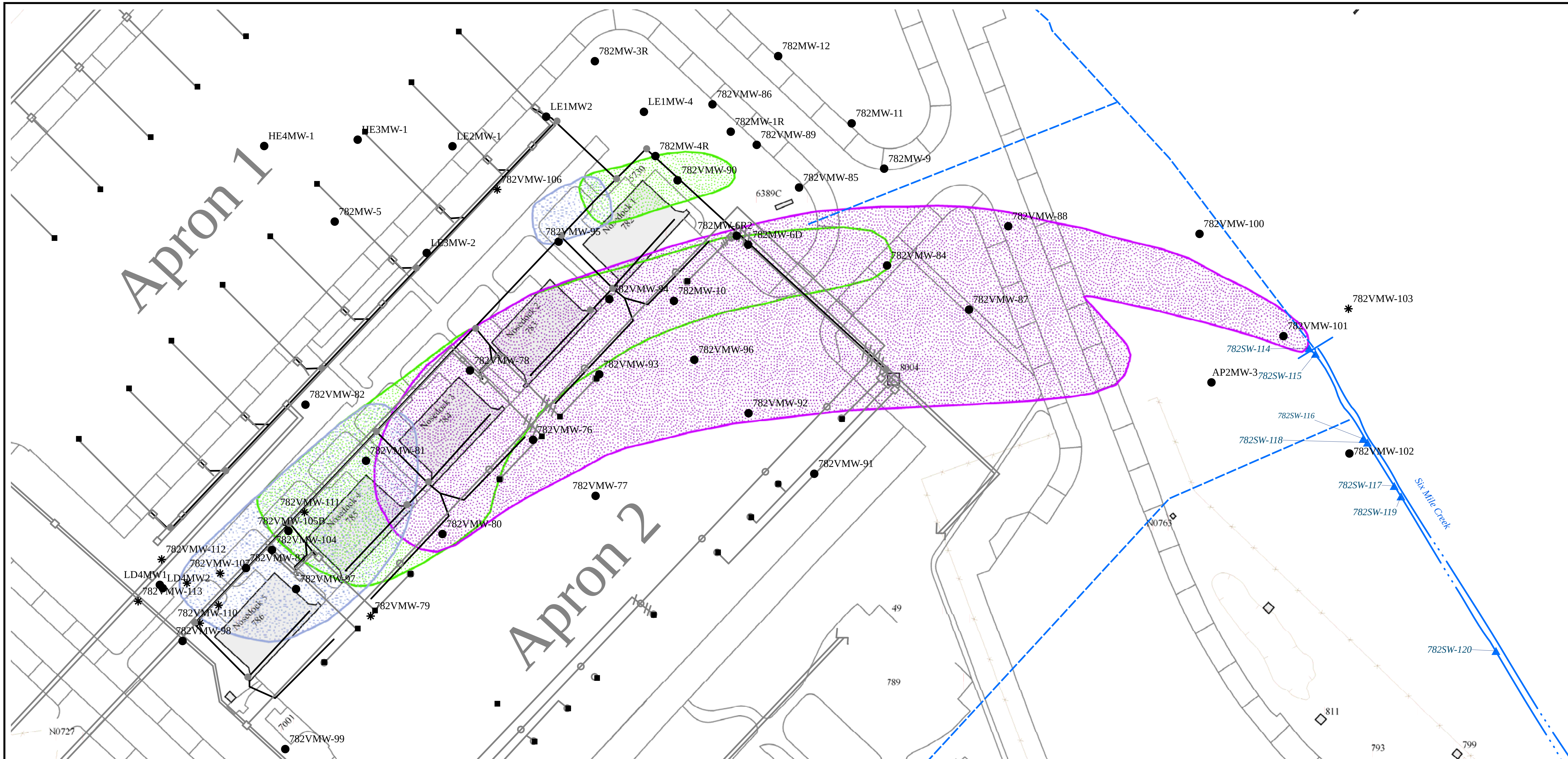

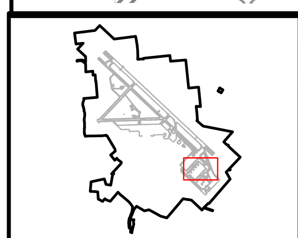

Site Location

Base Location

Key to Features

- Hydrant
- Manhole
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Monitoring Wells
- Soil Sample Locations
- Surface Water Sample Locations
- TCE Contamination 5 µg/L
- DCE Contamination 5 µg/L
- VC Contamination 2 µg/L

N

100 50 0 100 200 300

Feet

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UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 2-5
Nosedocks / Apron 2
Chlorinated Hydrocarbon
Plumes 2001-2002

FPM group

with petroleum contamination downgradient at the Apron 2 location of the site (Figure 2-6). The groundwater VOCs and natural attenuation parameter results indicate that anaerobic conditions are favorable for reductive dechlorination processes, and that these processes are actively working to reduce site concentrations of chlorinated solvents. Full results including natural attenuation parameters are shown in Appendix A. Field sampling forms are shown in Appendix B.

Biosparging is currently anticipated to be the recommended alternative for cleanup of the petroleum-related contamination northeast and northwest of Aprons 1 and 2. The effect of this alternative will be considered during the development of the remedy selection.

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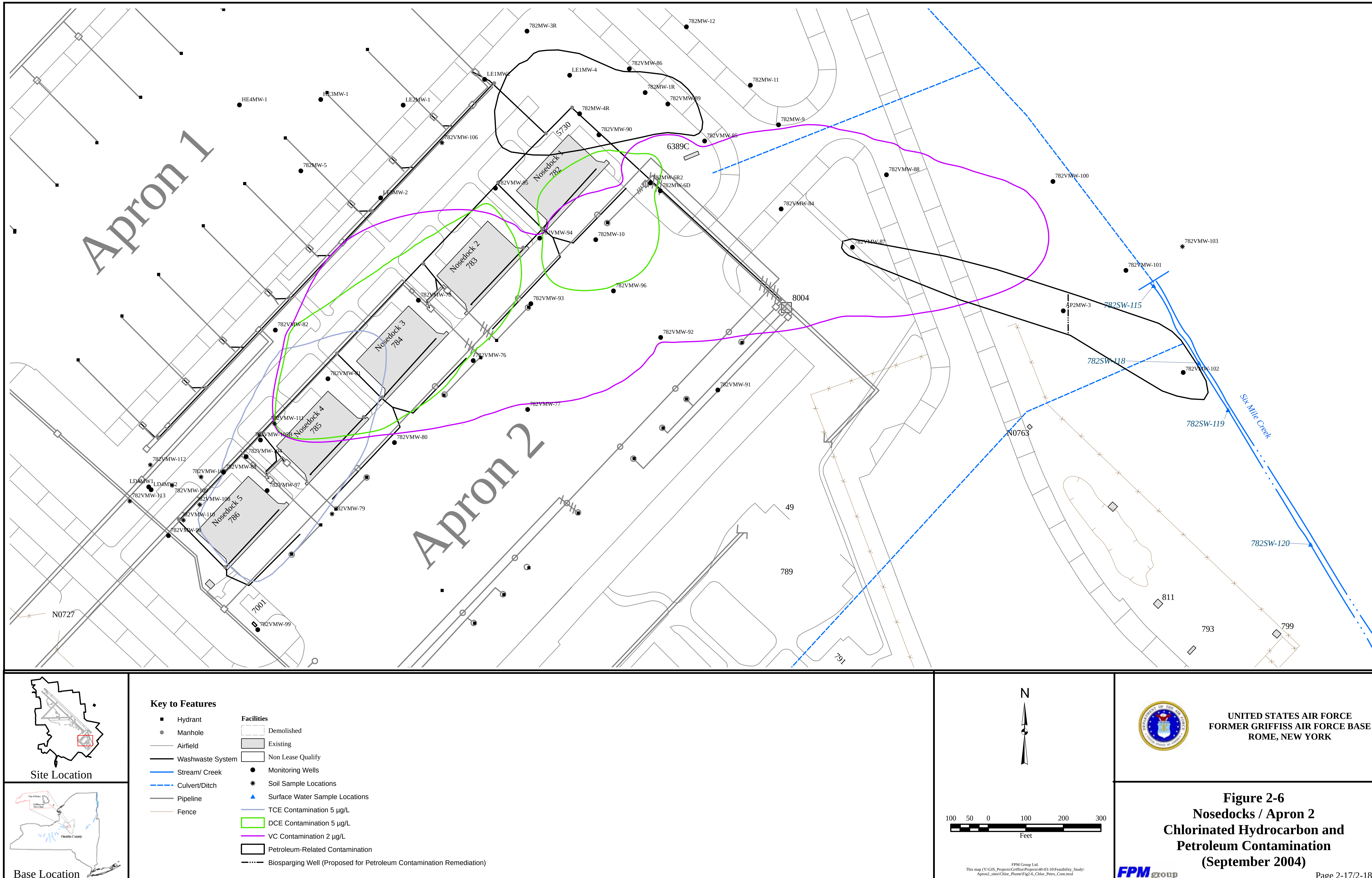

UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 2-6
Nosedocks / Apron 2
Chlorinated Hydrocarbon and Petroleum Contamination
(September 2004)

FPM group

3 IDENTIFICATION OF SITE-SPECIFIC ARARS AND TBCS[4]

The remedial actions at the Griffiss AFB site will be conducted under the purview of the USEPA and NYSDEC policies, standards, requirements, criteria, limitations, and guidance, and of the Department of Defense (DoD) and USAF policies, procedures, and guidance that are applicable to site remediation and environmental restoration.

3.1 Overall Applicability of Regulatory Programs

This FS covers chlorinated hydrocarbon contamination areas; the overall applicability of the regulatory programs for these areas are summarized below:

- Chlorinated Organics Contamination

  The remediation of the chlorinated organics plume and any associated residual soil contamination will primarily be addressed through the federal CERCLA program (also known as the "Superfund" program). Furthermore, as mandated by the Federal statutes, any State environmental or facility siting laws, policies, standards, requirements, criteria, or limitations that are more stringent than the corresponding Federal program elements will govern the remediation of the chlorinated plume. Moreover, since the chlorinated organics plume occurs within vicinity of petroleum contamination in areas of the site, both the Federal and State programs may need to be addressed under certain remediation scenarios such as pump-and-treat where the responses selected for one plume category may have an impact on the extent and response of the other plume category, even resulting in the intermingling or overlapping of these plumes. The DOD/USAF is the lead agency for the remediation program. However, agency (USEPA, NYSDEC) approvals and/or concurrence of selected remedies would still be required in accordance with the Federal Facility Agreement and Resolution of Disputes between the USAF, USEPA Region II, and NYSDEC.

3.2 Site-Specific Federal and State ARARs and TBCs

The purpose of this section is to identify site-specific Federal and State ARARs and TBCs. Since the NYSDEC does not have ARARs in its statute and to avoid misinterpretation of New York State requirements, the NYSDEC identifies the analogous State requirements for both ARARs (which are enforceable) and TBCs (which are non-enforceable) as the New York State Standards, Criteria and Guidelines (SCGs). In this document, to distinguish between enforceable and non-enforceable values, the terms ARARs and TBCs will be used, rather than the term SCGs, when referring to the New York State requirements.

4 For increased readability and cost savings for the public, verbatim excerpts of public documents such as codes, regulations, etc. may have been included without enclosing them in quotation marks or using other attribution devices, where such identification is not critical or essential to the understanding of the contents.

3.2.1 Definition and Types of ARARs and TBCs

ARARs

ARARs are environmental or public health requirements that are promulgated by the Federal or State Government and are determined to be legally applicable or relevant and appropriate to the chemicals/contaminants, remedial activities, or other actions/circumstances at a CERCLA site.

The primary concern during the development of remedial action objectives for hazardous waste sites under CERCLA or "Superfund", is the degree of protection afforded by a given remedy to human health and the environment. Section 121(d) of SARA and the NCP (40 CFR 300) require that primary consideration be given to remedial alternatives that attain or exceed ARARs. The purpose of this requirement and, more generally of the ARARs approach, is to make response actions executed under CERCLA comply with all pertinent Federal and (New York) State environmental requirements comprehensively, rather than to decree specific pre-determined cleanup goals that may or may not comprehensively address all requirements, nor be applicable, or relevant and appropriate, to a given site. State requirements must also be attained under Section 121 (d)(2)(c) of SARA, if they are legally enforceable and consistently applied statewide. The USEPA has indicated that ARARs must be identified for each site on the NPL.

Applicable, or relevant and appropriate requirements, are referred to as ARARs. The ARARs are legally enforceable rules or regulations. The NCP Section 300.5 (40 CFR Sec. 300.5), defines Applicable Requirements as "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." Applicable requirements must directly and fully address the situation at the site. Further, Applicable Requirements are those requirements promulgated under Federal or State laws that would be legally applicable to the response action if that action were not taken pursuant to Sections 104 or 106 of CERCLA.

The NCP (Section 300.5) defines Relevant and Appropriate Requirements as "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site." Relevant and appropriate requirements are intended to have the same weight as applicable requirements. As an example, RCRA landfill design criteria could be relevant and appropriate if wastes being disposed on-Site are similar to RCRA hazardous wastes.

Actions must comply with State ARARs that are more stringent than Federal ARARs. State ARARs are also used in the absence of a Federal ARAR, or where a State ARAR is broader in scope than the Federal ARAR. In order to qualify as an ARAR, State requirements must be promulgated and identified in a timely manner. Furthermore, for a State requirement to be a potential ARAR it must be applicable to all remedial situations described in the requirement, not just at CERCLA sites.

Identification of ARARs must be done on a site-specific basis and involves a two-part analysis: first, a determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is nevertheless both relevant and appropriate.

TBCs

ARARs are not currently available for every chemical, location, or action that may be encountered. For example, there are currently no ARARs which specify clean-up levels for soils or several groundwater contaminants. When ARARs are not available, remediation goals may be based upon other Federal or State criteria, advisories and guidance, or local ordinances. In the development of remedial action alternatives, the information derived from these sources is termed To Be Considered and the resulting requirements are referred to as TBCs. The TBCs are non-promulgated advisories or guidance issued by the Federal or State government that are not legally enforceable or binding and do not have the status of potential ARARs. The EPA guidance allows cleanup goals to be based upon non-promulgated criteria and advisories such as reference doses used in site risk assessments when ARARs do not exist, or when an ARAR alone would not be sufficiently protective of health or the environment in the given circumstance.

ARAR Waivers

Section 121 of SARA requires that the remedy chosen for a CERCLA site must attain all ARARs unless one of the six conditions (under which compliance with ARARs may be waived) is satisfied. These are:

1. **Interim Measures Waiver:** the selected remedial action is an interim remedy or a portion of a total remedy which will attain the standard upon completion; available for interim Records of Decision (RODs), or early source control or groundwater remedial actions;

2. **Greater Risk to Health and the Environment Waiver:** compliance with such requirements could result in greater risk to human health and the environment than alternate options; used to prevent damage to natural resources or historical landmarks that may result from implementation of a remedial alternative; this waiver is also available for New York State Inactive Hazardous Waste Sites;

3. **Technical Impracticability Waiver:** compliance with such requirements is technically impracticable from an engineering perspective; used commonly if defensible groundwater modeling during the feasibility study indicates that chemical-specific ARARs are not attainable in a given aquifer within a reasonable amount of time (USEPA, 1995a; USEPA, 1995b); this waiver is also available for New York State Inactive Hazardous Waste Sites;

4. **Equivalent Standard of Performance Waiver:** the selected remedial action will attain an equivalent standard of performance; used to waive a required design or operating standard where an alternative design can achieve equivalent or better results; this waiver is also available for New York State Inactive Hazardous Waste Sites;

5. **Inconsistent Application of State Standard Waiver:** the requirement has been promulgated by the State, but has not been consistently applied in similar circumstances; available if it can be demonstrated that a state has not applied an ARAR consistently in other site remediations; or,

6. **Fund Balancing Waiver:** compliance with the ARAR will not provide a balance between protecting the public health and the environment at this site with the availability of funds for response at other sites; applicable to sites where response action is taken utilizing funds from the Superfund account.

The first five (5) ARAR waivers are available for utilization at the Griffiss AFB site. The sixth waiver, fund balancing, is applicable only to "superfunded" sites and is, thus, not applicable to the site.

ARAR Applicability and Permitting for On-Site and Off-Site Remedial Actions

CERCLA mandates compliance with applicable requirements, and requirements deemed relevant and appropriate by the USEPA for on-Site activities, unless a waiver can be justified. Substantive requirements need to be fulfilled for on-Site activities, but administrative requirements (e.g., Federal, State and local permits; reporting requirements, etc.) do not need to be attained. Off-Site activities related to Superfund responses only need to comply with applicable requirements, but both substantive and administrative compliance are necessary. Similarly, exemptions from discharge or emissions permitting of on-site remedial activities by responsible parties at New York State Spills Sites are provided under consent agreements for site cleanup with NYSDEC. Any permits that would be needed despite these exemptions will be evaluated during the detailed analysis of alternatives, depending on remedial technologies and activities involved.

Role of ARARs in Remedy Selection

ARARs are used as a guide to establish the appropriate extent of site cleanup; to aid in scoping, formulating, and selecting proposed treatment technologies; and to govern the implementation and operation of the selected remedial alternative. Primary consideration should be given to remedial alternatives that attain or exceed the requirements of the identified ARARs. In addition, USEPA intends that the implementation of remedial actions should also comply with ARARs (and TBCs as appropriate) to protect public health and the environment. Throughout the RI/FS, ARARs are identified and utilized by taking into account the following:

- Contaminants suspected or identified to be at the site
- Chemical analyses performed, or scheduled to be performed

- Types of media (air, soil, groundwater, and surface water)
- Geology and other site characteristics
- Present/future use of site resources and media
- Potential contaminant transport mechanisms
- Purpose and application of potential ARARs
- Remedial alternatives considered for site clean-up

ARARs and TBCs are both used during the FS process to evaluate the remedial alternatives.

Types of ARARs

Based on the manner in which they are applied at a site, ARARs and TBCs fall into three broad categories, namely, chemical-specific (also known as contaminant-specific), location-specific, and action-specific ARARs and TBCs. These categories are described below:

- **Chemical-specific –** These ARARs and TBCs define acceptable exposure levels for a specific chemical in an environmental medium and are used in establishing preliminary remediation goals. They may be actual concentration based cleanup levels, or they may provide the basis for calculating such levels, and are typically health- or risk-based restrictions. In general, chemical-specific requirements are set for a single chemical compound or a closely-related group of chemical compounds and, typically, do not account for the potential effects of multiple contaminants. Examples of chemical-specific ARARs are MCLs for drinking water or ambient air quality standards for air. Examples of chemical-specific TBCs include USEPA health advisories, reference doses, and cancer slope factors. Chemical-specific ARARs and TBCs are employed to establish preliminary remediation goals.

- **Location-specific –** These ARARs place limitations or standards on the types of remedial activities which can be performed, or the concentrations of contaminants allowed, based on proximity of the site to specific natural and man-made features. Examples of natural site features include floodplains, wetlands, or geologically unstable areas. Examples of man-made features are local historic buildings and structures.

- **Action-specific –** These ARARs and TBCs set controls or restrictions for particular treatment and disposal activities related to the management of hazardous substances. These action-specific requirements are not directed towards dictating the selection of remedial alternative(s), but rather towards regulating their implementation. Examples of action-specific ARARs are effluent discharge limits, hazardous waste manifesting requirements, and limits on air emissions.

3.2.2 Site-Specific ARARs and TBCs

This section provides a preliminary determination of the regulations that are applicable or relevant and appropriate to the remediation of the Apron 1/Apron 2 sites. Both Federal and

State environmental regulations and public health requirements are considered. In addition, this section presents an identification of Federal and State criteria, advisories, and guidance that could be used for evaluating remedial alternatives. The preliminary ARARs and TBCs identified in this section will be further evaluated when performing detailed analysis of remedial alternatives in Section 6.0.

The ARARs and TBCs presented in this report are also consistent with the two-part USEPA guidance titled "CERCLA Compliance with Other Laws Manual" (USEPA, 1988a; USEPA 1989) and the USEPA guidance titled "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988b). Additional USEPA and DoD and USAF Installation/Environmental Restoration Program (IRP/ERP) policy and guidance documents were also reviewed and incorporated as appropriate into the remedial alternatives development and assessment process. Typically, these documents were not considered to be ARARs or TBCs for the Site. Additionally, the ARARs and TBCs presented in this report are consistent with the NYSDEC TAGM #4030 titled "Selection of Remedial Actions at Inactive Hazardous Waste Sites" (NYSDEC, 1990) and the NYSDEC guidance titled "Technical Guidance for Site Investigation and Remediation" (NYSDEC, 2002).

3.2.2.1 Chemical-Specific ARARs and TBCs

A partial listing of Federal and State chemical-specific ARARs and TBCs that potentially apply to Griffiss AFB is presented in Table 3-1 (Section 3 tables are presented at the end of the section for readibility). All of the ARARs and TBCs listed provide some specific instruction or guidance on acceptable or allowable concentrations of contaminants in the various media (groundwater, surface water, drinking water, air, treatment residues, etc.) at the site.

It is noted that the list of chemical-specific ARARs and TBCs presented in Table 3-1 is only preliminary, and that it shall be reviewed periodically (at a minimum every five years) for completeness and relevance based on then currently available and applicable site-specific information and updated as needed. A brief discussion of some of the contaminant-specific ARARs and TBCs is presented below. Table 3-1 shall be referred to for a comprehensive listing of all chemical-specific ARARs and TBCs.

- The Safe Drinking Water Act (SDWA) promulgated National Primary Drinking Water Standard the MCLs [40 CFR 141]. MCLs are enforceable standards for contaminants in public drinking water supply systems. They are based on consideration of health risks, as well as on the economic and technical feasibility of attaining those levels in a water supply system. The MCL Goals (MCLGs) are non-enforceable guidelines at which no known or anticipated adverse effect on the health of persons would occur, and which allow an adequate margin of safety; they do not consider the technical feasibility of contaminant removal. According to the NCP, an MCL or non-zero MCLG is generally an ARAR. Secondary MCLs (40 CFR 143) are non-enforceable guidelines for contaminants that primarily affect the cosmetic or aesthetic qualities related to public acceptance of drinking water such as taste, odor, color, and appearance. SDWA requirements are applicable to groundwater treatment alternatives for the site, unless restrictions are implemented ensuring that treated or untreated groundwater will not enter the public water supply system.

- Risk Based Concentrations are derived for site-specific exposure scenarios; the EPA Region III Risk-Based Concentration (RBC) table is a TBC for the site. The RBCs are derived for "standard" exposure scenarios, which exclude soil-to-air contaminant transfers, cumulative (synergistic) effect of multiple contaminants, and dermal risk from consideration.

- Risk Assessments may be conducted to establish the need for cleanup and for addressing the No Further Action alternative. They are used to evaluate the potential for carcinogenic and non-carcinogenic effects associated with exposure to site-related contaminants. Risk assessments may also be one of several factors that may be used to develop site-specific Alternate Concentration Limits (ACLs) when permitted under CERCLA.

- USEPA Ambient Water Quality Criteria (AWQC) were developed pursuant to Section 304(a)(1) of the Clean Water Act in 1980 for 64 pollutants, nine (9) of which were subsequently revised in 1984. The AWQC, which are not legally enforceable, are available for the protection of human health from exposure to contaminants in drinking water and from the ingestion of contaminants in aquatic biota, and for the protection of freshwater and saltwater aquatic life. AWQC may be applicable to those remedial actions which involve groundwater treatment and/or discharges to surface water.

- The NYSDEC Class GA Groundwater Standards (6NYCRR Part 703), and the New York State Sanitary Code Drinking Water Standards (State Sanitary Code, Part 5), are also considered ARARs. NYSDEC Class GA Groundwater Guidance Values ("Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations") are considered TBCs.

- The NYSDEC Class C Surface Water Standards (6NYCRR Part 703) may be applicable to those remedial actions which involve groundwater treatment and/or discharges to surface water. NYSDEC Class C Surfacewater Guidance Values ("Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations") are considered TBCs.

3.2.2.2 Location-Specific ARARs and TBCs

A partial listing of Federal and State location-specific ARARs and TBCs that potentially apply to Griffiss AFB is presented in Table 3-2 (Section 3 tables are presented at the end of the section for readibility). It is noted that the list of location-specific ARARs and TBCs presented in Table 3-2 is only preliminary, and that it shall be reviewed periodically (at a minimum every five years) for completeness and relevance based on then currently available and applicable site-specific information and updated as needed. A brief discussion of some of the location-specific ARARs and TBCs is presented below. Table 3-2 shall be referred to for a comprehensive listing of all location-specific ARARs and TBCs.

- Executive Order 11990 (Wetlands Protection) requires Federal agencies to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance their natural and beneficial values if there is a practicable alternative when undertaking new construction located in wetlands. This order may be potentially applicable to remedial activities that may affect wetlands. If the wetlands in the vicinity of the site will be impacted by any of the remedial alternatives, then the Statement of Procedures on Floodplain Management and Wetlands Protection (40 CFR 6, Appendix C) will also need to be considered.

- Executive Order 11988 (Floodplain Management) requires Federal agencies to evaluate potential long- and short-term effects of the planned actions in a floodplain environment to avoid adverse impacts and, if there is no practicable alternative, to employ all practicable means to limit the impacts to floodplains resulting from such actions. If the floodplains in the vicinity of the site will be impacted by any of the remedial alternatives, then the Statement of Procedures on Floodplain Management and Wetlands Protection (40 CFR 6, Appendix C) will also need to be considered.

- The Fish and Wildlife Coordination Act (16 USC 661) provides for coordination between regulatory agencies for protection of fish and wildlife during water-resource related projects. The Endangered Species Act of 1973 requires protection of endangered/threatened species and their critical habitats from activities authorized, funded, or carried out by Federal agencies. There are no known plant and animal species at the base or in the immediate vicinity of the base that are considered to be threatened or endangered by the U.S. Department of the Interior (FPM, 2004). Though some plant species present at the base are protected in the state of New York, these species have not been found at the site, i.e., in the portion of the base which is addressed in this FS. Therefore, threatened and endangered species are not considered to be a concern at this site. Also, the site is located in a highly developed portion of the base.

- The New York Wetlands Laws (NYCRR Articles 24, 25), which establish regulations for protecting the State's freshwater and wetlands may be applicable to remedial activities that may affect the wetlands.

3.2.2.3 Action-Specific ARARs and TBCs

A partial listing of Federal and State action-specific ARARs and TBCs that potentially apply to Griffiss AFB is presented in Table 3-3 (Section 3 tables are presented at the end of the section for readibility). It should be noted that such a list is not totally inclusive and must be reviewed for completeness periodically, to evaluate if additions to or deletions from the list are required. At a minimum, this review would take place every five years. A brief discussion of some of the action-specific ARARs and TBCs is presented below. These ARARs govern activities undertaken as part of site remediation.

- The 1980 CERCLA, as amended by the 1986 SARA requires that appropriate remedial actions shall be selected which are in accordance with 42 USC Section 9621, Cleanup standards, and, to the extent practicable, the NCP, and which provide for cost-effective response. In evaluating the cost effectiveness of proposed alternative remedial actions, the total short- and long-term costs of such actions shall be taken into account, including the costs of operation and maintenance for the entire period during which such activities will be required.

  Based on USEPA's experience with the CERCLA (Superfund) program during its first six years, SARA made several important changes and additions to the program. The SARA requires that Federal agencies pursue permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites. It also required Superfund actions to consider the standards and requirements found in other State and Federal environmental laws and regulations, required increased State involvement in every phase of the Superfund program, and increased the focus on human health problems posed by hazardous waste sites.

  Briefly, the CERCLA/SARA specifies the following requirements:

  – Remedial actions in which treatment that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment.

  – The selected remedial action shall be one that is protective of human health and the environment, that is cost-effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

  – If a remedial action shall be selected that is not appropriate for meeting the above stated preferences, an explanation as to why a remedial action involving such reductions was not selected shall be published.

  – The offsite transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available.

  – An assessment shall be conducted of permanent solutions and alternative treatment technologies or resource recovery technologies that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant. In making such assessment, the long-term effectiveness of various alternatives shall be specifically addressed. In assessing alternative remedial actions, at a minimum, the following shall be taken into account (as appropriate and applicable):

(A) the long-term uncertainties associated with land disposal;
(B) the goals, objectives, and requirements of the Solid Waste Disposal Act (42 U.S.C. 6901 et seq.);
(C) the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents;
(D) short- and long-term potential for adverse health effects from human exposure;
(E) long-term maintenance costs;
(F) the potential for future remedial action costs if the alternative remedial action in question were to fail; and
(G) the potential threat to human health and the environment associated with excavation, transportation, and redisposal, or containment.

– If a remedial action is selected that results in any hazardous substances, pollutants, or contaminants remaining at the site, such remedial action shall be reviewed no less often than each five (5) years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is determined that action is appropriate at such site, such action shall then be taken.

  Implementations of alternatives that provide permanent solutions have been evaluated in this report. Innovative treatment technologies that have been proven on full-scale applications have also been considered in this report.

- The Resource Conservation and Recovery Act (RCRA), as amended, governs the generation, transportation, treatment, storage, and the disposal of hazardous wastes. RCRA (40 CFR 264) standards may apply to remedial actions that include on-site storage and off-site hauling and disposal of hazardous wastes and excavated soils.

- Occupational Safety and Health Administration (OSHA) provides enforceable occupational safety and health standards for workers engaged in on-site remedial activities. Threshold Limit Values (TLVs) and Permissible Exposure Limits (PELs) are ARARs that are within the jurisdiction of the on-site health and safety officer; they are applicable to all on-site remedial activities.

- The US and New York State Department of Transportation (DOT) regulations govern the off-site transport of hazardous materials and wastes for disposal and/or treatment. All waste handlers shall have all applicable and valid permits and certifications; these regulations are applicable to all on-site remedial activities.

- The Hazardous and Solid Waste Amendments and the RCRA Land Disposal Restrictions regulate land disposal of hazardous wastes, which shall be taken into consideration for proposed remedial actions involving disposal options for excavated wastes.

- Technical and Operational Guidance Series (TOGS) provides information on deriving water quality guidance values for human and wildlife health, as well as bioaccumulation factors and site-specific standards.

- The New York State TAGM #4030 establishes the general rules for making a determination of "significant threat" and for the selection of a remedy; it is an ARAR for this site.

3.3 Remedial Action Objectives and Cleanup Goals

The remedial action objectives and chemical-specific cleanup goals are developed in this section.

3.3.1 Remedial Action Objectives

RAOs are established for different media for the protection of human health and the environment. The RAOs are established by considering the COCs, evaluating exposure pathways and potential receptors, and presenting acceptable contaminant levels or ranges (preliminary remediation goals) for each exposure route that are intended to reduce receptor exposure to contaminated media. Final acceptable exposure levels encompass the results of the human health and environmental risk assessment, including the evaluation of expected exposures and associated risks for each alternative. Contaminant levels present in each environmental media are compared to the acceptable levels noted above, including evaluation of the following factors:

- Under the CERCLA, the acceptable risk range for carcinogens is defined as risk falling in the range of one (1) additional cancer in 10,000 (10^{-4}) to one (1) additional cancer in 1,000,000 (10^{-6}). When the risk assessment indicates the total risk to an individual exceeds the upper end (10^{-4}) of the risk range, remedial action is generally warranted. Thus, whether remediation goals for all carcinogens of concern provide protection within the risk range of 10^{-4} to 10^{-6} will be considered. Although the 10^{-6} risk level is identified by EPA as the lower bound of risk in evaluating the results of risk assessment and for establishing preliminary remediation goals, the acceptable upper bound risk level is 10^{-4}. In the case of naturally occurring chemical substances, risk attributable to background levels may be taken into consideration.

- For all non-carcinogens of concern, the remediation goals shall provide sufficient protection at the site.

- Human health effects and environmental effects shall be addressed in developing RAOs.

- The exposure analysis of the risk assessment shall adequately address all pathways of human exposure identified in the baseline risk assessment.

Groundwater contamination that has been identified at the Nosedocks/Apron 2 area could pose a human health risk if groundwater is used as a source of drinking water. While aquifer yields under the base are generally too low to be suitable for municipal wells, the aquifer thickens to greater than 60 feet in the southernmost part of the base (including the region near the plumes at the site), and well yields in this area could conceivably be used for water supply wells. However, because current and future uses planned for this site are limited to industrial use, the installation of potable drinking water is not likely due to the ready access to existing water supplies for the base and the City of Rome. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The groundwater use restriction included drinking of groundwater and other uses such as utilizing it for industrial purposes.

Other exposure routes from contaminated groundwater include the inhalation of volatiles that migrate from shallow groundwater into buildings or the atmosphere and exposure to surface water and sediment contaminated by the discharge of groundwater.

Quantifiable human health risks above the target levels established for CERCLA/NYS Inactive Hazardous Waste sites exist based upon potential future land use and potential use of the groundwater. Therefore, several RAOs have been identified to mitigate the potential present and/or future risks associated with the Griffiss AFB site. For the chlorinated plumes addressed in this FS, these RAOs are:

- make the groundwater potable for domestic or municipal use, or prevent exposure to groundwater until natural processes attenuate the contamination to potable standards while maintaining ICs to prevent groundwater use;

- limit discharge of contaminated groundwater to the Six Mile Creek and prevent contaminated groundwater from adversely impacting surface water, sediment, wetlands, fish, and protected vegetation in the creek;

- prevent/minimize the leaching of any contaminants present in the vadose zone soils into the underlying aquifer due to infiltration of precipitation;

- limit additional migration of contaminants in groundwater beyond the existing plume boundaries and prevent/minimize the downgradient off-base migration of contaminated groundwater through Six Mile Creek discharges;
- prevent/minimize human exposure, including ingestion, inhalation, and dermal contact by present and future residents, visitors, employees, and construction workers, and environmental exposure to contaminants in the surface and subsurface soils, groundwater, and surface water;

- prevent/minimize the uptake of contaminants present in soils, groundwater, and surface water by plants, fish, and wildlife; and

- if active measures are not practicable (or cost-effective), control exposure to the waste through legally enforceable institutional means, which may be used in certain circumstances in combination with active, engineered controls and/or treatment in the management and cleanup of the site where it is determined that such controls are necessary to be protective; in such circumstances, employ restrictions to ensure that the controls remain in place, that they remain protective, and that they are effective in preventing exposure to hazardous substances for as long as the substances at the site remain hazardous.

3.3.2 Chemical-specific Cleanup Goals

Chemical-specific cleanup goals are developed to define the area and volume of groundwater that must be addressed for each plume to meet RAOs. These cleanup goals are based on the evaluation of ARARs and TBCs, and may be supplemented by the findings of site-specific risk assessments. These evaluations are used to determine contaminant levels that will not endanger human health or the environment.

The following approach was taken for establishing cleanup goals. Where ARARs are available, the lowest of the Federal or State ARARs was selected as a preliminary screening value. If neither federal nor NYSDEC ARARs were available, the lowest of the TBC values was used as the preliminary screening value. For each plume, preliminary screening values are compared to the maximum detected concentration for each contaminant to identify contaminants for which cleanup goal would need to be set. The ARARs/TBCs cleanup goals are compared with maximum contaminant concentrations occurring within a plume in Table 3-4 (Section 3 tables are presented at the end of the section for readibility).

[Note: Since the FS is an iterative process which is updated as additional site data is available as well as the full scope of the remedial alternatives are evaluated, cleanup goals are not finalized for the current document. However, for preliminary evaluation purposes the NYSDEC groundwater cleanup standards are assumed for defining the boundaries of contaminant plumes requiring cleanup and for use as preliminary screening levels for groundwater cleanup. The cleanup goals will be finalized upon completion of the internal (USAF) reviews of the Draft FS.]

Site risk assessments were prepared for the Nosedocks/Apron 2 Chlorinated Plume AOC during the RI (FPM, April 2004). The NCP and CERCLA define the target risk range for exposure to carcinogenic compounds as an excess upper bound lifetime risk within the range of 10^{-4} to 10^{-6}. Potential risks from exposure to carcinogens across the Nosedocks/Apron 2 Chlorinated Plume were evaluated for industrial workers' exposure to groundwater. The cumulative risk from exposure to contaminants in groundwater as measured in permanent monitoring well samples by industrial workers is 5.92×10^{-4}, which exceeds the USEPA's target risk range, which is within USEPA's target risk range. The pathway-specific risks from ingestion, dermal exposure to groundwater, and inhalation of volatiles released from groundwater as measured in permanent monitoring wells were 5.33×10^{-4}, 5.7×10^{-5}, and 1.87×10^{-6}, respectively. Vinyl chloride was the major volatile organic risk contributor for this exposure scenario for the ingestion pathway (4.31×10^{-4}), while arsenic was the major metal risk contributor (1.30×10^{-4}). While these estimated risks underscore the need to address the Nosedocks/Apron 2 plume, these estimates will not be used to set cleanup goals or identify extents of contamination, as this is adequately addressed by ARARs and TBCs.

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Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Groundwater:				
Safe Drinking Water Act (SDWA).	Pub. L. 95-523, as amended by Pub. L. 96-502, 42 USC 300(f) et. seq.	Main federal law that ensures the quality of the nation's drinking water; Sets limits to the maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs).	Applicable	The aquifer is a potential source of potable water to the area.
SDWA MCL Goals.	40 CFR 141	MCLG is the level of a contaminant in drinking water below which there is no known or expected risk to health.	Applicable	MCLGs allow for a margin of safety and are public health goals that are not legally enforceable.
National Primary Drinking Water Standards.	40 CFR Part 141	Applicable to the use of public water systems; Protects public health by limiting the levels of contaminants in drinking water; Establishes maximum allowable contaminant levels in drinking water delivered to customer; Establishes monitoring requirements and treatment techniques.	Applicable	Primary MCLs are legally enforceable. The MCL's are set, based on a risk assessment process, as close to MCLG's as possible using best available treatment technology and taking cost into consideration.
National Secondary Drinking Water Standards.	40 CFR Part 143	Applicable to the use of public water systems; Controls contaminants in drinking water that primarily affect the cosmetic or aesthetic qualities relating to public acceptance of drinking water; These contaminants are not considered to present a risk to human health at the secondary MCL levels; However, at considerably higher concentrations than secondary MCLs, health implications may also exist.	Applicable	Secondary MCLs pertain to cosmetic effects (e.g., skin or tooth discoloration) or aesthetic characteristics (taste, odor, or color in drinking water), and are not legally enforceable.

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Requirement to meet ARARs and MCLs/MCLGs under CERCLA.	42 USC 9621	With respect to any contamination remaining on site, if any promulgated standard, requirement, criteria, or limitation under any Federal environmental law (or a State environmental or facility siting law that is more stringent) are ARARs, the selected remedial action shall, at the completion of the remedial action, attain such ARARs for the residual contamination. Such remedial action shall require a level or standard of control which at least attains MCLs/MCLGs established under the Safe Drinking Water Act and water quality criteria established under the Clean Water Act, where such goals or criteria are relevant and appropriate.	Applicable	In determining whether or not any water quality criteria under the Clean Water Act is relevant and appropriate under the circumstances of the release or threatened release, the designated or potential use of the surface or groundwater, the environmental media affected, the purposes for which such criteria were developed, and the latest information available, shall be taken into consideration.
Provision for establishing Alternate Concentration Limits.	42 USC 9621; USEPA Directive 9283.1-12: USEPA Document # USEPA/540/R-96/023, October 1996 ("Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites, Final Guidance"); NCP - 55 FR 8754, March 1990	ACLs may be established as cleanup levels in lieu of drinking water standards (e.g., MCLs) in certain cases where contaminated groundwater discharges to surface water. The circumstances under which ACLs may be established at Superfund sites can be summarized as follows: (1.) the contaminated groundwater must have “known or projected” points of entry to a surface water body; (2.) there must be no “statistically significant increases” of contaminant concentrations in the surface water body at those points of entry, or at points downstream; and (3.) it must be possible to reliably prevent human exposure to the contaminated groundwater through the use of institutional controls. Each of these criteria must be met and must be supported by site-specific information.	Applicable	A contaminant release analysis, followed by a fate and transport analysis, can be used to develop ACLs at compliance points based on meeting MCLs at exposure points. This provision in the regulations allows the contaminant levels in groundwater to be above MCLs if safe levels are met at the facility boundary or in some cases off-site.

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
		The NCP Preamble advises that ACLs are not to be used in every situation in which the above conditions are met, but only where active restoration of the ground water is "deemed not to be practicable." This caveat in the Preamble signals that EPA is committed to the program goal of restoring contaminated groundwater to its beneficial uses, except in limited cases.		It should be noted that establishing ACLs is distinct from obtaining a technical impracticability waiver from ARARs, for which cost is generally not a major factor unless it is inordinately high. The ACLs and the technical impracticability waiver are mutually exclusive in that if one is available, there is no necessity for the other.
USEPA Region III Risk-Based Concentration (RBC) Table.	Region III Memo to RBC Table Users, April 2004, notifying the posting of the updated RBC Table on their website	The RBC Table contains, for "standard" exposure scenarios, chemical concentrations corresponding to fixed levels of risk [i.e., a Hazard Quotient (HQ) of 1, or lifetime cancer risk of 1E-6, whichever occurs at a lower concentration] in water, air, fish tissue, and soil. The primary use of RBCs is for chemical screening during baseline risk assessment. RBCs also have several important limitations. Specifically excluded from consideration are: (1.) transfers from soil to air, (2.) cumulative risk from multiple contaminants or media, and (3.) dermal risk. Additionally, the risks for inhalation of vapors from water are based on a very simple model, whereas detailed risk assessments may use more detailed showering models. Many RBCs are also based on adult risks.	TBC	Provides preliminary basis for comparison of risk-based concentrations with ARARs. The Region III tap water RBCs will be utilized for this purpose.
USEPA Office of Drinking Water Health Advisories.		Standards issued by the USEPA Office of Drinking Water since 1978.	TBC	

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Surface Water:				
Clean Water Act (CWA).	33 USC 1251 et. seq.	Applicable for alternatives involving treatment with point-source discharges to surface water.	Potentially Applicable	Criteria available for water and fish ingestion, and fish consumption for human health. State criteria are also available.
Toxic Pollutant Effluent Standards.	40 CFR Part 129	Applicable to the discharge of toxic pollutants into navigable waters.	TBC	Effluent limitation for toxic pollutants are based on the best available technology economically achievable (BATEA) for point source discharges.
General Provisions for Effluent Guidelines and Standards.	40 CFR 401	Establishes legal authority and general definitions that apply to all regulations issued concerning specific classes and categories of point sources.	Potentially Applicable	Provides for point source identification. Applicable to remedial action with effluent discharge.
Soil:				
USEPA Soil Screening Guidance (1996) and Supplemental Guidance (2001).	USEPA Document # USEPA/540/R-96/018, July 1996; OSWER 9355.4-24, March 2001	Provides non-binding guidance for developing risk-based Soil Screening Levels (SSLs) for protection of human health.	TBC	Provides basis and procedures to develop soil cleanup objectives and determine soil cleanup levels. Current FS is for remediation of groundwater. However, contamination in soil media (vadose zone) may need to be considered under certain remedial options.
EPA Region III Risk-Based Concentration (RBC) Table incorporating soil-to-groundwater SSLs.	Region III Memo to RBC Table Users, October 1999, on incorporating SSLs into RBC table; Region III Memo to RBC Table Users, April 2004, notifying the posting of the updated RBC table on their website	Provides non-binding guidance for developing risk-based SSLs for protection of human health.	TBC	Provides basis and procedures to develop soil cleanup objectives and determine soil cleanup levels. The Region III SSLs correspond directly to the Region III tap water RBCs.

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Air:				
Clean Air Act.	42 USC 7401 Section 112	Establishes limits on parameter emissions to atmosphere.	Applicable	Applicable if pollutants deemed hazardous or non-hazardous based on public health are discharged to air.
National Primary and Secondary Ambient Air Quality Standards (NAAQS).	40 CFR 50	Establishes primary and secondary NAAQS under Section 109 of the Clean Air Act. Primary NAAQS define levels of air quality necessary to protect public health. Secondary NAAQS define levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.	Potentially Applicable	Applicable to remedial action alternative(s) that may emit pollutants to the atmosphere.
CERCLA:				
Site Health Assessments by the Agency for Toxic Substances and Disease Registry (ATSDR).	CERCLA 42 USC 9604(i); RCRA 42 USC 6939a; 42 CFR 90	ATSDR is responsible for conducting health assessments at existing or proposed National Priority List (NPL) sites under CERCLA. It also has other health-related responsibilities under CERCLA and RCRA.	TBC	Griffiss AFB is a NPL site for which health assessments have been performed by ATSDR.
RCRA:				
RCRA - Identification and Listing of Hazardous Waste.	40 CFR Part 261	Defines those solid wastes which are subject to regulations as hazardous wastes under 40 CFR Parts 262-265, 268, and Parts 124, 270, 271.	Potentially Applicable	May be considered an ARAR for solids produced during groundwater treatment.

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Other:				
USEPA Epectations for Remedial Alternatives Development.	40 CFR 300.430(a)(1)(iii)(A-	The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste. To accomplish this goal, the NCP describes six (6) expectations for remedial alternatives development, which are specified in the referenced citation. These expectations shall be considered when developing the remedial alternatives; however, adherence to these expectations does not constitute sufficient grounds for selection of that alternative. The selection of an appropriate waste management strategy is determined solely through the remedy selection process outlined in the NCP, i.e., all remedy selection decisions are site-specific and must be based on a comparative analysis of the alternatives using the nine evaluation criteria in the EPA RI/FS Guidance document (EPA/540/G-89/004).	TBC	Applicable for developing remedial alternatives. However, from the results of the RI (FPM, 2004), there are no current sources for continuing contamination of the chlorinated plumes. Also, groundwater is generally not considered to be a source material. No non-aqueous phase liquids (NAPLs) are present within the chlorinated plumes, thus eliminating them as potential sources for continuing contamination. Therefore, since there are no principal threats posed at the chlorinated plumes Site by source materials, the need for any source control measures and the first expectation to use treatment are rendered moot with respect to source materials.
USEPA Directives and Protocols for evaluating and use of monitored natural attenuation (MNA) as a remedy	OSWER Directive 9200.4-17P, April 1999; and for chlorinated solvents, EPA Document Number EPA/600/R-98/128, September 1998.	The referenced documents clarify EPA's policy regarding the use of monitored natural attenuation (MNA) as a remedy (OSWER Directive 9200.4-17P), and prescribe technical protocols for evaluating and demonstrating the potential for MNA at the Site (EPA/600/R-98/128).	TBC	Applicable. Based on a rigorous analysis of monitoring data from the site over several years, the RI has concluded that natural attenuation is occurring at the Site. Additional analyses performed in this FS following the prescribed EPA technical protocols support the potential for MNA as a successful remedy for the Site.

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
USEPA Office of Research and Development Reference Doses.		Reference dose issued by the USEPA Office of Research and Development.	TBC	
Pretreatment Standards.	40 CFR 403	Establishes pretreatment standards to control pollutants that pass through or interfere with POTW treatment process or may contaminate sewage sludge.	Potentially Applicable	Applicable to remedial action alternative that includes discharge to POTW or to a sewer system that is connected to a POTW.
USEPA Health Advisories, Human Health Risk Assessment guidance, and Ecological Risk Assessment Guidance.	USEPA Guidance Documents, including USEPA Human Health Evaluation Manual, Part A (aka RAGS I) [(USEPA Document # USEPA/540/1-89/002, Dec. 1989) and any related documents; and Ecological Risk Assessment Guidance (USEPA Document # USEPA/540/R-97/006, Jan. 1997) and any related documents.]	These Guidance documents and advisories establish criteria and provide guidelines for evaluating human health and ecological risk at CERCLA sites.	TBC	These guidance documents and advisories are used to evaluate human health and risk due to site contaminants.
USEPA Environmental Criteria and Assessment Office Carcinogenic Potency Factors.		As devised by the USEPA's Environmental Criteria and Assessment Office, USEPA Carcinogen Assessment Group.	TBC	

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
New York State*				
Groundwater and Surface Water:				
NYSDEC "Derivation and Use of Standards & Guidance Values."	6 NYCRR Part 702; Also, TOGS 1.1.3, 1.1.4, and 1.1.5	Provides basis for derivation and use of water quality standards. Also, methodologies for deriving site-specific standards and guidance values are provided in the TOGS series.	Applicable	Applicable to groundwater cleanup levels.
New York Water Classifications and Quality Standards.	6 NYCRR Parts 609; 700-704	Describes classification system for surface water and groundwater. Establishes standards of Quality and Purity.	Applicable	Applicable to groundwater treatment. May be applicable if remedial activities include discharge to groundwater or surface water.
NYSDEC Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.	NYSDEC TOGS 1.1.1, June 1998	Provides a compilation of ambient water quality guidance values and groundwater effluent limitations for use where there are no standards (in 6NYCRR 703.5) or regulatory limitations (in 6NYCRR 703.6). For convenience, standards in 6NYCRR 703.5 and groundwater effluent limitations in 6NYCRR 703.6 are also included in TOGS 1.1.1.	Applicable	Applicable to groundwater cleanup levels and groundwater treatment.
NYSDEC Standards for Raw Water Quality.	10 NYCRR 170.4	Provides water quality standards.	Potentially Applicable	May be applicable to groundwater cleanup levels.
NYSDOH State Sanitary Code Drinking Water Supplies (MCLs).	10 NYCRR 5-1	Establishes water quality standards for potable water	Potentially Applicable	May be applicable to groundwater cleanup levels.
New York Regulation on State Pollutant Discharge Elimination System (SPDES).	6 NYCRR Parts 750-758	Describes the requirements and provisions of SPDES permits to specific effluent limits.	Potentially Applicable	May be applicable if remedial activities include discharge to groundwater or surface water.

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Soil:				
NYSDEC Soil Cleanup Objectives and Cleanup Levels.	NYSDEC TAGM HWR-92-4046 November 16, 1992 Revised-January 24, 1994	Applicable to the cleanup of contaminated soils. Cleanup goals recommended based on human criteria, groundwater protection, background levels, and laboratory qualification levels.	TBC	Provides basis and procedures to develop soil cleanup objectives and determine soil cleanup levels. Current FS is for remediation of groundwater. However, contamination in soil media (vadose zone) may need to be considered under certain remedial options.
NYSDEC Petroleum-Contaminated Soil Guidance Policy.	Spill Technology and Remediation Series (STARS) Memo #1, August 1992	Provides guidance on the handling, disposal, and/or reuse of non-hazardous petroleum-contaminated soils. While this document does not establish standards, it is intended as guidance in determining whether soils have been contaminated to levels requiring investigation and remediation. This document also constitutes a determination of beneficial use, in that if the petroleum-contaminated soil is determined to satisfy the criteria herein, such soil can be reused or disposed of as directed in this guidance, and is no longer considered a solid waste.	Potentially Applicable	May be applicable if petroleum-contaminated soils are excavated as part of a remedial action or incidental to such action, and require off-site disposal.

Table 3-1
Potential Chemical-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Air:				
NYSDEC Division of Air Guidelines for the Control of Toxic Ambient Air Contaminants.	DAR-1 (formally Air Guide 1)	Establishes air quality guidelines and standards.	Potentially Applicable	May be applicable if remedial alternative(s) include discharge to air.
New York Ambient Air Quality Standards.	6 NYCRR 256-257	Establishes air quality standards.	Potentially Applicable	May be applicable if remedial alternative(s) include discharge to air.
Hazardous Waste:				
New York Identification and Listing of Hazardous Waste Regulations.	6 NYCRR Part 371: Identification and Listing of Hazardous Waste	Identifies "characteristic" hazardous wastes and "listed" hazardous wastes.	Potentially Applicable	May be applicable if hazardous wastes are generated, treated, or disposed during remedial activities.
NYSDEC Land Disposal Restrictions.	6 NYCRR Part 376	Identifies hazardous waste that are subject to land disposal restrictions.	Potentially Applicable	May be applicable if site remedial action includes land disposal.

* Since New York State does not have ARARs in its statute and to avoid misinterpretation of New York State requirements, the NYSDEC identifies the analogous State requirements for both ARARs (which are enforceable) and TBCs (which are non-enforceable) as the New York State Standards, Criteria and Guidelines (SCGs). In this document, to distinguish between enforceable and non-enforceable values, the terms ARARs and TBCs will be used, rather than the term SCGs, when referring to the New York State requirements.

Table 3-2
Potential Location-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Ground Water and Surface Water:				
Clean Water Act.	33 USC 1251 et. seq., Section 404	Prohibits discharge of dredged or fill material into [surface] waters, including wetlands, without a permit. Preserves and enhances wetlands. Such activities shall not be permitted if there is a practicable alternative which would have less adverse impact on the aquatic ecosystem.	Potentially Applicable	Requires a permit for any remedial activity that proposes to discharge dredged or fill material into wetlands.
Regulations of Activities Affecting Water of the U.S.	33 CFR 320-329	Corps of Engineers, Department of the Army regulations are codified in Title 33 (Navigation and Navigable Waters) of the Code of Federal Regulations (33 CFR Parts 200-399).	Potentially Applicable	Applicable to remedial activities that affect navigable waters subject to Army Corps of Engineers regulations.
Wild and Scenic Rivers Act.	16 USC 1271 et. seq.	Establishes the Wild and Scenic River System to protect rivers designated for their wild and scenic values from activities which may adversely affect those values.	Potentially Applicable	May be applicable if remedial action will affect the free-flowing characteristics, or scenic or natural values of a designated river.
Fish and Wildlife:				
Fish and Wildlife Coordination Act.	16 USC 661	Provides procedures for consultation between regulatory agencies to consider fish and wildlife conservation during water resource-related projects. Sets standards for protection of fish and wildlife when Federal actions impact or alter a natural stream or water body. Prohibits water pollution by any substances that are deleterious to fish, plant life, or bird life and requires consultation with the U.S. Fish and Wildlife Service and appropriate state agencies.	Potentially Applicable	May be applicable to remedial activities that may affect fish and wildlife resources during remedial actions.
Endangered Species Act of 1973.	16 USC 1531 et. seq.; 50 CFR Part 81, 402	Requires Federal agencies to ensure that actions they authorize, fund, or carryout are not likely to jeopardize the continued existence of endangered/threatened species or adversely modify or destroy the critical habitats of such species.	Potentially Applicable	Applicable to remedial activities that may affect endangered or threatened species living in affected areas. There are no plant or animal species at the base. Thus, this Act is potentially applicable only if remedial activities have off-base impacts.

Table 3-2
Potential Location-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Floodplain, Wetland, Coastal Zone:				
Executive Order On Floodplain Management.	Executive Order No. 11988; 40 CFR 6.302(b) and Appendix A	Requires Federal agencies to evaluate the potential long- and short-term effects of actions that may take place in a floodplain and to avoid the adverse impacts associated with direct and indirect development of a floodplain wherever there is a practicable alternative. If there is no practicable alternative, the proposed action shall include all practicable means to limit impact to floodplains which may result from such use.	Potentially Applicable	Applicable to remedial actions that affect wetland areas.
Wetland Executive Order.	Executive Order No. 11990; 40 CFR 6.302(a) and Appendix A	Details requirements for preservation of wetlands whenever there is a practicable alternative. If there is no practicable alternative, the proposed action shall include all practicable means to limit impact to wetlands which may result from such use.	Potentially Applicable	May be applicable to remedial activities that may affect wetlands.
RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal facilities.	40 CFR, Part 264.18	Part 264.18 establishes location standards including seismic considerations, and floodplain requirements to prevent washout, or to result in no adverse effects on human health or the environment if washout occurs.	Potentially Applicable	May be applicable to remedial activities affected by seismic considerations or remedial activities conducted in floodplain areas.
USEPA Guidance on Floodplains and Wetlands Assessments	USEPA Memorandum "Policy on Floodplains and Wetlands Assessments for CERCLA Actions," August, 1985	This directive discusses specific situations requiring preparation of a floodplains or wetlands assessment, and the factors which should be considered in preparing such an assessment for CERCLA response actions.	TBC	To be considered for remedial actions that affect floodplains and wetland areas.

Table 3-2
Potential Location-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Other:				
National Historic Preservation Act (NHPA) of 1966, as amended through 2000.	16 USC 461, 470 et. seq.; 40 CFR 6.301(b); 36 CFR 800	Establishes regulations for determining a site's eligibility for listing in the National Registry of Historic places. Requires consideration of remedial activity impact upon or near to any property included in or eligible for inclusion in the National Registry of Historic Places. Avoid impacts. Where impacts are unavoidable, mitigate through design and data recovery.	Not Applicable	There are no properties on or in the vicinity of the site that are either currently included in or are likely to be eligible for inclusion in the National Registry of Historic Places.
Archaeological and Historical Preservation Act.	16 USC 469a-1 et. seq.	Provides for the preservation of historical and archaeological data. Applicable if historical and archeological data would be affected by remedial action.	Not Applicable	There are no properties on or in the vicinity of the site that are either currently covered by or are likely to be eligible for coverage by the Archaeological and Historical Preservation Act.

Table 3-2
Potential Location-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
New York State*				
Fish and Wildlife:				
Endangered and Threatened Species of Fish and Wildlife.	6 NYCRR Part 182	Designates endangered and threatened species for protection.	Potentially Applicable	Applicable to remedial activities that may affect endangered or threatened species. There are no plant or animal species at the base. Thus, this regulation is potentially applicable only if remedial activities have off-base impacts.
Floodplain, Wetlands, Costal Zone:				
Floodplain Management Regulations - Development Permits.	6 NYCRR 500	Establishes standards for development activities conducted within floodplain areas.	Potentially Applicable	Applicable to remedial activities that are conducted within floodplain areas.
New York Wetlands Laws.	NYCRR Articles 24, 25	Establishes requirements for the protection of freshwater and tidal wetlands.	Potentially Applicable	May be applicable to remedial activities that may affect wetlands.
Environmental Conservation Law.	New York Consolidated Laws Service: Environmental Conservation Law: Articles 17, 37, 71, 72	Establishes requirements for the protection of New York State Waters.	Potentially Applicable	May be applicable if remedial activities include discharge to groundwater or surface water.
Use and Protection of Waters.	6 NYCRR Part 608	Establishes standards for use and protection of waters.	Applicable	Applicable to remedial activities that affect waters.

* Since New York State does not have ARARs in its statute and to avoid misinterpretation of New York State requirements, the NYSDEC identifies the analogous State requirements for both ARARs (which are enforceable) and TBCs (which are non-enforceable) as the New York State Standards, Criteria and Guidelines (SCGs). In this document, to distinguish between enforceable and non-enforceable values, the terms ARARs and TBCs will be used, rather than the term SCGs, when referring to the New York State requirements.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Executive Orders:				
Executive Order on Federal Compliance with Pollution Control Standards.	Executive Order No. 12088, October 1978	Made federal agencies responsible for cleaning up their facilities because they were not separately addressed in the original CERCLA or NCP. Delegated to federal agencies the responsibility for ensuring compliance with applicable pollution control standards.	Applicable	
Executive Order on Superfund Implementation.	Executive Order No. 12580, January 1987	Delegated the President's CERCLA authority to the USEPA; however, in cases of releases or threatened releases on or from DOD properties, the authority was delegated to the DOD, which in turn delegated the authority to USAF for its facilities. Thus, the USAF has lead agency authority for its sites. However, agency (USEPA, State) approvals and/or concurrence of selected remedies may still be required to varying degrees depending on the status of facilities (NPL or non-NPL).	Applicable	
DoD Orders:				
Directive on Environmental Restoration Program (DERP).	DoD Directive 4715.7, April 1996	Provides instruction on the policies, procedures, and responsibilities implemented by the Defense Environmental Restoration Program (DERP) and the Base Realignment and Closure (BRAC) program. The goal of the DERP and BRAC environmental restoration program is to reduce, in a cost-effective manner, the risks to human health and the environment attributable to contamination resulting from past DoD activities. This goal is accomplished through the policies established in this directive, including: (1.) Identify, evaluate, and, where appropriate, remediate contamination resulting from past DoD activities. (2.) Ensure immediate action to remove imminent threats to human health and the environment. (3.) Support the development and use of cost-effective innovative technologies and process improvements in the restoration process.	Applicable	Restoration activities may be conducted beyond the boundaries of a DoD facility or installation when it has been determined that contamination has migrated from a source within such a facility or installation or when hazardous substances from a DoD facility have come to be placed outside the facility.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Air Force Instruction on Air Force Policy Directive 32-70 concerning Environmental Restoration Program.	AFI 32-7020, February 2001	Provides guidance and procedures for executing the Air Force Environmental Restoration Program. This AFI implements the DERP, as outlined in the DoD Directive 4715.7, April 1996, as supplemented by DoD DERP Management Guidance, March 1998. Incorporated by reference into this instruction [in May 2000] are policies regarding Integration of Natural Resource Injury issued by the Deputy Under Secretary of Defense (Environmental Security) [DUSD(ES)] under "Interim Policy on Integration of Natural Resource Injury Responsibilities and Environmental Restoration Activities," May 2000, which require the integration of natural resource injury considerations into the ERP cleanup process at Air Force facilities. Under these requirements, whenever practicable, at sites where the Air Force is both a potentially responsible party/lead agent and a natural resource trustee (e.g., Air Force installations), the Service has to identify injury to natural resources and redress such injury during the site assessment, investigation, and remedy selection and implementation process, primarily achieved by conducting an ecological risk assessment during the RI/FS phase of the cleanup process. The resulting information should then be used to determine which response alternative would best redress past natural resource injury, and whether an alternative would itself cause additional injury. Whenever practicable and consistent with the CERCLA and NCP remedy selection process, a response action that results in the least amount of residual natural resource injury should be selected.	Applicable	The Air Force ERP mission is to identify, investigate, and clean up contamination associated with past Air Force activities as necessary to protect human Air Force executes cleanup and completes site close-out using a "risk plus other factors" approach for setting priorities, through building productive partnerships with regulators, community based decision making, and implementation of effective and efficient cleanup technologies.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
CERCLA and SARA:				
Selection of remedial action under CERCLA, as amended by SARA.	CERCLA/SARA - 42 USC 9621; CERCLA - Public Law 96-510, December 1980; SARA - Public Law 99-499, October 1986	Requires that the selected remedial action shall be one that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable., and which provide for cost-effective response. The CERCLA further specifies the following requirements: Remedial actions in which treatment that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants are to be preferred. The offsite transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available. An assessment shall be conducted of permanent solutions and alternative treatment technologies or resource recovery technologies that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant.	Applicable	In evaluating the cost effectiveness of proposed alternative remedial actions, the total short- and long-term costs of such actions shall be taken into account, including the operation and maintenance costs for the entire period during which such activities will be required. In making such assessment, the long-term effectiveness of various alternatives shall be specifically addressed.
		If a remedial action is selected that results in any hazardous substances, pollutants, or contaminants remaining at the site, such remedial action shall be reviewed no less often than each five (5) years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is determined that action is appropriate at such site, such action shall then be taken.		

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Ground Water and Surface Water:				
Clean Water Act.	33 USC 1251 et. seq.	Restoration and maintenance of chemical, physical, and biological integrity of the nation's water.	Applicable	Sets standards to restore and maintain the integrity of the nation's water.
Effluent Limitations.	33 USC 1311; CWA Section 301	Technology-based discharge limitations for point sources of conventional, non-conventional, and toxic pollutants.	Potentially Applicable	Applicable for treatment options requiring discharge either to surface water bodies (e.g., Six Mile Creek) or to POTWs.
Water Quality Standards and Effluent Limitations.	33 USC 1312; CWA Section 302	Protection of intended uses of receiving waters (e.g., public water supply, recreational uses).	Potentially Applicable	Applicable for treatment options requiring discharge either to surface water bodies (e.g., Six Mile Creek) or to POTWs.
Water Quality Standards and Implementation Plans.	33 USC 1313; CWA Section 303	Requires State to develop water quality criteria.	Potentially Applicable	Applicable for treatment options requiring discharge either to surface water bodies (e.g., Six Mile Creek) or to POTWs.
Toxic and Pretreatment Effluent Standard.	33 USC 1317; CWA Section 307	Establishes list of toxic pollutants and pretreatment standards for POTWs discharge.	Potentially Applicable	Applicable for treatment options requiring discharge either to surface water bodies (e.g., Six Mile Creek) or to POTWs.
National Pollutant Discharge Elimination System (NPDES) Permit Regulations.	40 CFR 122	Establishes permitting requirements for effluent discharge.	Potentially Applicable	Applicable for treatment options requiring discharge either to surface water bodies (e.g., Six Mile Creek) or to POTWs.
NPDES Regulations.	40 CFR 125	Establishes criteria and standards for technology-based treatment requirements under the Clean Water Act.	Potentially Applicable	May be applicable for treatment alternatives including discharge to surface water (e.g., Six Mile Creek) or POTWs.
Regulations on Test Procedures for the Analysis of Pollutants.	40 CFR 136	Establishes test procedures for pollutant analysis in water.	Potentially Applicable	Applicable for alternatives including discharge to surface water (e.g., Six Mile Creek) or POTWs.
Safe Drinking Water Act Underground Injection Control Regulations.	40 CFR Parts 144-148	The Act aims to (1) protect the nation's sources of drinking water, and (2) public health by implementing proper water treatment techniques. These regulations set standards for underground injection of hazardous wastes and other fluids. Specifically, no injection shall be authorized if it results in the movement of fluid containing any contaminant into underground sources of drinking water.	Potentially Applicable	Applicable to wastewater treatment alternatives involving underground injections that may endanger drinking water sources (e.g., remedial alternatives involving groundwater infiltration/recirculation).

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Wild and Scenic Rivers Act.	16 USC 1271 et. seq.	Establishes the Wild and Scenic River System to protect rivers designated for their wild and scenic values from activities which may adversely affect those values.	Potentially Applicable	May be applicable if remedial action will affect the free-flowing characteristics, or scenic or natural values of a designated river.
Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites, USEPA Office of Emergency and Remedial Response.	USEPA Document # USEPA/540/G-88/003; OSWER Directive 9383.1-2	Provides guidance for developing, evaluating, and selecting groundwater remedial action at Superfund sites.	TBC	Guidance for selecting remedial alternative. Includes action related considerations, such as overall protection of human health and the environment, and implementability.
Air:				
Clean Air Act.	42 USC 7401 Section 112	Establishes limits on parameter emissions to atmosphere.	Applicable	Applicable if pollutants deemed hazardous or non-hazardous based on public health are discharged to air.
National Ambient Air Quality Standards (NAAQS).	40 CFR Part 50	Establishes primary and secondary NAAQs under Section 109 of the Clean Air Act.	Potentially Applicable	Applicable to alternatives that may emit pollutants to the air; establishes standards to protect public health and welfare.
Standards of Performance for New Stationary Sources.	40 CFR Part 60	Applicable to alternatives that will emit pollutants from new or modified stationary (facility) sources.	Potentially Applicable	May be applicable if remedial alternative treatment system or facility generates air emissions.
RCRA - Air Emission Standards for Process Vents.	40 CFR Part 264, Subpart AA	Describe air emission standards for process vents, closed-vent systems, and control devices at hazardous waste facilities; applicable to distillation, fractionation, thin-film evaporation, solvent extraction, and air or steam stripping operations that manage hazardous wastes containing organics at concentrations of at least 10 ppmw.	Potentially Applicable	May be applicable if remedial alternatives which are subject to these requirements are implemented at the site.
RCRA - Air Emission Standards for Equipment Leaks.	40 CFR Part 264, Subpart BB	Describe air emission standards for equipment leaks at hazardous waste facilities where equipment contains or contacts hazardous wastes containing organics at concentrations of at least 10 percent by weight.	Potentially Applicable	May be applicable if remedial alternatives which are subject to these requirements are implemented at the site.
RCRA - Air Emission Standards for Tanks, Surface Impoundments, and Containers.	40 CFR Part 264, Subpart CC	Describe air emission standards for facilities that treat, store, or dispose of hazardous wastes in tanks, surface impoundments, or containers.	Potentially Applicable	May be applicable if remedial alternatives which are subject to these requirements are implemented at the site.
Guidance on Control of Air Emissions from Air Strippers at Superfund Sites.	OSWER Directive 9355.0-28.	Provides guidance on the control of emissions from air strippers used for groundwater treatment at Superfund (CERCLA) sites.	TBC	May be applicable if selected remedial alternative treatment system includes air strippers.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
RCRA:				
Resource Conservation and Recovery Act (RCRA) Standards for Owners and Operators.	40 CFR Part 264	Standards for Owners and Operators of hazardous waste facilities. Applicable to treatment, storage, transportation, and disposal of hazardous waste and wastes listed under 40 CFR Part 261.	Potentially Applicable	May be required for waste/soil disposal or treatment options. Includes design requirements for treatment and post-closure care.
RCRA Subtitle D - Solid Waste.	40 CFR Part 264, Subtitle D	Applicable to the management and disposal of non-hazardous wastes.	Potentially Applicable	Specifies minimum technical standards for solid waste disposal facilities.
RCRA - Part 262 Standards for Generators Part 263 Standards for Transporters.	40 CFR Parts 262 and 263	Applicable to generators and transporters of hazardous waste.	Potentially Applicable	Applicable to off-site disposal or treatment of hazardous waste.
RCRA - Land Disposal Restrictions.	40 CFR Part 268	Applicable to alternatives involving land disposal of hazardous wastes, and requires treatment to diminish a waste's toxicity and/or minimize contaminant migration.	Potentially Applicable	May be required for waste/soil disposal or treatment options.
RCRA - Used Oil Management Standards.	40 CFR Part 279	Describe standards for generators, transporters, processors, marketers, recycling, and disposal of used oil. On-specification, off-specification, hazardous waste used oil, and materials contaminated with used oil are addressed.	Applicable	Applicable to remedial alternatives involving the handling, management, and/or disposal of waste oil or waste-oil contaminated media (e.g., free product).
Transportation of Hazardous Wastes.	49 CFR 171-180 for Transportation; CFR Parts 1-1399 for Highways	Requirements of hazardous materials transportation, including interstate and intra-state transportation.	Potentially Applicable	Applicable to remediation alternatives that involve the off-site transportation of hazardous waste.
RCRA - Part 270 Hazardous Waste Permit Program.	40 CFR 270	USEPA administered hazardous waste permit program.	Applicable	Covers the basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities.
Wetlands:				
Wetland Permits.	33 USC 1344; CWA Section 404	Applicable to remedial actions in and around wetlands.	Potentially Applicable	Applicable to remedial actions involving excavation or dredging in and around wetlands if the actions involve discharges to or activities near Six Mile Creek.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
Fish and Wildlife:				
Fish and Wildlife Coordination Act.	16 USC 661	Provides procedures for consultation between regulatory agencies to consider fish and wildlife conservation during water resource-related projects. Sets standards for protection of fish and wildlife when Federal actions impact or alter a natural stream or water body. Prohibits water pollution by any substances that are deleterious to fish, plant life, or bird life and requires consultation with the U.S. Fish and Wildlife Service and appropriate state agencies.	Potentially Applicable	May be applicable to remedial activities that may affect fish and wildlife resources during remedial actions.
Other:				
Threshold Limit Values, American Conference of Governmental Industrial Hygienists.	ACGIH ISBN: 0-936712-92-9	Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) are listed as guidelines to assist in the control of health hazards.	TBC	TLVs and BEIs were not developed for use as legal standards but may be used during site remedial activities to monitor worker exposure to air contaminants.
Occupational Safety and Health Act.	29 CFR 1910, 1926	Provides enforceable occupational safety and health standards (permissible exposure limits or PELs) for workers engaged in on-site field activities.	Applicable	These standards regulates employee exposure to air contaminants and provide guidelines for equipment handling and personal protection.
National Institute of Occupational Safety and Health.		Provides nonenforceable recommended exposure limits (RELs) for occupational activities for chemicals with PELs.	TBC	These are guidelines for worker exposure to air contaminants.
National Historic Preservation Act (NHPA) of 1966, as amended through 2000.	16 USC 461, 470 et. seq.; 40 CFR 6.301(b); 36 CFR 800	Establishes regulations for determining a site's eligibility for listing in the National Registry of Historic places.	Applicable	Requires consideration of remedial activity impact upon or near to any property included in or eligible for inclusion in The National Registry of Historic Places. Avoid impacts. Where impacts are unavoidable, mitigate through design and data recovery.
USEPA Area of Contamination (AOC) Policy.	55 FR 8758-8760	Allows waste to be consolidated within an AOC without triggering land disposal restrictions or minimum technical requirements.	Potentially Applicable	Applicable for remedial actions that may involve material containing hazardous waste.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
New York State*				
Remedy Selection:				
Remedy Selection for Inactive Hazardous Waste Disposal Sites.	6 NYCRR Part 375-1.10; TAGM 4030, May 1990	Establishes the general rules for the selection of a remedy. The goal of the program is to restore the site to pre-disposal conditions, to the extent feasible and authorized by law. At a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by hazardous waste disposed at the site through the proper application of scientific and engineering principles.	Applicable	The environmental factors used for making a "significant threat" determination are listed in 6 NYCRR Part 375-1.4. The mere presence of hazardous waste at a site or in the environment is not a sufficient basis for a finding that hazardous waste disposed at a site constitutes a significant threat.
		The TAGM provides guidelines to select an appropriate remedy and sets forth a hierarchy of remedial technology treatments which will be consistent with SARA and RCRA land disposal restrictions. If a remedial action resulting in a permanent and significant reduction in the toxicity, volume, or mobility of hazardous wastes was not selected, the justification for such action shall be discussed in the Record of Decision (ROD). If a remedial action that leaves any hazardous wastes at the site is selected, such remedial action shall be reviewed no less than once each five (5) years after completion of the remedial action to assure that human health and the environment are being protected by the implemented remedial action, and to identify any permanent remedy available for the site. If upon such review, it is determined that action is approriate, such action shall be required by the agency (NYSDEC).		However, where an identifiable source of contamination exists at a site, it should be removed or eliminated, to the extent feasible, regardless of presumed risk or intended use of the site.
Ground Water and Surface Water:				
New York Regulation on State Pollutant Discharge Elimination System (SPDES).	6 NYCRR Part 750-758	Describes permit requirements, applications, standards, compliance schedule, duration, reissuance, monitoring, recording, and reporting of SPDES permitting process.	Potentially Applicable	Remedial action alternatives must comply with the substantive provision of the SPDES permitting requirements. May be applicable if remedial activities require SPDES permit.
New York Rules on SPDES Program Fees.	6 NYCRR Part 485	Specifies SPDES Program fees.	Potentially Applicable	May be applicable if remedial activities require SPDES permit.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
New York Water Pollution Control Regulations.	6 NYCRR Parts 608, 610-614	Establishes regulations for the use and protection of waters.	Potentially Applicable	May be applicable if remedial alternative includes discharge to groundwater or surface water.
Underground Injection.	40 CFR 144-147	Provides requirements for Underground Injection Control System (UIC) plan and establishes classifications of wells.	TBC	To be implemented for remedial activities that involve underground injection.
NYSDEC Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.	NYSDEC TOGS 1.1.1, June 1998	Provides a compilation of ambient water quality guidance values and groundwater effluent limitations for use where there are no standards (in 6NYCRR 703.5) or regulatory limitations (in 6NYCRR 703.6). For convenience, standards in 6NYCRR 703.5 and groundwater effluent limitations in 6NYCRR 703.6 are also included in TOGS 1.1.1.	Applicable	Applicable to groundwater cleanup levels and groundwater treatment.
Water Supply Emergency Plans, Notifications, and Reporting.	10 NYCRR Part 5; NYSDOH Public Water Systems documents	Describes requirements and procedures for handling community water system emergencies, emergency notifications, reporting, and responding to organic chemical concerns.	TBC	To be considered in conjunction with remedial activities that may result in emergency situations with respect to community water system or organic chemical contamination of public water systems.
Air:				
General Process Emission Sources.	6 NYCRR Part 212	Establishes allowable emissions for general process sources.	Potentially Applicable	Applicable to remedial alternatives that result in emissions to the air.
Incinerators.	6 NYCRR Part 219	Establishes particulate emission limits for incinerators.	Potentially Applicable	Applicable to remedial alternatives that result in emissions to the air.
Air Permits and Certificates.	6 NYCRR Part 201	Describes requirements and procedures for obtaining air permits and certificates. Note: Certain emissions related to remediation projects (e.g., air strippers and soil vents for remediating gasoline spills at Superfund sites, and ozone generators for water treatment processes) are exempt from permitting under this Part 201.	Potentially Applicable	Applicable to remedial alternatives that result in emissions to the air.
General Prohibitions.	6 NYCRR Part 211	Describes prohibitions and limitations placed on air pollution.	Potentially Applicable	Applicable to remedial alternatives that result in air pollution not covered in other parts, including alternatives subject to visibility limitations.
New York Environmental Conservation Law.	New York Consolidated Laws Service: Environmental Conservation Law: Articles 1, 3, 5, 7-8, 19, 38, 70-72	Establishes requirements for the protection of air quality.	Potentially Applicable	May be applicable if remedial alternatives include discharge to air.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
New York Air Pollution Control Regulations.	6 NYCRR Parts 200-221	Provides provisions for the preservation and control of air contamination and air pollution.	Potentially Applicable	May be applicable if remedial alternatives include discharge to air.
Air Quality Standards.	6 NYCRR Parts 256, 257, and 290	Establishes air quality standards. Part 290 is specific to Oneida County where Griffiss AFB is located.	Potentially Applicable	Applicable to remedial alternatives that result in emissions to the air.
Hazardous Waste:				
New York Identification and Listing of Hazardous Waste Regulations.	6 NYCRR Part 371	Identifies "characteristic" hazardous wastes and "listed" hazardous wastes.	Potentially Applicable	May be applicable if hazardous wastes are generated, treated, or disposed during remedial activities.
New York Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements.	6 NYCRR Part 373-1	Establishes permit requirements and construction and operations standards.	Potentially Applicable	May be applicable if remedial activities include treatment, storage, and/or disposal of hazardous waste.
New York Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal facilities.	6 NYCRR Part 373-2	Establishes minimum State standards that define the acceptable management of hazardous waste.	Potentially Applicable	May be applicable if remedial activities include treatment, storage, and/or disposal of hazardous waste.
New York Interim Status Standards for Owners and Operators of Hazardous Waste Facilities.	6 NYCRR Part 373-3	Establishes minimum State standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure or fulfillment of post-closure requirements.	Potentially Applicable	May be applicable if remedial activities include treatment, storage and /or disposal of hazardous waste.
New York Rules on Releases, Registration, and Listing of Hazardous Substances.	6 NYCRR Part 595-597	Establishes requirements for the reporting of releases, emergency response, investigation of releases, and corrective action.	Potentially Applicable	May be applicable if remedial activities include the storage of hazardous waste.
New York General Hazardous Waste Management System Regulations.	6 NYCRR Part 370	Provides definitions of terms and general standards applicable to hazardous waste management system regulations.	Potentially Applicable	May be applicable if site remedial action alternative includes the management of hazardous waste.
New York Rules on Hazardous Waste Program Fees.	6 NYCRR Part 483	Establishes regulatory program fees.	Potentially Applicable	May be applicable if site remedial action alternative includes the management of hazardous waste.
New York Hazardous Waste Manifest System Regulations.	6 NYCRR Part 372	Establishes record keeping requirements and standards related to the manifest system for hazardous wastes.	Potentially Applicable	May be applicable if remedial activities require the transportation of hazardous waste.

Table 3-3
Potential Action-Specific ARARs/TBCs*
Feasibility Study For Griffiss-Air Force Base
Rome, New York

Standard, Requirement, Criteria or Limitation	Citation Or Reference	Description	Status	Comments
New York Rules on Collection and Transport of Industrial Wastes.	6 NYCRR Part 364	Regulates transportation of hazardous materials.	Potentially Applicable	May be applicable if action results in off-site transport of hazardous materials.
Requirements for Solid Waste Management Facilities.	6 NYCRR Part 360	Establishes standards applicable to the operation of solid waste management facilities.	Potentially Applicable	Describes design criteria, monitoring and closure requirements for solid waste management facilities such as landfills. May be applicable is site remedial alternative includes the disposal of wastes at on-site landfill.
Fish and Wildlife:				
Endangered and threatened Species of Fish and Wildlife; Species of Special Concern.	6 NYCRR Part 182	Identifies endangered and threatened species and species of special concern.	Applicable	May be applicable if any such species are known to habituate the area and the Six Mile Creek may be impacted by remedial activity.
Wetlands:				
New York Wetlands laws.	NYCRR Articles 24, 25	Establishes requirements for the protection of freshwater and tidal wetlands.	Potentially Applicable	May be applicable if treated waters are discharged to the Six Mile Creek and thereon to the Barge Canal.
New York Wetlands Regulations.	6 NYCRR Part 661: Tidal Wetlands Land Use Regulations	Establishes regulations for the protection of tidal wetlands.	Potentially Applicable	May be applicable if treated waters are discharged to the Six Mile Creek and thereon to the Barge Canal.
Other:				
New York Uniform Procedures Regulations.	6 NYCRR Part 621	Governs the administration of environmental permits.	Potentially Applicable	May be applicable if remedial activities require permitting.
NYSDEC Draft Technical Guidance for Site Investigation and Remediation.	NYSDEC Draft DER-10, Dec. 2002	Describes the basic scope of work required by NYSDEC for investigation and remediation of potentially contaminated sites. It also contains a comprehensive listing of State SCGs for Site Investigation and Remediation, which shall be consulted when performing a detailed analysis of alternatives for the Feasibility Study (FS).	TBC	Take into consideration during detailed analysis of alternatives for the FS, and when developing work plans and conducting remedial actions.

* Since New York State does not have ARARs in its statute and to avoid misinterpretation of New York State requirements, the NYSDEC identifies the analogous State requirements for both ARARs (which are enforceable) and TBCs (which are non-enforceable) as the New York State Standards, Criteria and Guidelines (SCGs). In this document, to distinguish between enforceable and non-enforceable values, the terms ARARs and TBCs will be used, rather than the term SCGs, when referring to the New York State requirements.

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TABLE 3-4
CLEANUP GOAL SELECTION PROCESS FOR NOSEDOCKS / APRON 2 CHLORINATED PLUMES
(µg/L)

	ARARs							TBCs		MAXIMUM CONCENTRATION VALUES***			
	DRINKING WATER			GROUNDWATER*		SURFACE WATER		DRINKING WATER					
Contaminant	Federal MCLG 40CFR Part 141	Federal MCL 40CFR Part 141	NY Sanitary Code Drinking Water Standards (MCL) 10NYCRR 5-1	NYSDEC Class GA Groundwater Standards 6NYCRR 703.5	NYSDEC Class GA Groundwater Guidance Values TOGS 1.1.1	NYSDEC Class C Surface Water Standards 6NYCRR 703.5	NYSDEC Class C Surface Water Guidance TOGS 1.1.1	EPA Region III Tap Water Criteria	Preliminary Screening Level for Groundwater **	TCE Plume	DCE Plume	Vinyl Chloride Plume	Cleanup Goal
VOCs													
1,1-dichloroethene	7	7	5	5	n/a	n/a	n/a	350	5	0.38	0.38	U	5
1,1-dichloroethane	n/a	n/a	5	5	n/a	n/a	n/a	800	5	U	0.49	0.49	5
1,2,4-trimethylbenzene	n/a	n/a	5	5	n/a	n/a	33 A(C) 290 A(A)	12	5	18.00	U	U	5
1,3,5-Trimethylbenzene	n/a	n/a	5	5	n/a	n/a	n/a	12	5	2.80	U	U	5
benzene	0	5	5	1	n/a	10 H(FC)	210 A(C) 760 A(A)	0.32	1	0.28	0.46	0.46	1
cis-1,2-dichloroethene	70	70	5	5	n/a	n/a	n/a	61	5	--	56.00	--	5
ethylbenzene	700	700	5	5	n/a	n/a	17 A(C) 170 A(A)	1300	5	9.90	U	U	5
isopropylbenzene	n/a	n/a	5	5	n/a	n/a	2.6 A(C) 23 A(A)	n/a	5	3.70	U	U	5
xylene (m+p)	10,000	10,000	5	5	n/a	n/a	65 A(C) 590 A(A)	210	5	19.00	U	U	5
methylene chloride	n/a	n/a	5	5	n/a	200 H(FC)	n/a	4.1	5	U	U	U	5
n-butylbenzene	n/a	n/a	5	5	n/a	n/a	n/a	n/a	5	0.29	U	U	5
n-propylbenzene	n/a	n/a	5	5	n/a	n/a	n/a	n/a	5	4.00	U	U	5
MTBE	n/a	n/a	10	10	n/a	n/a	n/a	2.6	10	U	U	24	10
p-isopropyltoluene	n/a	n/a	5	5	n/a	n/a	n/a	n/a	5	0.40	U	U	5
naphthalene	n/a	n/a	50	10	10	n/a	13 A(C) 110 A(A)	6.5	10	3.20	U	U	10
sec-butylbenzene	n/a	n/a	5	5	n/a	n/a	n/a	n/a	5	1.70	U	U	5
trichloroethylene (TCE)	0	5	5	5	n/a	40 H(FC)	n/a	0.026	5	29.00	--	--	5
tetrachloroethene (PCE)	0	5	5	5	n/a	n/a	1 H(FC)	0.1	5	0.38	U	U	5
tert-butylbenzene	n/a	n/a	5	5	n/a	n/a	n/a	n/a	5	0.22	U	U	5
trans-1,2-dichloroethene	100	100	5	5	n/a	n/a	n/a	120	5	1.60	4.60	4.6	5
vinyl chloride	0	2	2	2	n/a	n/a	n/a	0.015	2	--	--	96	5
Total VOC's										94.9	61.9	125.6	

Notes:
Only analytes that are detected in at least one of the plumes in this table are shown.
* NYSDEC CLASS GA Groundwater Limitations are identical to NYSDEC CLASS GA Groundwater Standards
** Preliminary Screening Levels for Groundwater are identical to NYSDEC Class GA Groundwater Standards
*** For each contaminant, Maximum Concentration Value among all sampling results from all wells in particular plume during September '04 sampling.
-- - Concentrations of these constituents were not included in these plumes so as to avoid double-counting.
U - The results were analyzed for, but not detected.
n/a - Not available.
A(A) - Fish Survival (fresh water)
A(C) - Fish Propagation (fresh water)
H(FC) - Human Consumption of Fish (fresh water)
: Concentration above Preliminary Screening Level for Groundwater

4 ENGINEERING BASIS OF THE FEASIBILITY STUDY

In this Section 4.0, the environmental contamination data presented in Section 2.0 is used to quantify the nature and extent of contamination, including estimating the contamination plume volumes and amounts potentially requiring cleanup.

4.1 Estimation of Soil Concentration

Soil concentrations of organic contaminants will be estimated from known dissolved concentrations of these contaminants in groundwater plumes by assuming equilibrium partitioning of contamination between the dissolved (in groundwater) and adsorbed (to organic carbon in soil) phases.

The magnitude of the partitioning of organic contaminants between the two phases is determined by the soil-water partition coefficient (Kd), according to the relation:

$Cs = Cw * Kd$, (Eqn. 4-1)

<u>where</u>:

Cs	=	soil concentration at equilibrium, [µg contaminant/kg soil];
Cw	=	groundwater concentration at equilibrium [µg contaminant/L water]; and
Kd	=	soil-water partition coefficient of chemical, [L water/kg soil].

In turn, the soil-water partition coefficient is determined by assuming that the partitioning of the contaminant between the phases occurs due to the adsorption of the organic contaminant to the organic carbon present in the soil. The partitioning of contamination between the organic carbon and water is measured by the organic carbon partition coefficient (Koc), which is the ratio of amount of chemical adsorbed per unit weight of organic carbon to the chemical concentration in solution at equilibrium.

Thus,

$Kd = Koc * foc$, (Eqn. 4-2)

<u>where</u>:

Koc	=	organic carbon-water partition coefficient of chemical, [(µg adsorbed/kg organic carbon)/(µg dissolved/L water)] and
foc	=	organic carbon content of soil, [kg organic carbon/kg soil]

From Eqns. 4-1 and 4-2,

$Cs = Cw * Koc * foc$, (Eqn. 4-3)

where Cw is known from groundwater concentration data, Koc is obtained from published literature, reliable internet sources, or calculated from solubility data (in that order of preference), and foc is assumed to be a typical value of 0.001 (i.e., 0.1%).

The soil concentrations calculated (estimated) using Eqn. 4-3 are included in Table 4-1 for the Nosedocks/Apron 2 Chlorinated Plume. The calculations performed in Table 4-1 are discussed in more detail in Section 4.2.

4.2 Estimation of Dissolved and Saturated Zone Contamination Volumes and Amounts

The AFCEE software program titled Monitoring and Remediation Optimization System (MAROS) was used to estimate the total amount (mass) of TCE, DCE, and VC present in dissolved form in the respective TCE, DCE, and VC plumes based on sampling data from 33 existing monitoring wells at the Site. Essentially, the MAROS program estimates the mass by dividing a plume into contiguous triangular regions with the well sampling locations located at the apex points (corners) of each triangle, with an associated COC concentration and saturated thickness at each sample location. A spatial interpolation method over these triangles (using a Delaunay Triangulation method) and the calculated geometric mean concentration of each triangle for a particular COC allows calculation of mass for that COC in the plume. The MAROS User's Guide describes in more detail the methodology used for calculating the mass (AFCEE, 2004).

The mass estimates for dissolved TCE, DCE, and VC were made using MAROS for eight (8) rounds of sampling between February 2002 and September 2004, which is the last round of sampling for which comprehensive validated data was available. The results of the MAROS mass estimates are included in Appendix D, and discussed in detail in Section 4.6.

Data from the latest available sampling round (September 2004) was used to estimate the total amount of TCE, DCE, and VC present in the chlorinated plume, which includes the dissolved mass calculated by MAROS and the mass adsorbed to the saturated zone soil within the plume. The total mass of TCE, DCE, and VC were estimated per the following methodology:

1. The effective concentration of TCE, DCE, and VC were calculated from the dissolved mass and plume area results (Appendix D). The effective concentrations thus calculated may be interpreted as concentrations that are uniformly present in the plume, which when multiplied by the plume volumes and porosity (i.e., the volume of water actually within the plumes), yield the masses calculated by MAROS for dissolved TCE, DCE, and VC.

2. Since the MAROS analysis were performed for the COCs only (TCE, DCE, and VC), for each plume, the effective dissolved concentrations were determined by scaling their maximum concentrations in the same ratio as between the effective (calculated) and maximum (measured) concentrations for TCE, DCE, and VC [e.g., for TCE plume, effective concentration for any other contaminant in that plume = maximum concentration for that contaminant in the TCE plume from among all wells * (effective concentration for

TABLE 4-1

CALCULATED CONCENTRATIONS OF CONTAMINATION IN SATURATED ZONE SOIL FOR NOSEDOCKS / APRON2 CHLORINATED PLUMES

Contaminant	Koc (L/kg)	ESTIMATED EFFECTIVE CONCENTRATION VALUE *					
		TCE Plume		DCE Plume		Vinyl Chloride Plume	
		Effective GW Conc.* (µg/L)	Soil Conc. (µg/kg)	Effective GW Conc.* (µg/L)	Soil Conc. (µg/kg)	Effective GW Conc.* (µg/L)	Soil Conc. (µg/kg)
VOCs							
1,1- dichloroethene	467	0.1	0.05	0.03	0.01	U	
1,1-dichloroethane	30	U		0.04	0.001	0.04	0.001
1,2,4-trimethylbenzene	1476	5	7.4	U		U	
1,3,5-trimethylbenzene	1646	0.8	1.3	U		U	
benzene	83	0.1	0.0	0.05	0.004	0.04	0.003
cis-1,2-dichloroethylene	125	--[1]		5	0.6	--[1]	
ethylbenzene	1100	2.7	3.0	U		U	
isopropylbenzene	1533	1	1.53	U		U	
m,p,-xylene (sum of isomers)	834	5	4.2	U		U	
methylene chloride	8.8	U		U		U	
n-butylbenzene	3735	0.1	0.4	U		U	
n-propylbenzene	1533	1	1.5	U		U	
methyl tert butyl ether (MTBE)	40	U		U		2	0.1
p-isopropyltoluene	2809	0.1	0.3	U		U	
naphthalene	2603	0.9	2.3	U		U	
sec-butylbenzene	3010	0.5	1.5	U		U	
trichloroethylene (TCE)	130	8	1.0	--[1]		--[1]	
tetrachloroethene (PCE)	426	0.1	0.04	U		U	
t-butylbenzene	2277	0.1	0.23	U		U	
trans-1,2-dichloroethene	59	0.4	0.024	0.4	0.02	0.4	0.02
vinyl chloride	30	--[1]		--[1]		8.0	0.2
Total VOC's		**25.9**	**24.79**	**5.5**	**0.67**	**10.5**	**0.35**

Notes:

Fraction of organic carbon (kg organic carbon/kg soil) = foc = 0.001 [assume, typical default value]

koc = Organic carbon partition coefficient [(mg adsorbed/kg organic carbon)/(mg dissolved/liter solution)]

* GW Conc. (µg/L) = Estimated effective dissolved groundwater concentration based on geometric mean results from MAROS analyses of measured values (sampling results).

Soil Conc. (µg/kg) = Calculated soil concentration in saturated zone assuming equilibrium between adsorbed and dissolved phases
= [GW Conc. (µg/L)] X foc X [koc (L/kg)]

[1]Concentrations of these constituents were not included in these plumes so as to avoid double-counting.

TCE as calculated from MAROS results / maximum TCE concentration)]. The other non-COC contaminants have lower maximum groundwater concentrations compared to the COCs, and this approach is anticipated to yield reasonably reliable results.

[Please Note: Although the calculated effective concentrations were used, as described above, for estimating the amounts of contamination within the plume volumes, the maximum TCE, DCE, and VC concentrations were used for estimating the cleanup pore volumes and cleanup times of the TCE, DCE, and VC plumes, respectively, in Tables 4-2 and 4-3 since the maximum concentrations will control the design cleanup times.]

3. In Table 4-1, the soil concentrations are then calculated using Equation 4-3, where the effective concentration is used for Cw.

4. The total (dissolved + adsorbed) amounts of contamination in the TCE, DCE, and VC plumes are next calculated in Table 4-4. In this table, the plume dimensions are the same as those presented in Section 2.0.

   A typical soil porosity of 0.25 was assumed. The groundwater contamination volume is adjusted for porosity, so that the reported volumes of groundwater represent the actual volume of contaminated groundwater contained within the physical boundaries of the plume.

   A typical soil bulk density of 2 kg/L soil (57 kg/cu. ft. soil) was assumed for calculating soil contamination amounts from soil concentrations.

5. The above calculations yield the following results (based on analysis of equations 4-1 to 4-3:

Plume	Amount Dissolved in Groundwater (lb)	Amount Adsorbed to Soil (lb)	Total amount in Plume (lb)
TCE	1	10	11
DCE	1	1	2
VC	6	1	7
Total	8	12	20

6. Finally, it should be noted that the contamination volumes and amounts were estimated for groundwater plume boundaries defined by the NYSDEC Class GA groundwater standards, which may change if different cleanup goals are chosen.

4.3 Estimation of Cleanup Times

The amount of time needed to naturally cleanup the contaminated zones are calculated here to serve as the baseline for the remedial alternatives evaluation.

4.3.1 Case of No Biodegradation

In the absence of any new contamination entering a contamination zone, the concentrations and amounts of contamination in this zone will decrease over time as fresh groundwater enters from upgradient and removes contamination from the zone as it flows downgradient of the zone. The contamination thus removed may be re-deposited (adsorbed) onto previously uncontaminated soil downgradient of original zone and re-dissolved over time until it is diluted to below standards or discharged through some other source (e.g., surface water).

A “Batch Flush” model, which is derived in Appendix C, was used to calculate the number of pore volumes of the contaminated zone needed to completely flush the contaminated zone and reduce contaminant concentrations below the preliminary screening goals (NYSDEC Class GA groundwater standards). Briefly, this model assumes that equilibrium conditions are attained (for the partition between the soil and water) prior to the “flushing” of every batch of water. Considering the slow flow rates encountered in groundwater movement, the equilibrium model is assumed to be adequate for the level of alternatives analysis (-30% to +50% cost range) required by the FS.

The pore volume calculations, using equations derived in Appendix C, are included in Table 4-2. The number of years needed to remove the pore volumes calculated above for the various plumes are calculated in Table 4-3. Average hydraulic conductivity and gradient reported in the RI report for the Chlorinated Plume (FPM, April 2004) was used for calculating the groundwater flow velocities, which are used to estimate the amount of time needed to remove the pore volumes estimated earlier for reducing the contamination in the original zone to preliminary cleanup levels. Maximum concentration values (from September 2004 sampling round) for TCE, DCE, and VC in TCE plume, DCE plume, and VC plume, respectively, were used in estimating the pore volumes (Table 4-2) and cleanup times (Table 4-3).

The cleanup times calculated in Table 4-3 for the “no biodegradation” case reflect the estimated times needed for the contaminated zones of the various plumes to naturally achieve preliminary cleanup goals due to removal of contamination by desorption and advection. They also reflect the estimated times needed for cleanup of these zones if extraction technologies are employed (i.e., groundwater pumping) to pump at rates that create capture zones that have the same widths and thicknesses as the groundwater plume dimensions. The cleanup times estimated above are assumed to be conservative since the highest concentrations in the plumes were used to perform pore volume calculations, and additional natural attenuation factors such as biodegradation and dilution due to dispersion and diffusion were not considered.

TABLE 4-2

PORE VOLUMES FOR NOSEDOCKS / APRON2 CHLORINATED PLUMES CALCULATED USING BATCH FLUSH MODEL

Contaminant	Koc (L/kg)	Kd (L/kg)	Maximum Contaminant Level (µg/L)	TCE Plume: Max. GW Conc.* (µg/L) (Co)	TCE Plume: # of Pore Volumes** (N): no bio-degradation	TCE Plume: # of Pore Volumes** (N): 3-year half life	DCE Plume: Max. GW Conc.* (µg/L) (Co)	DCE Plume: # of Pore Volumes** (N): no bio-degradation	DCE Plume: # of Pore Volumes** (N): 5-year half life	Vinyl Chloride Plume: Max. GW Conc.* (µg/L) (Co)	Vinyl Chloride Plume: # of Pore Volumes** (N): no bio-degradation	Vinyl Chloride Plume: # of Pore Volumes** (N): 9-year half life
Biodegradation rate constant, Kb (per year)					0	0.231		0	0.139		0	0.077
Time for one (1) flush, T (year)					6.65	6.65		11.87	11.87		19.94	19.94
VOCs												
cis-1,2-dichloroethylene	125	0.125	5	--[1]	0.0	0.0	56	3.5	1.1	--[1]	0.0	0.0
trichloroethylene (TCE)	130	0.13	5	29	2.7	0.8	--[1]	0.0	0.0	--[1]	0.0	0.0
vinyl chloride	30	0.03	2	--[1]	0.0	0.0	--[1]	0.0	0.0	96	2.4	1.3

Notes:

foc = Fraction of organic carbon in saturated zone soil (value defined in Table 4-1)

Koc = Organic carbon partition coefficient [(mg adsorbed/kg organic carbon)/(mg dissolved/liter solution)]

Kd = Partition Coefficient of chemical between soil and water = Koc X foc

E = porosity

d = Bulk density of soil

Cn = Final Groundwater concentration

Co = Initial Groundwater concentration

Kb = Biodegradation rate constant (per year)

T = Time for one (1) flush of plume volume (year)

* GW Conc. (µg/L) =Dissolved Groundwater concentration, maximum measured value (sampling results).

** Roundup calculated number of pore volumes to one (1) decimal place

Number of Flushes (n) = $\ln(Cn/Co) / \{\ln[1 + E / (K_d*d)]^{-1} - kT\}$

[1]Concentrations of these constituents were not included in these plumes so as to avoid double-counting.

TABLE 4-3
CLEANUP TIME CALCULATIONS FOR GROUNDWATER PLUMES

Site	Plume Name	COC*	Plume Thickness (ft)	Plume Length (ft)	Plume Width (ft)	Remedia-tion Plume Volume** (gal)	Dist. from Rear of Plume to Six Mile Creek (ft)	Discharge Rate Across Face of Plume (gal/day)	Time for One Flush (yr) ***	Travel Time From Front of Plume to Six Mile Creek (yr) ****	Travel Time From Rear of Plume to Six Mile Creek (yr) *****	Without Biodegradation		With Biodegradation (3-yr, 5-yr, and 9-yr half lives for TCE, DCE, and VC plumes, respectively)	
												Max. # of Flushes	Time to Flush the Total Volume of Plume Using Batch Flush Model (yr)	Max. # of Flushes	Time to Flush the Total Volume of Plume Using Batch Flush Model (yr)
Chlorinated Plume	TCE Plume	TCE	14	700	330	6,047,580	2,467	2,493	6.65	16.78	23.42	2.7	17.9	0.8	5.3
	DCE Plume	cis-1,2-dichloroethylene	23	1250	330	17,741,625	2,000	4,096	11.87	7.12	18.99	3.5	41.5	1.1	13.1
	Vinyl Chloride Plume	vinyl chloride	23	2100	700	63,224,700	2,150	8,687	19.94	0.47	20.41	2.4	47.9	1.3	25.9

Notes:
Hydraulic Conductivity = 11 ft/day
Hydraulic Gradient = 0.0066 ft/ft
Discharge Velocity = Hydraulic Conductivity X Hydraulic Gradient = 0.072 ft/day
Seepage (Pore) Velocity = Discharge Velocity / Porosity = 0.289 ft/day
Discharge Rate Across Face of Plume (gal/day) = Plume Width (ft) X Plume Thickness (ft) X Discharge Velocity (ft/day) X 7.48 gal/ft^3
Volume of Water to be Flushed = Remediation Plume Volume X Max. # of flushes
# of years to flush the total volume of plume = Volume of Water to be Flushed (gal) / [Discharge Rate Across Face of Plume (gal/day) X 365]
* COC requiring maximum number of flushes assuming no biodegradation.
** Plume Volume (in gal.) = Plume Thickness (ft) X Plume Length (ft) X Plume Width (ft) X Porosity X 7.48 (gal/ft^3) [Also Note 1 below]
Note 1: Unlike the case for calculating the plume volumes and contamination amounts where the plume areas were based on the shape of plume contours, for estimating remediation plume volumes in this table, the calculations were based on the length and width of plumes (to calculate areas and volumes). Since the intent is to perform calculations for the seepage front the Remediation Plume Volume calculated using plume length and width will result in larger volumes (compared to using areas based on plume shapes), but will more correctly represent the cleanup times.
*** = Time for one (1) flush is same as time for groundwater to travel from rear of plume to front of plume = Plume Length (ft) / [Seepage Velocity (ft/day) X 365], years
**** = Time for groundwater to travel from front of plume to Six Mile Creek = [Dist. from rear of plume to Six Mile Creek (ft) - Plume Length (ft)] / [Seepage Velocity (ft/day) X 365], years
***** = Time for groundwater to travel from rear of plume to Six Mile Creek = Dist. from rear of plume to Six Mile Creek (ft) / [Seepage Velocity (ft/day) X 365], years
Ks (source decay rate constant for input into Biochlor) = [ln (1+E/K_dd) / T (time for single flush)]
Ktotal (total source decay rate constant) = Kb (biodegradation rate constant, per year) + Ks (source decay rate constant for input into Biochlor)

4.3.2 Case of Biodegradation

The RI report for the Chlorinated Plume (FPM, April 2004) has concluded that there is evidence of biodegration at the site. Therefore, in Table 4-3, cleanup times were calculated assuming biodegradation for the Batch Flush model. (As was noted earlier, the cleanup times were estimated using the maximum concentrations for TCE, DCE, and VC in TCE plume, DCE plume, and VC plume, respectively.) A literature search for biodegradation rates of contaminants at the site revealed limited data or data with a wide range of values. However, biodegradable compounds of interest generally appear to have biodegradation half-lives of about 3 years or less.

Monitoring data is available from eight (8) rounds of sampling between February 2002 and September 2004. Site-specific biodegradation first-order rate constants were estimated using this data for TCE, DCE, and VC in Appendix E, by performing exponential fit of concentration vs. time data. It was assumed that concentration effects due to advection and other processes are negligible within the approximately 2.5-year data window. Based on these analyses, the site-specific first-order biodegradation rate constants for maximum concentration areas were estimated as follows:

For TCE: Half-life = 3 years; Rate constant k = 0.231/year
For DCE: Half-life = 5 years; Rate constant k = 0.139/year
For VC: Half-life = 9 years; Rate constant k = 0.077/year

The site-specific rate constant data from Appendix E (summarized above) was used in Tables 4-2 and 4-3 to estimate the cleanup pore volumes and cleanup times for the case of biodegradation. The cleanup times calculated assuming biodegradation reflect the times needed for the contaminated zones of the various plumes to naturally achieve preliminary cleanup goals due to removal of contamination by desorption and advection with biodegradation. They also reflect the estimated times needed for cleanup of these zones if extraction technologies are employed (i.e., groundwater pumping) to pump at rates that create capture zones that have the same widths and thicknesses as the groundwater plume dimensions. The cleanup times estimated above are assumed to be conservative (although not as conservative as the estimates for the Case of No Biodegradation, Section 4.3.1) since the highest concentrations in the plumes were used to perform pore volume calculations.

4.4 Estimating Travel Times and Plume Discharge Volumes

The time needed for one flush that is calculated in Table 4-3 represents the time needed by groundwater to travel the plume length (i.e., time for a water particle to travel from the rear location to front location of the plume). Also, travel times are calculated in Table 4-3 for the front and rear portions of the various plumes to reach the downgradient Six Mile Creek (i.e., time for a water particle to travel from the front and rear locations of the plume to the Six Mile Creek). However, the chlorinated plumes show evidence of having stabilizied or trending towards stabilization and natural attenuation before reaching the creek. Finally, the discharge volume rates across the plume cross-sections are also calculated in Table 4-3 using average hydraulic conductivity and gradient reported in the RI for the Chlorinated Plume (FPM, 2004); these discharge rates approximately represent the extraction rates needed for capturing the plumes in the absence of re-injection and infiltration from precipitation and other sources to groundwater.

4.5 Engineering Evaluation of Plumes and Conclusions

There are a total of three (3) significant groundwater contamination plumes requiring potential remedial action at the Site. The findings of this Section 4.0 (Sub-sections 4.1 thru 4.4) will be summarized and discussed briefly below for each the Site plumes. (Some numbers may have been rounded.)

Examination of monitoring data between February 2002 and September 2004 indicates that the chlorinated plumes have essentially stabilized in both areal extent and location, or trending towards stabilizing with little movement shown towards the creek. Figures 4-1, 4-2, and 4-3 show the progression of the TCE, DCE, and VC plumes, respectively, which also demonstrate that the plumes appear to have stabilized and potentially shrinking in extent with time.

These observations strongly indicate that the natural attenuation processes are occurring at the Site, which are evaluated in detail in the following sub-sections.

4.6 Plume Stability

Stable or shrinking plumes are defined by degradation rates that exceed the contaminant input into the plume from contaminant source(s). Plume stability is evaluated by examining the trend of the plume length (i.e. shrinking, expanding, stable, stable with discharge to surface water, etc.). The Nosedocks/Apron 2 Chlorinated Plume has been monitored since the RI in 2002, including eight rounds of data for TCE, DCE, and VC. To demonstrate plume stability, the statistical non-parametric Mann-Kendall test was used to evaluate concentration trends at individual wells. Also, TCE, DCE, and VC isopleth maps were prepared for each round of data, and the total mass of VOCs and the area of the total VOC plume were compared.

4.6.1 Evaluation of Contaminant Concentrations in Individual Wells using Mann-Kendall Statistics

The Mann-Kendall test is a non-parametric test (Gilbert, 1987) that can be used to define the stability of a solute plume (i.e., stable, diminishing, or expanding) based on concentrations trends at individual wells. The AFCEE program MAROS was used to obtain the Mann-Kendall statistics for individual components (i.e., either TCE, DCE, or VC) during monitoring rounds conducted from 2002 to September 2004. Key results for each plume are discussed below.

Within the TCE plume, wells 782VMW-81 and –83 indicated a definite (i.e., greater than 95% confidence) decreasing trend, while the trend at 782VMW-105b was “probably decreasing” [confidence in trend was 92.9%]. No trend was identified at 782VMW-97, another source area TCE well. MAROS defines “no trend” as an upward or downward trend could not be established, and either (a) the Mann-Kendall statistic was positive, or (b) the Mann-Kendall statistic was negative but the coefficient of variance was greater than or equal to 1 (indicating the data show a greater degree of scatter about the mean).

Within the DCE plume, a "stable" trend was identified at well 782MW-10, while "no trends" were identified at wells 782VMW-76, 78, and 782MW-6R2. MAROS defines "stable" trends as indicating that upward or downward trends could not be established with greater than 90% confidence, the Mann-Kendall statistic was negative, but the coefficient of variance was less than 1 (i.e., indicating that the data form a relatively close group about the mean).

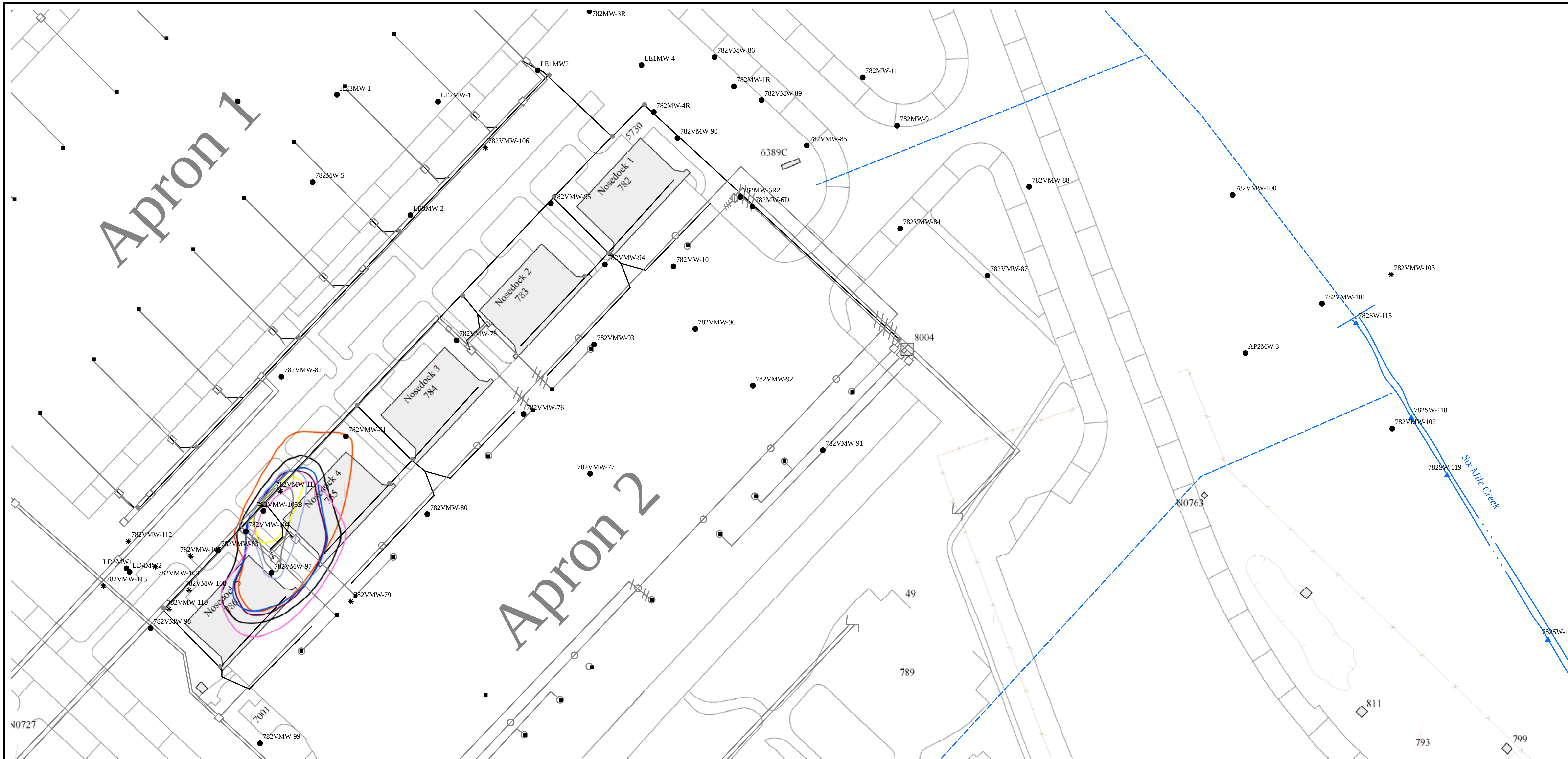
Within the VC plume, wells 782VMW-93 and 782MW-10 indicated stable trends, and wells 782VMW-84 and -96 indicated no trends.

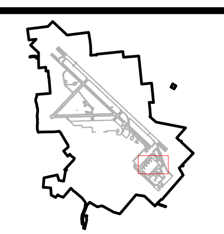
4.6.2 Isopleth Maps and Evaluation of Total Mass

Plan view maps were prepared for individual chlorinated ethenes (i.e., TCE, cis-DCE, and VC) for each sampling round to assess whether long-term trends in contaminant concentrations are apparent. The extent of each individual component, is shown for each sampling round from 2002 through September 2004 in Figures 4-1 through 4-3.

Maps of individual contours for each chlorinated ethene were also prepared to observe general increases or decreases in plume size between sampling rounds for select high concentratrion areas (targeted for in situ treatment described in Section 6). For TCE, the 20 µg/L isocontour is displayed in Figure 4-1. After multiple rounds of sampling, it is evident that the areal extent of the 20 µg/L contour has decreased over time, and is mainly restricted to the area encompassing wells 782VMW-105b and 782VMW-97. For DCE, the 30 µg/L isocontour is shown in Figure 4-2. The isocontour is shown with two lobes, a larger one to the west (upgradient) centered on well 782VMW-78, and a smaller one to the east centered on well 782MW-10. The larger lobe, after an initial increase in areal extent since the 2002 sampling round, appears to once again be retreating in size as of the September 2004 sampling round, while the smaller lobe has also decreased in size. For VC, the 80 µg/L contour is shown in Figure 4-3. The isocontour shows a definite movement of the VC plume downgradient over time, as the center of the plume appears to have moved from 782VMW-93 to 782VMW-96.

The trends in areal extents of the each individual chlorinated ethene plume were investigated with the use of the statistical program MAROS. Mann-Kendall statistics were calculated for the second moments of each chlorinated ethene, using the data from 33 monitoring wells located throughout the plume collected over several sampling rounds conducted from 2002 through December 2004. For the Sigma XX component, the moment trends were stable for TCE, DCE, and VC. For the Sigma YY component, the moment trend was stable for TCE, but decreasing for DCE and VC. Therefore, although the areas of elevated concentrations within the plume tend to fluctuate somewhat in magnitude and location over time, the extents of the individual plumes (assuming a constant thickness) appear to have at least remained stable since 2002, with some indication of decreasing size for DCE and VC.





Site Location

Base Location

Key to Features

- Hydrant
- Manhole
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Monitoring Wells
- Soil Sample Locations
- Surface Water Sample Locations

- TCE Contamination February 2002
- TCE Contamination February 2003
- TCE Contamination June 2003
- TCE Contamination September 2003
- TCE Contamination December 2003
- TCE Contamination March 2004
- TCE Contamination July 2004
- TCE Contamination September 2004

N

100 50

Feet

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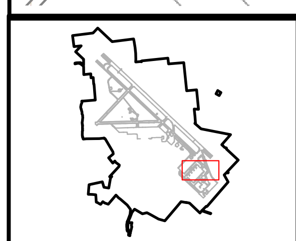
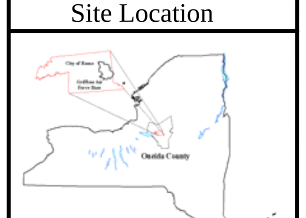
UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 4-1
TCE Contamination
20 µg/L Over Time

FPM group



Site Location



Base Location

Key to Features

- Hydrant
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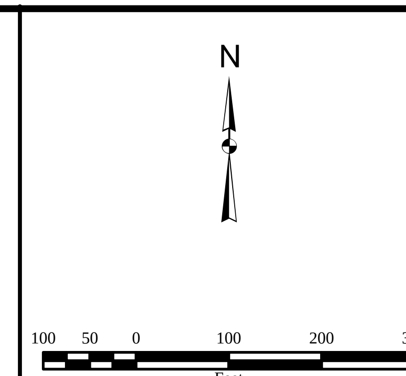
- Culvert/Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Monitoring Wells
- Soil Sample Locations
- Surface Water Sample Locations

- DCE Contamination February 2002
- DCE Contamination February 2003
- DCE Contamination June 2003
- DCE Contamination September 2003
- DCE Contamination December 2003
- DCE Contamination March 2004
- DCE Contamination July 2004
- DCE Contamination September 2004



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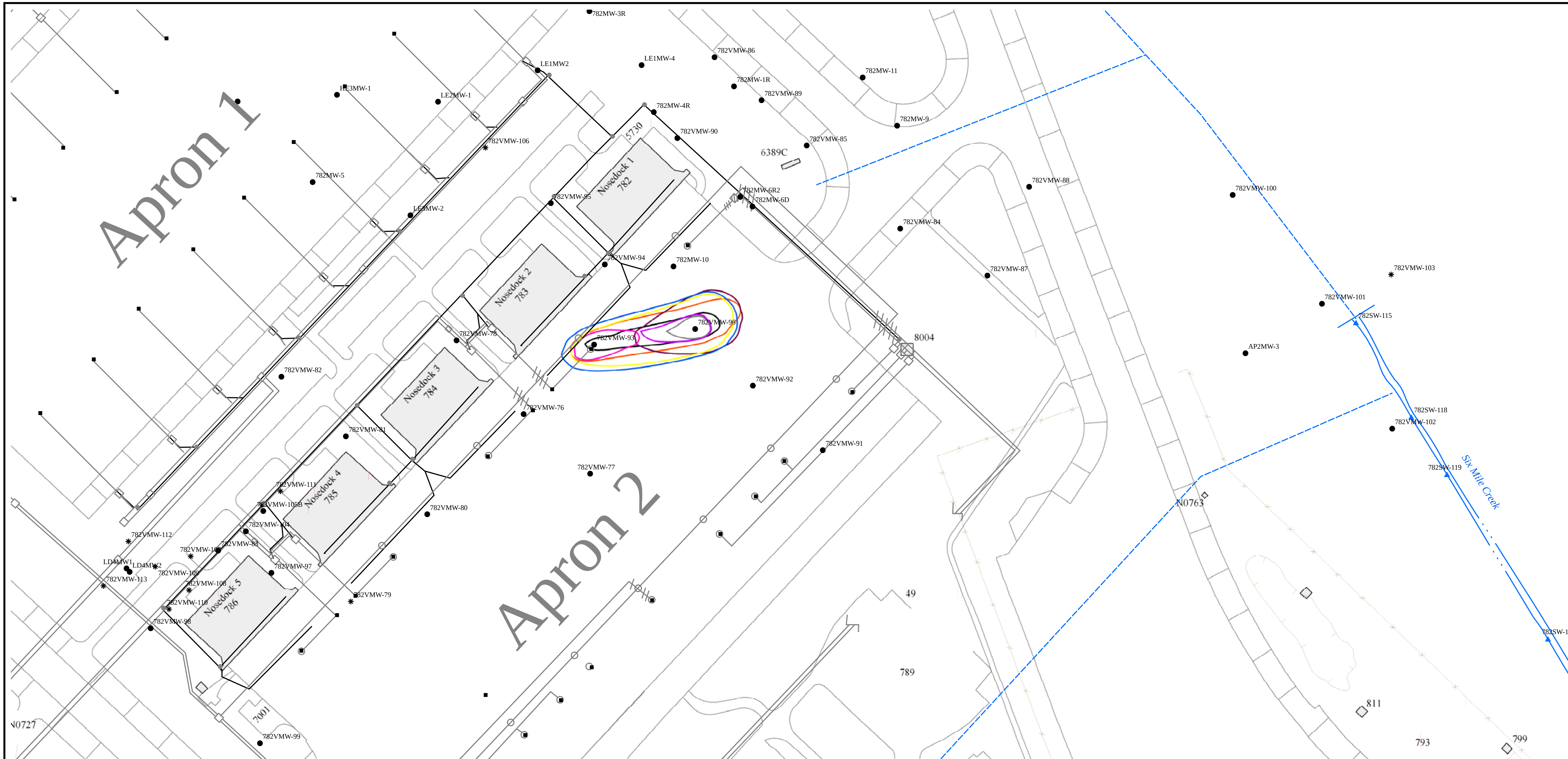
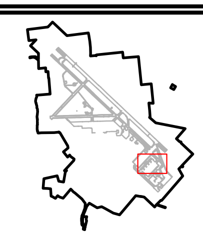
UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

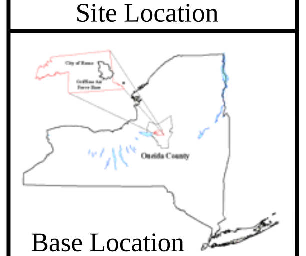
Figure 4-2
DCE Contamination
30 µg/L Over Time

FPM group





Site Location



Base Location

Key to Features

- Hydrant
- Manhole
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/ Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Monitoring Wells
- Soil Sample Locations
- Surface Water Sample Locations

- VC Contamination February 2002
- VC Contaminatino February 2003
- VC Contamination June 2003
- VC Contamination September 2003
- VC Contamination December 2003
- VC Contamination March 2004
- VC Contamination July 2004
- VC Contamination September 2004

N

100 50 0 100 200

Feet

FPM Group Ltd.
This map (Y:\GIS_Projects\Griffiss\Projects\40-03-10\Feasibility_Study\Apron2_sites\Chlor_Plume\Fig4-3_VC_Time

UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 4-3
VC Contamination
80 µg/L Over Time

FPM group

The trend in total mass of each individual chlorinated ethene plume was also calculated within the MAROS program. Mann-Kendall statistics were calculated for the zeroth moments of chlorinated ethen, again using the data from sampling rounds conducted from 2002 through December 2004. While TCE showed no trend, stable trends were identified for both DCE and VC. It should be noted that the total masses for each plume were also minimal.

In summary, preparation of isopleth maps and investigation of areal extent and mass trends strongly support an assumption of plume stability .

4.7 Summary and Conclusions

- The following conservative assumptions were made for the engineering evaluation of the plumes:

  – The contamination volumes and amounts were estimated for groundwater plume boundaries defined by the NYSDEC Class GA groundwater standards, which may change if different cleanup goals are chosen.

  – The cleanup times calculated in Table 4-3 for the “no biodegradation” case reflect the estimated times needed for the contaminated zones of the various plumes to naturally achieve preliminary cleanup goals due to removal of contamination by desorption and advection alone. They also reflect the estimated times needed for cleanup of these zones if extraction technologies are employed (i.e., groundwater pumping) to pump at rates that create capture zones that have the same widths and thicknesses as the groundwater plume dimensions. The cleanup times thus estimated are assumed to be conservative since the highest concentrations in the plumes were used to perform pore volume calculations, and additional natural attenuation factors such as biodegradation and dilution due to dispersion, diffusion, and volatilization were not considered.

  – The RI report for the Chlorinated Plume (FPM, April 2004) has concluded that there is evidence of biodegration at the site. A literature search for biodegradation rates of contaminants at the site revealed limited data or data with a wide range of values. However, biodegradable compounds of interest generally appear to have biodegradation half-lives of about 3 years or less. Site-specific calculations for biodegradation rate constants based on monitoring data from February 2002 to September 2004 indicate that natural biodegradation is occurring at the Site with half-lives of 3 years, 5 years, and 9 years for TCE, DCE, and VC, respectively.

TABLE 4-4
ESTIMATES OF CONTAMINATION VOLUMES AND AMOUNTS

Site	Plume Name	COC	Plume Thick-ness (ft)	Plume Length (ft)	Plume Width (ft)	Plume Area (ft^2)	Plume Volume* (million gal.)	GROUNDWATER** CONC. COC (µg/L)	GROUNDWATER** CONC. Total VOC (µg/L)	GROUNDWATER** AMOUNT COC (Lb)	GROUNDWATER** AMOUNT Total VOC (Lb)	SOIL CONC. COC (µg/Kg)	SOIL CONC. Total VOC (µg/Kg)	SOIL AMOUNT COC (lb)	SOIL AMOUNT Total VOC (lb)	TOTAL AMOUNT COC (lb)	TOTAL AMOUNT Total VOC (lb)
Chlorinated Plume	TCE Plume	TCE	14	700	330	231000	6.05	8	26	0	1	1	25	0	10	1	11
	DCE Plume	cis-1,2-dichloroethylene	23	1250	330	412500	17.74	5	6	1	1	1	1	1	1	2	2
	Vinyl Chloride Plume	vinyl chloride	23	2100	700	1470000	63.22	8	10	4	6	0	0	1	1	5	7
							TOTAL FOR SITE: 87.01				8				12		20

Porosity = 0.25
Soil Density = 2 kg/l = 56.634 kg/ft^3

Notes:
* Plume Volume = Plume Area (ft^2) X Plume Thickness (ft) X porosity X 7.48 gal/cubic feet
** = Dissolved Amount Only
***=Total volume of all plumes neglecting overlap
Amount of Contamination in Groundwater = Plume volume (gal.) X Conc. in gw (ug/L) / 10^9 X 3.79 L/gal X 2.205 lb
Amount of Contamination in Soil = Soil Density (Kg soil/ ft^3 soil) X Plume Area (ft^2) X Plume Thickness (ft) X Conc. in soil (ug/Kg) / 10^9 x 2.205 lb
DCE includes cis-1,2-DCE and trans-1,2-DCE

5 GENERAL RESPONSE ACTIONS AND INITIAL SCREENING OF REMEDIAL TECHNOLOGIES[5]

The site-specific ARARs, TBCs, and the RAOs for protecting human health and environment from adverse impacts due to groundwater contamination by chlorinated organics were developed in Section 3.0. The RAOs and ARARs/TBCs together specify the cleanup objectives and cleanup levels, along with other applicable or relevant and appropriate regulatory and program requirements and guidelines. In the current Section 5.0, General Response Actions (GRAs) that will satisfy the RAOs and ARARs/TBCs will be developed; potentially applicable technologies for cleanup of contamination will be identified; and a preliminary screening of these technologies will be performed based on considerations of technical implementability, effectiveness, and cost. The natural attenuation processes occurring at the Nosedocks/Apron2 Chlorinated Plume Site and the fate and transport of the groundwater plumes is also evaluated to the extent of estimating potential cleanup times.

5.1 Innovative Technologies Consideration

During the FS, many technologies and approaches are used to assess and remediate contaminated sites, some of which are considered new or innovative. The USEPA defines innovative remediation technologies as those that feature new methodologies, new equipment, or both, and for which sufficient published cost and performance data are not yet available. Innovative technology benefits can include better performance, reduced cost and complexity, and shorter clean-up time.

The SARA indicates a preference for utilization of innovative treatment technologies. Also, the Department of Defense (DoD) supports the development and use of cost-effective innovative technologies and process improvements in the restoration process (DoD Directive on Environmental Restoration Program, Directive # 4715.7, April 1996). Consistent with the above preferences, innovative technologies are included in this FS for consideration in the remedy selection process. It is possible that, during the screening process (Section 5.0) or in the detailed analysis phase of the FS (Sections 6.0), some or all of the innovative technologies considered in this FS may be excluded from the remedial selection process based on considerations of their developmental status, technical applicability and appropriateness, potential by-products, potential system reliability/maintainability, etc., as determined from information available from USEPA guidance and other authoritative sources. However, despite or in addition to the remedies selected in this FS, at its discretion the USAF may award performance-based contracts which would allow adoption of innovative technologies by the awardees for site cleanup with prior consent and appropriate oversight by the USAF.

5 For increased readability and cost savings for the public, verbatim excerpts from public documents such as codes, regulations, technology descriptions, etc. may have been included without enclosing them in quotation marks or using other attribution devices, where such identification is not critical or essential to the understanding of the contents.

5.2 General Response Actions

GRAs are those broad categories of remedial action that will satisfy the RAOs and address the contamination problem at the site.

Based on the existing knowledge of the site, the following 8 types of GRAs have been identified as potentially applicable to the groundwater remediation at the site:

1. No Further Action,
2. Limited Action,
3. Institutional Controls,
4. Monitored Natural Attenuation,
5. Collection and Containment (also referred to as “Capture and Control”),
6. In-Situ treatment,
7. Ex-Situ treatment, and
8. Disposal.

Some of the above GRAs may potentially satisfy all the RAOs and cleanup goals for the site by themselves, whereas other GRAs will have to be combined in order to achieve them.

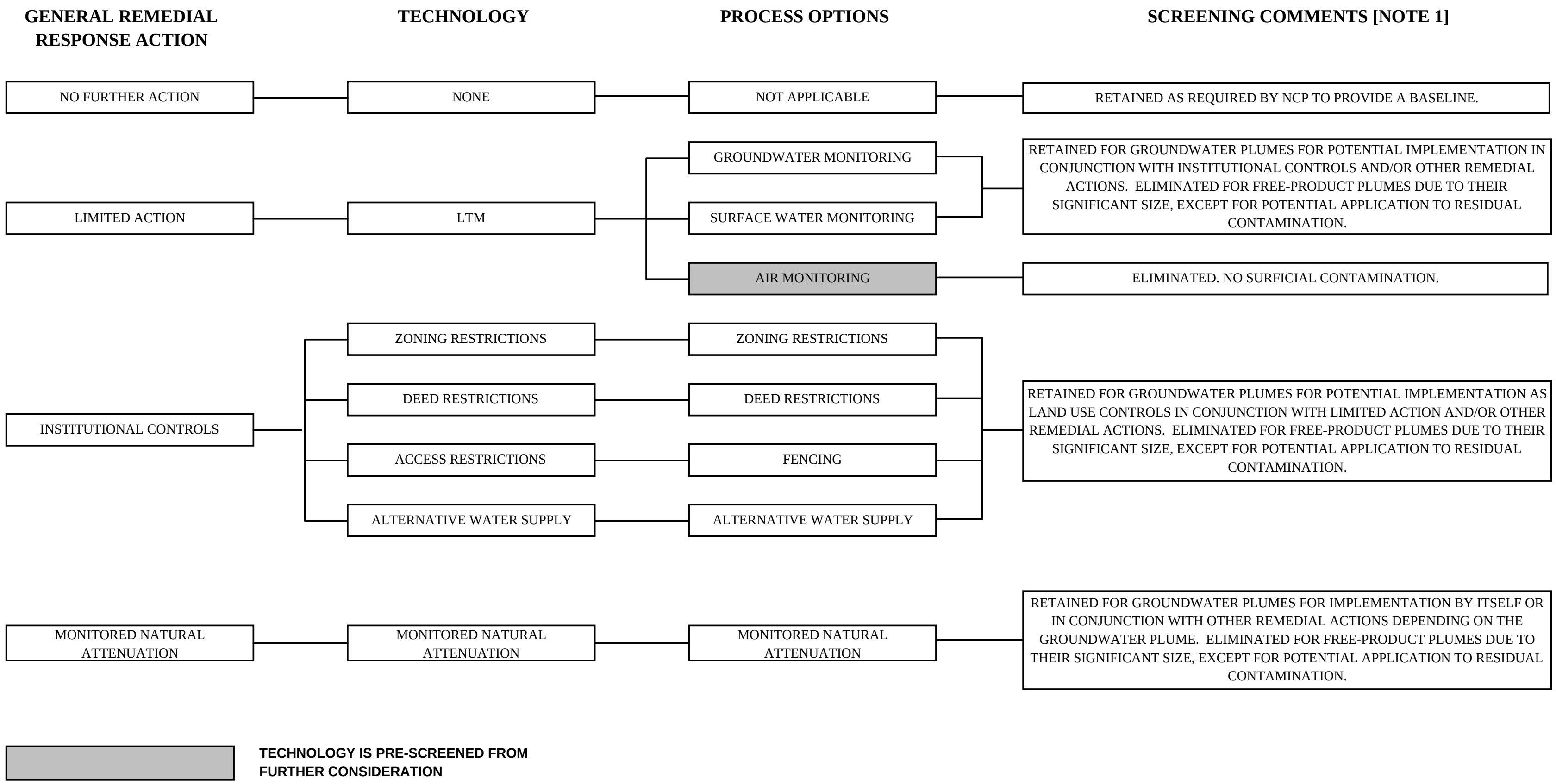
As was stated in Section 1.0, Introduction, this FS will address remedy selection for the chlorinated groundwater plumes. Some remedial alternatives may result in the cleanup of the chlorinated groundwater contamination, whereas other alternatives may only be targeted specifically for one or the other plume (i.e., TCE, DCE, or VC plume). As evident from Section 2.0, Environmental Setting, the various chlorinated plumes are in close physical and/or hydraulic proximity to each other and also to petroleum contamination at several locations on site. Therefore, during detailed analysis of alternatives in Sections 6.0, EVALUATION OF ALTERNATIVES, as a preferred remedy emerges (or preferred remedies emerge), special consideration will be given to the potential commingling of the various plumes and its potential impact on the selected remedy for the group of contaminants concerned. This potential commingling of the plumes may arise for remedies that include Collection and Containment, In-Situ Treatment, Ex-Situ Treatment, or Disposal response actions.

The remedial technologies and process options associated with each category of GRA are shown in Figure 5-1. A brief description of each GRA is stated below:

5.2.1 No Further Action

A No Further Action response must be evaluated during the course of the FS and used as a baseline to compare other alternatives. As prescribed by the NCP, No Further Action is only an acceptable alternative when it does not result in an unacceptable risk to human health and the environment. For the Site, a five-year review would be conducted every five years to determine whether appropriate remedial action should be considered at that time depending on the nature and extent of contamination and the potential for unacceptable risk to human health and the environment at that time relative to the current baseline conditions.

Figure 5-1
Screening of Groundwater Remediation
Technologies for Technicial Implementability

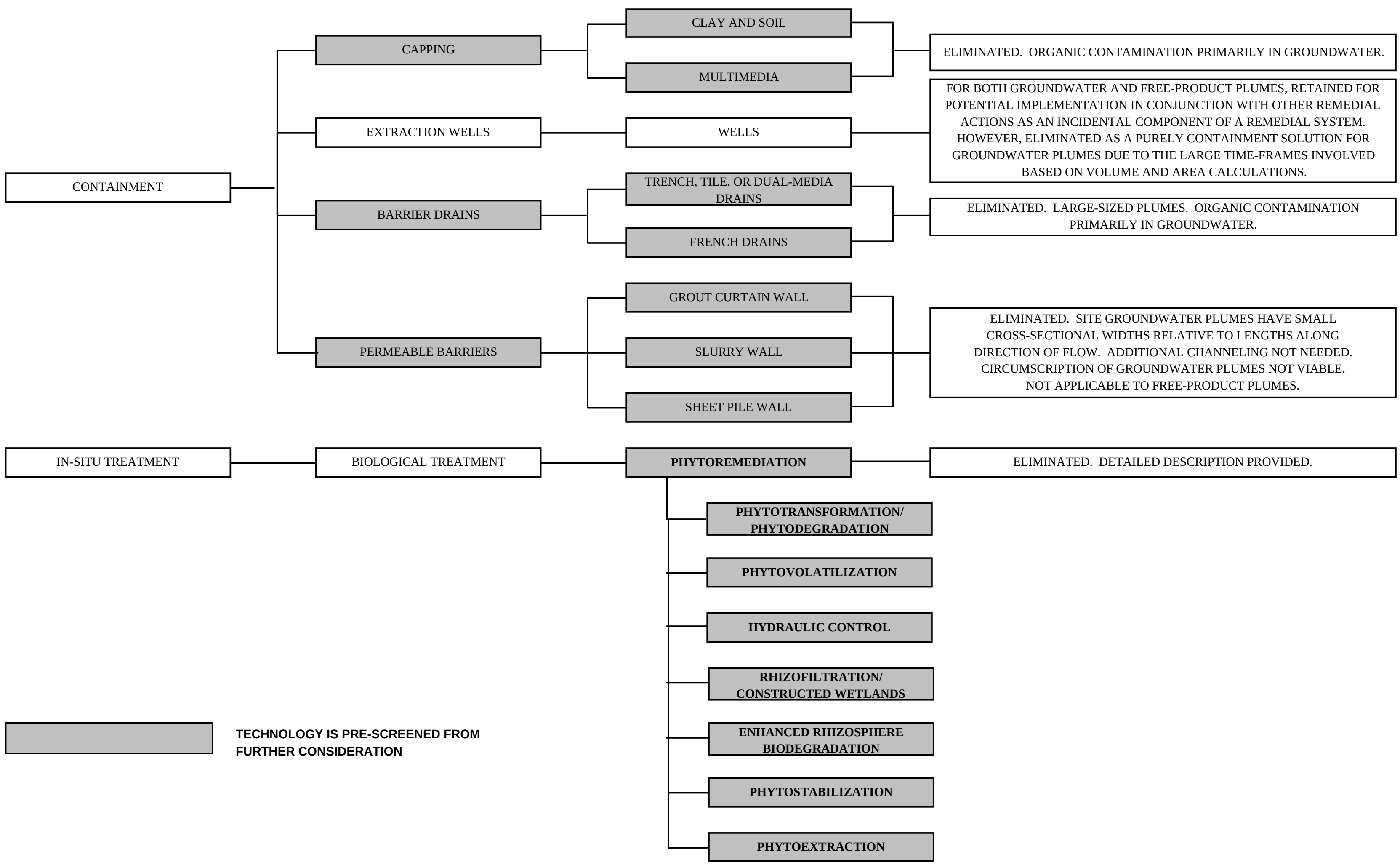


GENERAL REMEDIAL RESPONSE ACTION | **TECHNOLOGY** | **PROCESS OPTIONS** | **SCREENING COMMENTS [NOTE 1]**

Figure 5-1 (cont.d')

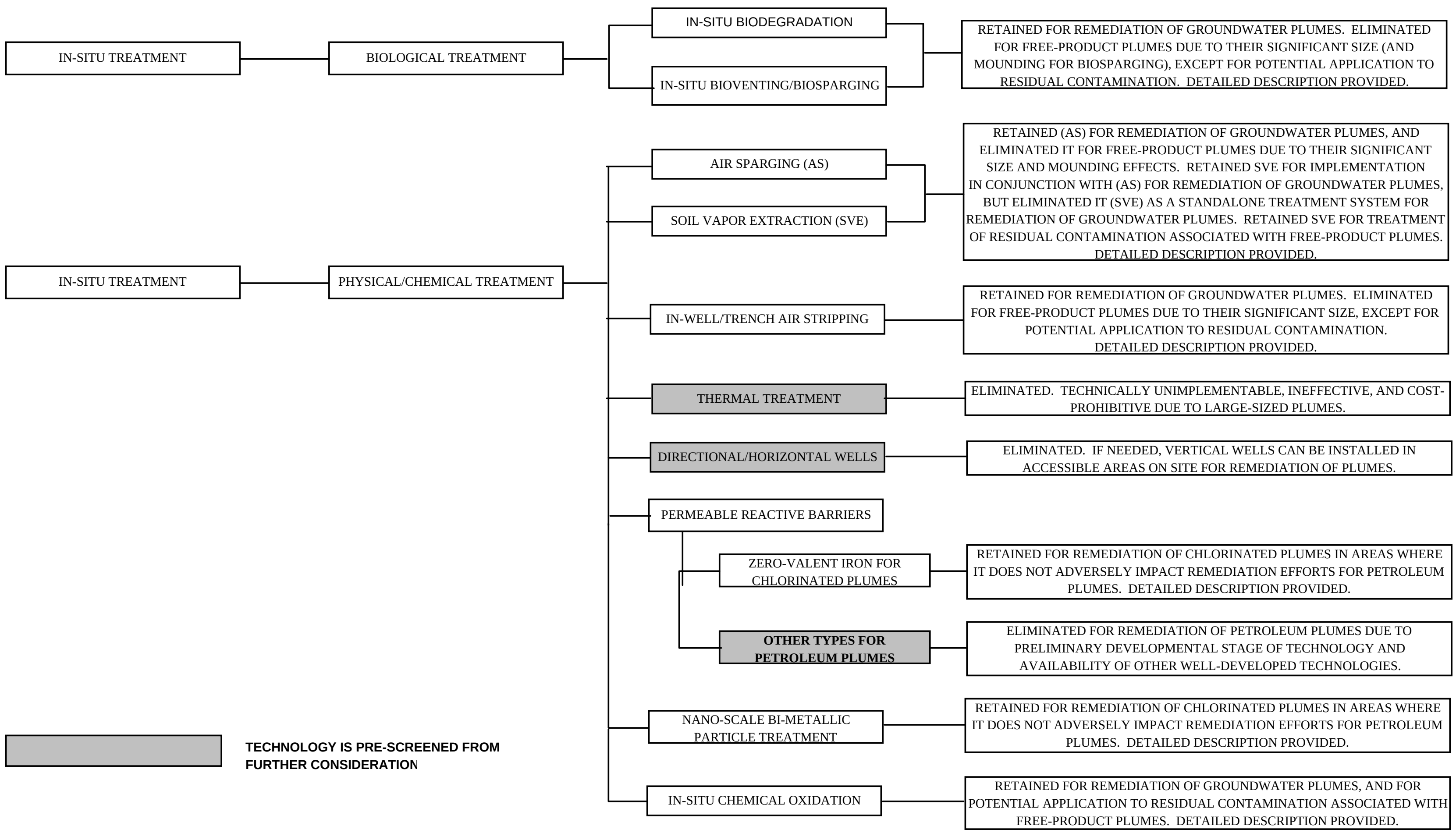
Screening of Groundwater Remediation

Technologies for Technicial Implementability



GENERAL REMEDIAL RESPONSE ACTION | **TECHNOLOGY** | **PROCESS OPTIONS** | **SCREENING COMMENTS [NOTE 1]**

Figure 5-1 (cont.d')
Screening of Groundwater Remediation
Technologies for Technicial Implementability

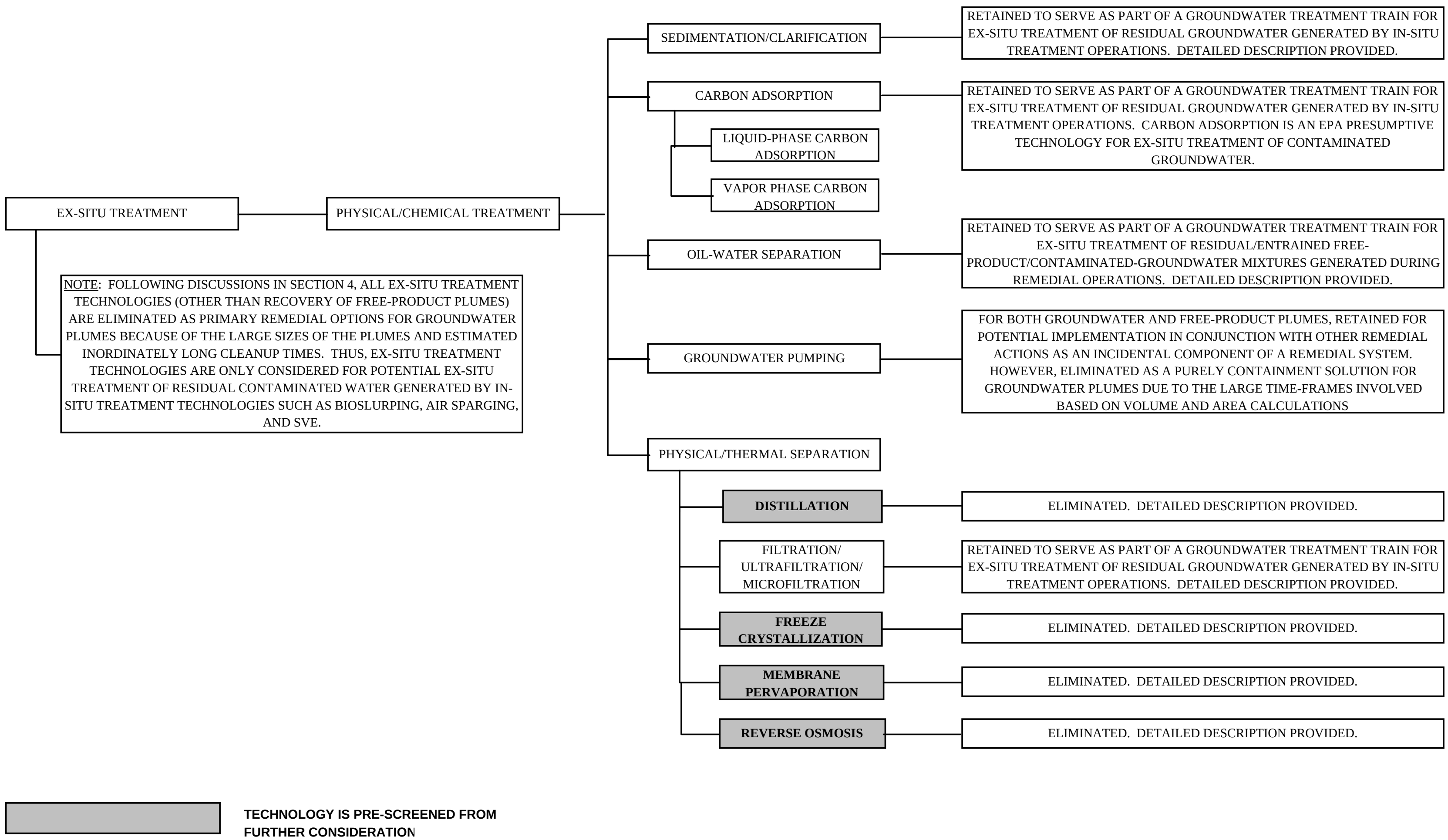


GENERAL REMEDIAL RESPONSE ACTION | **TECHNOLOGY** | **PROCESS OPTIONS** | **SCREENING COMMENTS [NOTE 1]**

Figure 5-1 (cont.d')

Screening of Groundwater Remediation

Technologies for Technicial Implementability

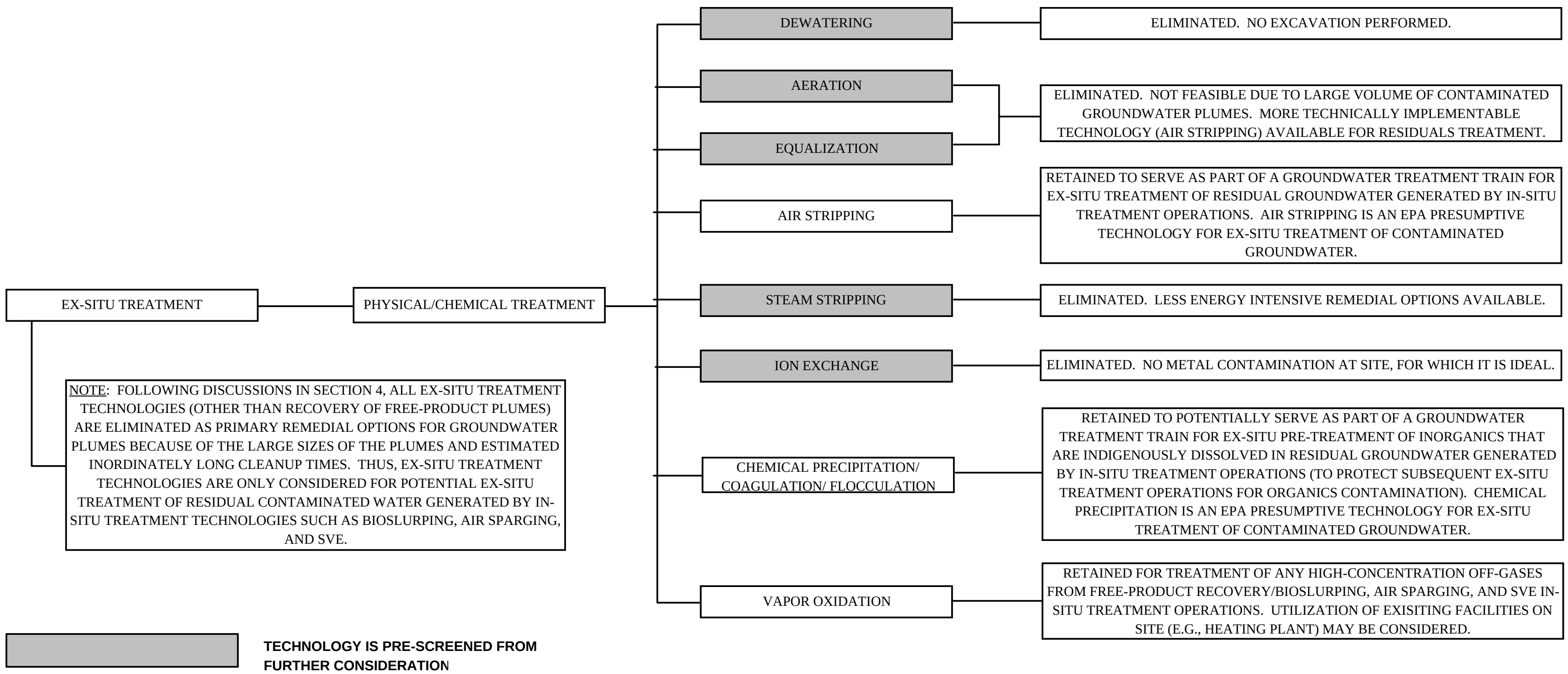


GENERAL REMEDIAL RESPONSE ACTION | **TECHNOLOGY** | **PROCESS OPTIONS** | **SCREENING COMMENTS [NOTE 1]**

Figure 5-1 (cont.d')

Screening of Groundwater Remediation

Technologies for Technicial Implementability

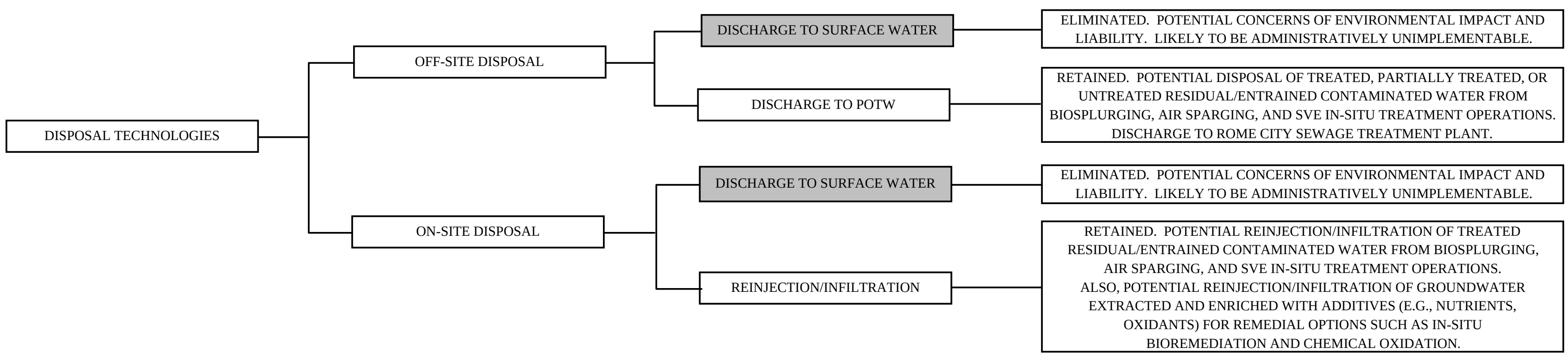


GENERAL REMEDIAL RESPONSE ACTION | **TECHNOLOGY** | **PROCESS OPTIONS** | **SCREENING COMMENTS [NOTE 1]**

Figure 5-1 (cont.d')

Screening of Groundwater Remediation

Technologies for Technicial Implementability



Note1: Under Screening Comments, the term "Retained" refers to retaining that particular technology and/or process option for potential inclusion, either alone or in conjunction with other technologies/process options, as a remedial alternative for the detailed analysis phase of the FS. Detailed descriptions of technology/process option and initial screening evaluations are provided in Section 5.5.

The No Further Action GRA is retained as a remedial alternative for the detailed analysis phase of the FS.

5.2.2 Limited Action

The Limited Action response involves environmental monitoring or the LTM of existing and, if needed, new groundwater monitoring wells at the site to serve as an early warning system for the protection of potential receptors prior to completion of exposure pathways. Other objectives of the LTM may include collecting data for continued refinement of the conceptual site model (CSM) for groundwater flow so that the predictions regarding the fate and transport of COCs are accurate, evaluating COC degradation due to remedial action or natural attenuation processes, or collecting data that support site closure. No active remedial measures would be conducted.

Monitoring will be performed following a specified schedule (with flexibility included therein to respond to rapidly changing situations or contingencies if such were to occur). The monitoring data will be evaluated as it becomes available. For the Site, a comprehensive review of prior monitoring data would be conducted every five years to determine whether appropriate remedial action should be considered at that time depending on the nature and extent of contamination and the potential for unacceptable risk to human health and the environment at that time relative to the current baseline conditions.

The Limited Action GRA involving LTM of groundwater and/or surface water is retained as a remedial alternative for the detailed analysis phase of the FS for implementation in conjunction with ICs GRA and/or other remedial actions.

5.2.3 Institutional Controls

Institutional Controls are not technologies, but rather consist of non-technical or legal controls that are implemented to reduce or prevent the potential for human exposure to contaminated groundwater. Deed restrictions, for example, may be placed on affected property to prohibit a landowner from installing drinking water wells within designated areas, or State or local health districts may issue notifications to prohibit well installation or water use for specified purposes unless it is treated to remove the contaminants and may also issue health advisories. This category of response action may also include administrative Land Use Controls (LUCs) such as zoning restrictions, or engineering controls such as access restrictions and providing alternative water supply.

Institutional controls are not intended to be used alone or in perpetuity. Rather, they would be used in conjunction with natural attenuation processes or other remedial measures that result in the eventual reduction of contaminant concentrations to cleanup levels or LTM to monitor the conditions of the Site to ensure the public health and environment is not being affected.

At the Site, while aquifer yields under the base are generally too low to be suitable for municipal wells, the aquifer thickens to greater than 60 feet in the southernmost part of the base (including the region near the plumes at the site), and well yields in this area could conceivably be used for water supply wells. However, because current and future uses planned for this site are limited to industrial use, the installation of potable drinking water is not likely due to the ready access to existing water supplies for the base and the City of Rome. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The groundwater use restriction included drinking of groundwater and other uses such as utilizing it for industrial purposes.

Institutional controls are inappropriate when a valuable natural resource such as a sole-source aquifer would remain unusable for a long period of time. However, because groundwater in the vicinity of the plumes at the Site is not used as a drinking water source, this technology is effective in preventing exposure to groundwater contaminants, and ICs are readily implemented.

Thus, the ICs GRA involving LUCs as described in the above paragraph and/or engineering controls (such as access restrictions and providing alternative water supply) is retained as a remedial alternative for the detailed analysis phase of the FS for implementation in conjunction with the Limited Action GRA and/or other remedial actions.

5.2.4 Monitored Natural Attenuation

Current USAF policy requires the evaluation of natural attenuation for all base FSs. Monitored Natural Attenuation (MNA) is a response that uses ongoing physical, chemical, and/or natural biological processes to reduce the concentrations of contaminants within an aquifer, including biodegradation, abiotic degradation, sorption, volatilization, and dispersion. There are often aerobic and anaerobic processes occurring within a plume that will eventually reduce contaminant concentrations to cleanup levels. Often, MNA can be used in conjunction with Enhanced Passive Remediation (EPR) or in-situ active remediation measures, or as a follow-up to active remediation measures that have already been implemented. Typically, highly contaminated areas may require more intensive remediation actions, while minimally contaminated areas are suited to MNA or EPR.

While natural attenuation uses naturally occurring treatment mechanisms described above to reduce the concentration of contaminants in an aquifer, in the case of chlorinated organics it primarily relies on the destructive mechanisms of anaerobic biological reduction. Under the right conditions, anaerobic microorganisms can reductively dechlorinate organic solvents, ultimately producing ethane and chloride end products. Alternatively, this mechanism can produce less chlorinated compounds that are amenable to mineralization through aerobic biological treatment mechanisms. The reductive dechlorination reaction requires anaerobic conditions as well as sufficient electron donors to supply reducing power. Typically, electron donors include hydrocarbon contamination that may be collocated with the solvent contamination, or carbohydrate or organic acid material that may be present either naturally or from the disposal of non-hazardous material.

Adsorption of contaminants on to soil particles and dilution and dispersion of contaminants in groundwater are the other two natural processes that contribute to attenuation of contaminant concentrations. These physico-chemical processes (adsorption, dilution, and dispersion) do not destroy contaminants. However, they create initial steady-state conditions for the plume boundary (as defined by cleanup levels), which reduces in size over time as the natural biological processes degrade and destroy the contaminants until site closure is achieved.

The Natural Attenuation response action can be an effective means of achieving cleanup goals, particularly when these goals are based on site-specific risk reduction. It includes documentation of how these processes are occurring and how they will remediate groundwater prior to its exposure to potential receptors, either as a stand-alone option or in conjunction with other engineered remediation processes. Thus, the Natural Attenuation response is different from a No Further Action response in that it is a proactive approach focusing on verification and monitoring of natural remediation processes rather than relying completely on engineered remediation processes. Consequently, remedial action involving Natural Attenuation is often paired with LTM (together referred to as MNA) under Limited Action response to verify that the contamination poses no risk to human health or the environment and that the natural processes are reducing contamination levels and risk as predicted.

A protocol was developed by USEPA to document the natural attenuation process. This protocol provides the methods needed to verify natural attenuation is occurring, and the conditions under which it can be applied. This technology can be used to clean up a site if the existing processes are suitable to treat contaminants as fast as they are released, and that the plume would not migrate to potential future receptors.

The RI report for the Chlorinated groundwater plumes (FPM, April 2004) has concluded that there is evidence of biodegradation occurring at the site by reductive dechlorination. The biodegradation potential of petroleum plumes, if any are present, is also well-established. A literature search for biodegradation rates of contaminants at the site revealed limited data or data with a wide range of values. However, biodegradable compounds of interest generally appear to have biodegradation half-lives of about 3 years or less, and recalcitrant compounds (trimethylbenzenes, MTBE, naphthalene) of the order 5-15 years. Also, from data and analysis presented in Section 4.0, several of the plumes have dilute contamination over large areas, with potential for natural attenuation before reaching the Six Mile Creek.

5.2.4.1 Natural Attenuation Processes For The Nosedocks/Apron 2 Chlorinated Plume

The U.S. Environmental Protection Agency (EPA) defines monitored natural attenuation as the “reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The 'natural attenuation processes' that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater.” (EPA, OSWER Directive 9200.4-17P) These in-situ processes include both physical and biological processes:

- Physical: dispersion; dilution; sorption; volatilization; radioactive decay; chemical stabilization, transformation, or destruction of contaminants;

- Biological: biodegradation; and biological stabilization, transformation, or destruction of contaminants.

Within the Nosedocks/Apron 2 Chlorinated Plume, the chlorinated hydrocarbon volatile organic compounds identified in the groundwater at concentrations greater than potential ARARs include TCE; cis-1,2-DCE; vinyl chloride; and trans-1,2-DCE. The latter three compounds are typical intermediate degradation products that can be produced during the reductive dechlorination of TCE under anaerobic conditions (although the percent production of cis-DCE is much higher than trans-DCE for biodegradation).

5.2.4.2 Physical Processes

TCE and its daughter products were found dissolved in the groundwater only, at concentrations indicating no free product. Chlorinated hydrocarbon compounds can occur as DNAPLs in their pure states such that they tend to sink through the groundwater column toward the bottom of the aquifer. The concentrations encountered across the site did not necessarily increase with depth, and indicated that the source area was small, and that perhaps the parent compound, TCE, dissolved completely into the groundwater phase before sinking to the bottom of the aquifer.

Vertical and horizontal transport in the aqueous phase of the soil-water interface is a possible transport process. As a class, volatiles exhibit a wide range of solubility in water. Organic chemicals move in the groundwater system by advection and dispersion, and transport is retarded by adsorption, hydrophobic partitioning and biological and chemical degradation. All of these factors influence the direction and rate of transport as well as the ultimate fate of organic contaminants in a groundwater system. Site COCs can be transported in the direction of groundwater flow, and could reach Six Mile Creek via groundwater discharge. Once reaching the creek, partitioning into sediment by adsorption, into surface water by dissolution, and into air by volatilization would occur. Biodegradation processes can also occur, as previously discussed. Generally, VOCs have a low potential for bioaccumulation in aquatic systems.
There is little potential for off-site migration of the site VOCs in surface water. Although the Nosedocks/Apron 2 Chlorinated Plume appears to be migrating towards Six Mile Creek, levels in the most-downgradient wells suggest that the plume biodegrades prior to reaching the creek. Even if contaminated groundwater (vinyl chloride) reaches the creek, as measured in seep samples [i.e., during the RI, at 782SW-114 (0.31 F µg/L)], surface water samples in the creek do not indicate measurable levels of VC, indicating that the levels are attenuating upon discharging to the creek or prior to reaching the creek through the seeps, via volatilization or by ongoing bioremediation taking place in the sediment.

5.2.4.3 Biological Processes

The most common lines of evidence used to demonstrate natural attenuation of organic compounds dissolved in groundwater include:

- Historical trends in contaminant data showing plume stabilization and/or loss of contaminant mass over time (**first line of evidence**);

- Analytical data showing that geochemical conditions are suitable for biodegradation and that active biodegradation has occurred as indicated by the consumption of electron acceptors and/or the production of metabolic byproducts (**second line of evidence**);

- Microbiological data that support the occurrence of biodegradation (**third line of evidence**).

The groundwater VOC and geochemistry results within the Nosedocks/Apron 2 Chlorinated Plume indicate that anaerobic conditions are favorable for reductive dechlorination processes, and that these processes are actively working to reduce site concentrations of chlorinated solvents. DCE produced biologically by the reductive dechlorination of TCE is almost 100% cis-DCE, whereas manufactured DCE is mostly 1,1-DCE and only contains 10-20% cis-DCE. The results overwhelmingly indicate the presence of cis-DCE and minimal, if any, concentrations of 1,1-DCE across the length of the plume, and provide evidence that intrinsic in-situ reductive dechlorination is a major degradative pathway governing the fate of TCE at this site. Also, the groundwater results indicate that reductive dechlorination processes are continuing through ethene (from a positive detection recorded at downgradient well 782VMW-101 during the RI [FPM, 2004]), albeit slowly from accumulated concentrations of vinyl chloride.

Because the first two lines of evidence provide overwhelming evidence for natural biodegradation within the Nosedocks/Apron 2 Chlorinated Plume, microbiological data was not collected for this site (i.e., in the form of laboratory microcosm studies, which are commonly used for this purpose).

5.2.4.4 Geochemical and Field Parameter Indicators for Reductive Dechlorination

In addition to the disappearance of parent product (TCE), and the formation of daughter products (cis,1,2-DCE, VC, and ethene), various geochemical parameters and field instrument parameters can be measured to support evidence of biological natural attenuation processes. The following section describes the geochemical parameters and field parameters as they are expected to vary in the presence of active reductive dechlorination pathways. The parameters of interest include:

- Geochemical parameters (including electron acceptors, methane/ethane/ethane, chloride, alkalinity, and TOC), and

- Field instrument parameters (including dissolved oxygen, redox, temperature, and pH measurements).

5.2.4.5 Geochemical Parameters for Reductive Dechlorination

Microorganisms obtain energy for cell production and maintenance by catalyzing the transfer of electrons from electron donors to electron acceptors. This process results in the oxidation of the electron donor (which, during aerobic respiration, is often the contaminant of concern), and the reduction of the electron acceptor. In most scenarios, dissolved oxygen (DO) is the primary electron acceptor. After DO is consumed, anaerobic microorganisms generally use electron acceptors in the following order of preference – nitrate, ferric iron, sulfate, and carbon dioxide (AFCEE Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, Wiedemeier et al., 1996). During reductive dechlorination, dechlorinating microorganisms use the chlorinated hydrocarbon as an electron acceptor, not as a source of carbon, and hydrogen is used as the electron donor. Reductive dechlorination has been demonstrated under nitrate- and iron-reducing conditions, but the most rapid biodegradation rates, affecting the widest range of chlorinated aliphatic hydrocarbons, occur under sulfate-reducing and methanogenic conditions. Anaerobic destruction of chlorinated hydrocarbons is thus associated with the depletion of these competing electron acceptors, thus, the reduction of nitrate, solubilization of iron, reduction of sulfate, and production of methane.

Groundwater samples collected during the RI and LTM sampling rounds were also analyzed for the following geochemical indicator parameters: nitrate, total (ferric and ferrous) and dissolved (ferrous [Fe^{2+}]) iron (the latter which was measured in the field using a Hach® kit), sulfate, sulfide, methane/ethane/ethane (first RI sampling round only, in 2002), chloride, alkalinity, and total organic carbon. These parameters can be used to document if the groundwater conditions support biological degradation processes, particularly chlorinated hydrocarbon biodegradation. These parameters help to identify if groundwater conditions are aerobic or anaerobic, and to indicate what mechanisms may be working to assist in the biodegradation of remaining site contamination.

After the DO is consumed, nitrate is used as an alternate electron acceptor for anaerobic biodegradation of organic carbon via denitrification. In this process, nitrate (NO_3^-) is converted to nitrite (NO_2^-); therefore, nitrate depletion relative to background conditions can be an indication of biological activity. Furthermore, in the protocol, it states that for reductive dechlorination to occur, nitrate concentrations in the contaminated portion of the aquifer must be less than 1 mg/L (Wiedemeier et al., 1996). During the RI, for example, nitrate was measured above 1 mg/L in the upgradient wells only – 782VMW-98, -99, and 782VMW-97 (the latter of which, although included in the TCE plume, can be considered upgradient to the reductive dechlorination activity).

After DO and nitrate have been depleted by microbial activity, ferric iron (Fe^{3+}) is used as an electron acceptor during anaerobic biodegradation of organic carbon. Ferric iron is reduced to ferrous iron (Fe^{2+}), which is soluble in groundwater, and is therefore an indicator of microbial degradation activity. The presence of elevated total iron concentrations, typically observed in groundwater from wells affected by fuel compounds and/or vinyl chloride, suggests the solubilization of iron is occurring. The amount of ferrous iron produced is dependent on the concentration of bioavailable iron in the groundwater; areas with little to no bioavailable iron will not exhibit an increase in ferrous iron concentrations. During the RI, for example, ferrous iron was measured at levels above 1 mg/L in several within-plume wells, but less than 1 mg/L at wells in the source area (782VMW-81 [2002 only] and -105b), and upgradient wells (782VMW-98 and -99).

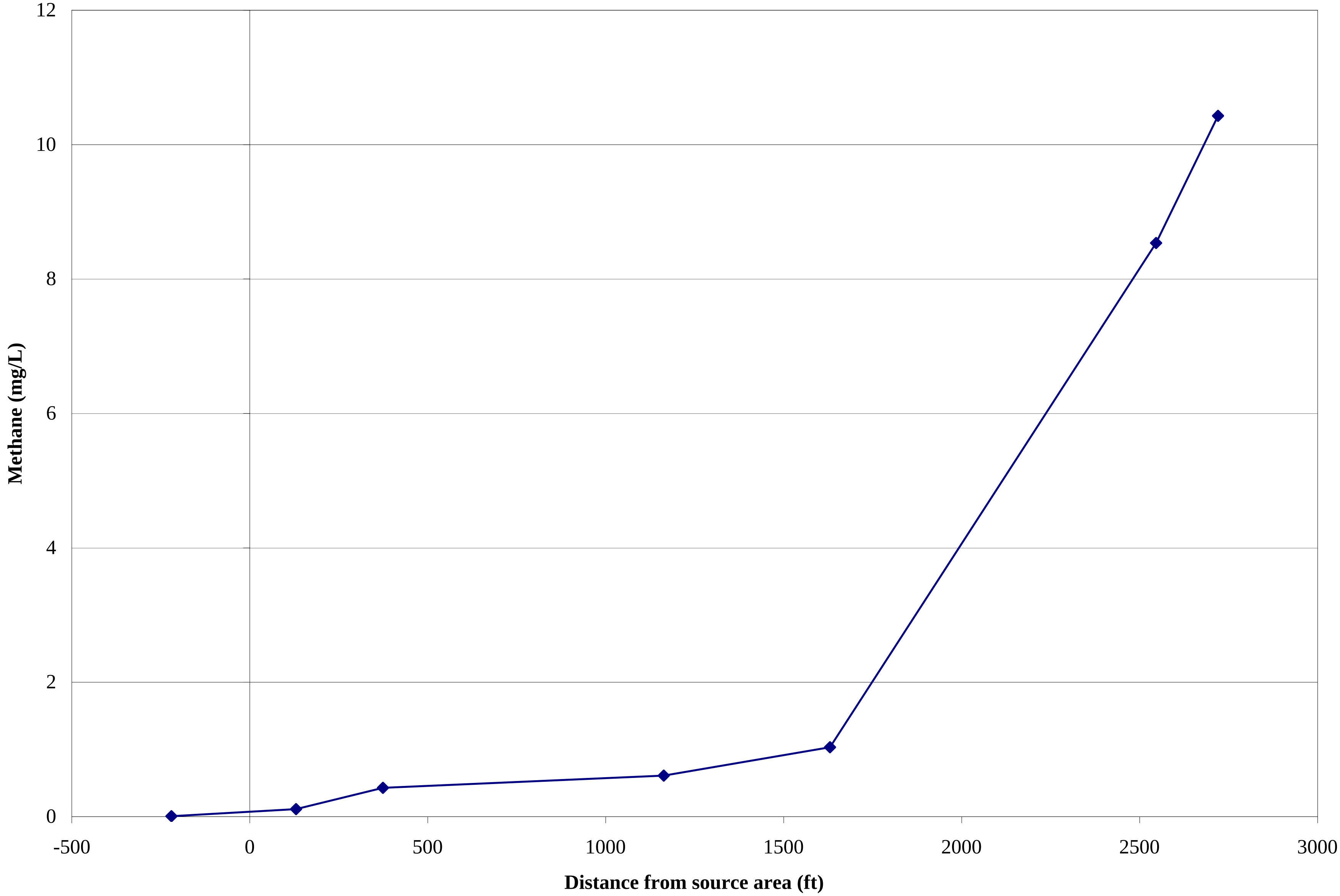
Sulfate is the next thermodynamically preferred alternate electron acceptor and is used by microbes once the oxygen, nitrate, and ferric iron have been depleted by anaerobic biodegradation. Sulfate is converted to sulfide in the subsurface during anaerobic biodegradation, often forming hydrogen sulfide gas, which produces a "rotten egg" odor. This process results in a depletion of sulfate and the production of sulfide. Sulfide may not always be detected in groundwater samples, however, because it commonly forms metal sulfide precipitates and falls out of solution. Concentrations of sulfate greater than 20 mg/L may result in competition for electron donor (hydrogen) between sulfate reducers and dechlorinators (Wiedemeier et al., 1996). During the RI, for example, sulfate was measured at levels less than 20 mg/L across the site, except for locations 782VMW-76 (2003 only), -83 (2002 only, and the sulfate result was associated with "R", indicating the result was rejected), -86 (2003 only), -89 (2003 only), -91, and -100 (2002 only). The latter four locations are outside the boundaries of the main, southern chlorinated plume. Sulfide was detected only in one upgradient well, 782VMW-98.

During methanogenesis, carbon dioxide is used as an electron acceptor, and is reduced to methane, or acetate is split to form carbon dioxide and methane. Methanogenesis occurs after oxygen, nitrate, bioavailable ferric iron, and sulfate have been depleted in the groundwater. The presence of methane dissolved in groundwater indicates highly reducing conditions, and is often characteristic of those conditions conducive for reductive dechlorination. During the RI, for example, in 2002, the methane concentrations increased directly with distance from the source area, with levels at 782VMW-101 and -102 recorded at 8.5 mg/L and 10.4 mg/L, respectively (Figure 5-2). (Methane/ethane/ethane analysis was not conducted for samples collected during LTM sampling rounds.) These results suggest that strongly reducing conditions are present in the subsurface, and may help to promote natural biodegradation of chlorinated hydrocarbons via reductive dechlorination.

The reduction of vinyl chloride to ethene is the last step in the reductive dechlorination pathway.

Groundwater conditions indicating ethene production with simultaneous vinyl chloride reduction is a strong indicator that reductive dechlorination is actively working to reduce chlorinated hydrocarbon concentrations to non-toxic byproducts. The reduction of ethene to ethane is a possibility at sites exhibiting extremely reducing conditions. In most cases, the reduction of ethene to ethane is not observed until the vinyl chloride concentrations have been nearly exhausted (de Bruin et al., 1992). For example, in 2002, ethene was recorded at measurable levels approaching 10 µg/L at downgradientmost well location 782VMW-101. (Methane/-ethane/ethane analysis was not conducted for samples collected during LTM sampling rounds.)

Figure 5-2
Methane Concentrations in Groundwater Along the Length of Chlorinated Plume



During reductive dechlorination of chlorinated hydrocarbons, chloride is released into the groundwater. This results in chloride concentrations in affected groundwater that are elevated relative to background conditions. Elevated chloride concentrations in affected and downgradient wells indicate that chlorinated hydrocarbons are being actively biodegraded, and chloride is being liberated. Because chloride behaves as a conservative tracer as it travels through groundwater, it is also observed downgradient of areas contaminated with high levels of chlorinated solvents. For example, during the RI in 2002, chloride was measured at levels greater than twice the upgradient concentration (36 mg/L) at several locations, including: 782VMW-76, 78, -81, -82, -84, 85, -86, -89, -90, -94, -95, and -105b, 782MW-6D, and -6R2.

The total alkalinity of a groundwater is indicative of an aquifer's capacity to buffer an acid, and results from the presence of hydroxides, carbonates, and bicarbonates of elements such as calcium, magnesium, sodium, potassium, or ammonia. These species result from the dissolution of rocks (primarily carbonate rocks), the transfer of carbon dioxide from the atmosphere, and biodegradation activity. When carbon dioxide is produced, it increases the alkalinity, and can therefore be an indicator of biological activity. In anaerobic systems where carbon dioxide is used as an electron acceptor, it is reduced by methanogenic bacteria during methanogenesis, and methane is produced. During reductive dechlorination, hydrogen ion is also released, which may decrease the alkalinity. In general, areas contaminated with fuel hydrocarbons exhibit a higher total alkalinity than background areas. Changes in alkalinity are most pronounced during aerobic respiration, denitrification, iron reduction, and sulfate reduction. Alkalinity was not a major indication of reductive dechlorination during the RI, as results from 2002 indicated only wells outside the plume boundaries with levels more than twice the background concentration at 782VMW-98 (418 mg/L). During the RI sampling round in 2003, locations 782VMW-77 and -88 were reported within the plume boundaries with alkalinity concentrations higher than twice the background concentration. Subsequent LTM sampling rounds have indicated similar results.

Total organic carbon (TOC) is a measure of all the carbon present in the groundwater including both natural carbon and that from human activities. TOC is important because during reductive dechlorination, chlorinated hydrocarbon compounds are used as electron acceptors, and this dehalorespiration requires an appropriate source of carbon for microbial growth in order for this process to occur. Microbes may use both forms of carbon for growth. The dissolved total organic carbon (TOC) levels observed across the site, though not extremely high, support a hypothesis that (non-toxic) organic matter (or perhaps its petroleum-related co-contaminants which may have degraded) is present in the aquifer to serve as an electron donor or a cosubstrate for the biodegradation of the chlorinated compounds present in the plume. During both RI monitoring rounds, for example, TOC was reported at every sampling location at levels below 20 mg/L, which may in fact indicate that TOC is a limiting factor for further plume degradation.

5.2.4.6 Field Instrument Parameters

Oxygen is the most thermodynamically preferred electron acceptor and is normally depleted in areas with relatively higher chlorinated hydrocarbon concentrations. The range of values observed in the affected areas across the site indicates anaerobic to weakly aerobic conditions, and was measured in 2002, for example, at less than 1 mg/L at several locations across the length of the chlorinated plume.

Hydrocarbon-degrading microbes are active within a pH range of 6 to 8 standard units (s.u.). Based on 2002 results, with the exception of 782VMW-99, where a cement leakage through the screen was suspected, site conditions are within this range (from 6.32 [782VMW-87] to 7.90 [782VMW-94]).

Groundwater temperature affects the rate of biodegradation, and for every 10 °C increase in temperature between 5 and 25 °C, biodegradation rates may double. The temperature range of groundwater across the site was measured in 2002 from 2.95 to 13.56 °C.

The redox potential of groundwater is a measure of electron activity and is an indicator of the relative tendency of a solution to accept or transfer electrons. The redox potential of groundwater typically ranges from –400 mV to +800 mV. Positive redox values (redox > 0) indicate oxidizing (and generally aerobic) conditions (i.e., loss of electrons) and negative values (redox < 0) indicate reducing (and generally anaerobic) conditions (i.e., gain of electrons). Redox conditions are usually mediated by biological activity. Negative redox measurements are favorable for indicating reductive dechlorination, especially when levels are less than -100 mV. Such readings were recorded at several locations across the site during all sampling rounds.

5.2.4.7 Screening for Natural Biodegradation

The biogeochemical signature left in groundwater when organic compounds are biodegraded, in conjunction with the ambient geochemical conditions within the aquifer, can be used to assess the potential for chlorinated solvent biodegradation in the form of a scoring system introduced by Wiedemeier et al. (1996a and b). The AFCEE program BIOCHLOR incorporates this checklist/scoring system that requires concentrations of electron acceptors, parent and daughter chlorinated solvents, methane, TOC, chloride, and redox, temperature, and pH measurements. These data are evaluated based on whether or not they are characteristic of the reductive dechlorination biotransformation process, and a total score above 20 signifies “strong evidence for anaerobic biodegradation of chlorinated organics.” By inputting the results from the RI Nosedocks/Apron 2 Chlorinated Plume sampling event, the site yielded a score of 26. The score sheet is provided as Figure 5-3. This high score means that there is very strong evidence that reductive dechlorination of chlorinated ethenes is occurring in the Nosedocks/Apron 2 Chlorinated Plume.

5.2.4.8 Summary of the Lines of Evidence to Support Natural Attenuation

Many independent but converging lines of evidence are presented in this section to evaluate and quantify natural attenuation of the Nosedocks/Apron 2 Chlorinated Plume, including an evaluation of plume behavior over time and an interpretation of chemical and geochemical analytical data. All of the available evidence supports the occurrence of natural attenuation of chlorinated ethenes and the efficacy of natural attenuation within the Nosedocks/Apron 2 Chlorinated Plume.

Figure 5-3
BIOCHLOR Biodegradation Assessment Scoring Sheet

Natural Attenuation Screening Protocol	Interpretation	Score	
The following is taken from the USEPA protocol (USEPA, 1998). The results of this scoring process have no regulatory significance.	Inadequate evidence for anaerobic biodegradation* of chlorinated organics	0 to 5	**Score: 26**
	Limited evidence for anaerobic biodegradation* of chlorinated organics	6 to 14	
	Adequate evidence for anaerobic biodegradation* of chlorinated organics	15 to 20	
	Strong evidence for anaerobic biodegradation* of chlorinated organics	>20	*Scroll to End of Table*

* reductive dechlorination

Analysis	Concentration in Most Contam. Zone	Interpretation	Yes	No	Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	◉	○	3
	> 5mg/L	Not tolerated; however, VC may be oxidized aerobically	○	◉	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	◉	○	2
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	◉	○	3
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	◉	○	2
Sulfide*	>1 mg/L	Reductive pathway possible	○	◉	0
Methane*	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	◉	○	3
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	◉	○	1
	<-100mV	Reductive pathway likely	◉	○	2
pH*	5 < pH < 9	Optimal range for reductive pathway	◉	○	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	○	◉	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	○	◉	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	○	○	
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	○	◉	0
Chloride*	>2x background	Daughter product of organic chlorine	◉	○	2
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	○	○	
Volatile Fatty Acids	>0.1 mg/L	Intermediates resulting from biodegradation of aromatic compounds; carbon and energy source	○	○	
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	◉	○	2
PCE*		Material released	○	◉	0
TCE*		Daughter product of PCE [a/]	○	◉	0
DCE*		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE[a/]; 1,1-DCE can be a chem. reaction product of TCA	◉	○	2
VC*		Daughter product of DCE[a/]	◉	○	2
1,1,1-Trichloroethane*		Material released	○	◉	0
DCA		Daughter product of TCA under reducing conditions	○	◉	0
Carbon Tetrachloride		Material released	○	◉	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	○	◉	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	◉	○	2
	>0.1 mg/L	Daughter product of VC/ethene	○	◉	0
Chloroform		Daughter product of Carbon Tetrachloride	○	◉	0
Dichloromethane		Daughter product of Chloroform	○	◉	0

* required analysis.
a/ Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

SCORE Reset

End of Form

Based on the statistical analysis of contaminant concentrations in individual wells, the results suggest that the contaminant concentrations within the plume are stable or declining over time. The calculated plume cleanup times under natural biodegradation and attenuation conditions is less than 30 years for all chlorinated plumes (Table 4-3). Evaluations in the RI and in this FS of natural attenuation data demonstrate that the chlorinated plumes are undergoing natural attenuation, including reductive dechlorination, and that the plumes have stabilized in extent and location and gradually decreasing over time. Based on the evaluation of the trends in areal extent and total mass estimates of each chlorinated ethene in the Nosedocks/Apron 2 Chlorinated Plume over the sampling rounds conducted between 2002 and December 2004, it is apparent that the plumes have stabilized and the sizes of the plumes are declining over time. From a review of the areas of the isopleth maps, it is also apparent that the plumes have reached steady-state equilibrium, and that the maximum contaminant concentrations within the contaminant plume are steady or declining over time.

Available biogeochemical data also support the efficacy of ongoing natural attenuation. Depletion of electron acceptors including DO and sulfate, elevated concentrations of metabolic byproducts including Fe(II), methane, alkalinity, chloride, and decreased ORP in areas with elevated contaminant concentrations provide clear evidence that the observed reductions in contaminant concentration and total mass observed within the plume are, at least in part, the result of natural biodegradation. The presence of daughter products (i.e., DCE, VC, and ethene) resulting from the reductive dechlorination of chlorinated ethenes also provides conclusive evidence that reductive dechlorination is removing organic contaminants from grdounwater. Based on the screening process, there is strong evidence for the reductive dechlorination of chlorinated ethenes in the plume.

The evidence presented in this section is clear and compelling for the efficacy of natural attenuation, and specifically natural biodegradation, of the Nosedocks/Apron 2 Chlorinated Plume. From the decreases observed in the isopleth maps for higher concentrations of individual contaminants, it is apparent that the core of the plume has undergone significant reductions.

These observations, coupled with the fact that Six Mile Creek has not been impacted by the plume contaminants, preliminarily support the remedial alternative of monitored natural attenuation (MNA) with groundwater restrictions/ICs.

Thus, the Monitored Natural Attenuation GRA is retained as a remedial alternative for the detailed analysis phase of the FS for implementation by itself or in conjunction with other remedial actions depending on the groundwater plume.

5.2.5 Collection and Containment (also referred to as Capture and Control)

Collection and Containment response actions include technologies that reduce the mobility of contaminants and risks associated with exposure to contaminants, thereby providing protection of human health and the environment. These technologies involve minimal or no treatment. These actions consist of capturing and/or controlling groundwater movement through the use of technologies like capping and grading to eliminate or minimize infiltration from surface water runoff, horizontal subsurface barriers (drains or collection trenches) and extraction wells (vertical, inclined, or horizontal) to collect and extract groundwater and by changing the hydraulic gradient in the surrounding area (hydraulic control), and vertical subsurface barriers (impermeable or low permeability walls such as slurry walls, sheet piling, and grout curtain walls) to divert the flow of groundwater from a contaminated area or to direct the flow of contaminated groundwater into a capture or treatment system. Trenches may be installed with pumped collection systems such as pipes and sumps. The selection of an appropriate groundwater Collection and Containment system depends upon the objectives of the remedial action, the depth of contamination, and the geologic and hydrogeologic characteristics of the aquifer. For example, extraction wells are usually preferred for locations where the water table is deeper, and collection trenches are applicable to shallower plumes. As another example, the barrier drain system is most useful in formations with low transmissivity and when the flow of contaminated groundwater must be controlled over a large area.

By themselves, Collection and Containment actions do not reduce either the toxicity or the volume of contaminants at the site. Thus, they are generally used in combination with treatment technologies (ex-situ technologies for extracted water and in-situ technologies for water diverted within the subsurface as in the case of diversion barriers). If, as an outcome of this FS, engineered remedial actions are chosen for site cleanup, it would be with the objective of developing alternatives that reduce the risks of exposure and meet the RAOs by reducing mobility and performing treatment of contaminants. Therefore, options involving solely Collection and Containment (including solely groundwater containment and hydraulic control) have not been developed in this FS.

5.2.6 In-Situ Treatment

Response actions involving treatment are preferred under SARA because they generally result in permanent remedy by reducing the toxicity, mobility, or volume of hazardous substances present at the site and, thus, provide a greater degree of protection to public health and environment.

In-situ treatment of contaminated groundwater allows the groundwater to be treated in the aquifer without extraction. In-Situ Treatment response action consists of biological, physical, or chemical treatment technologies. Since certain treatment technologies such as thermal processes belong to a special class of treatment technologies that involve both physical and chemical phenomena, therefore, the physical and chemical technologies are catalogued under the common heading of “Physical/Chemical Treatment” within the In-Situ Treatment GRA in Figure 5-1.

5.2.7 Ex-Situ Treatment

Response actions involving treatment are preferred under SARA because they generally result in permanent remedy by reducing the toxicity, mobility, or volume of hazardous substances present at the site and, thus, provide a greater degree of protection to public health and environment. Treatment may be performed either on-site or offsite.

Ex-situ treatment requires groundwater to be captured and removed from the aquifer before treatment. Groundwater is captured using a groundwater recovery system such as recovery wells or trenches. Ex-Situ Treatment response action consists of biological, physical, or chemical treatment technologies. Since certain treatment technologies such as thermal processes belong to a special class of treatment technologies that involve both physical (e.g., steam stripping) and chemical phenomena (e.g., vapor oxidation), therefore, the physical and chemical technologies are catalogued under the common heading of "Physical/Chemical Treatment" within the Ex-Situ Treatment GRA in Figure 5-1.

The advantage of Ex-Situ Treatment over In-Situ Treatment is that it allows for greater flexibility in establishing the biological, chemical, or physical conditions, or any combination of these conditions, that are required to remove or destroy the contaminants. However, it can be typically more expensive compared to In-Situ treatment for accomplishing the same level of cleanup, and additional wastes may be generated that would need treatment or disposal.

5.2.8 Disposal

If one or more of the Collection and Containment/treatment technologies are incorporated into potential alternatives, the disposal of extracted groundwater must also be addressed. Disposal actions, like Collection and Containment response actions, reduce the mobility of the contaminants through physical deposition and may be used separately or in conjunction with treatment technologies. By themselves, disposal actions do not reduce the toxicity or the volume of hazardous substances at the site. However, in combination with Collection and Containment and treatment response actions, they do contribute to reducing the toxicity, mobility, or volume of hazardous substances present at the site and, thus, to providing a greater degree of protection to public health and environment. This category of response action can occur on-site or offsite. In the case of groundwater, disposal technologies typically include beneficial use or re-injection of treated groundwater, or its discharge to surface waters. A special case of disposal is discharge of groundwater (either after complete or limited treatment, or before treatment) to a publicly owned treatment works (POTW), either directly or through a sanitary sewer. Offsite disposal to a POTW also results in treatment at that facility. Disposal to surface water is typically direct, but it can be disposed of indirectly through a storm drain or a ditch.

It should be noted that response actions involving groundwater treatment alternatives, particularly Ex-Situ Treatment alternatives, may generate liquid, sludge, soil, or other wastes which may themselves require treatment and/or proper on-site or offsite disposal. In this FS, treatment and/or disposal of such incidental wastes will be addressed within the context of the treatment response actions.

5.3 Identification of Technologies and Process Options

The remedial technologies and process options associated with each category of GRA that are considered for the cleanup of Site contamination were developed from several sources, including:

- the Federal Remediation Technologies Roundtable (FRTR) databases and screening matrix;
- the USEPA Hazardous Waste Clean-Up Information (CLU-IN);
- the USEPA Remediation and Characterization Innovative Technologies (REACHIT) database;
- the USEPA Superfund Innovative Technology Evaluation (SITE) Program;
- the USEPA Vendor Information System for Innovative Treatment Technologies (VISITT);
- the AFCEE Technology Transfer Program database;
- Groundwater Remediation Technologies Analysis Center (GWRTAC) database;
- In-house reports for other sites at the Griffiss Air Force Base;
- the Interim Final Guidance for Conducting RI/FS under CERCLA (October 1988);
- experience on other hazardous waste projects;
- literature and vendor survey and knowledge of new, innovative technologies; and
- the best professional judgment of engineers and scientists performing feasibility studies.

As was stated earlier, the remedial technologies and process options associated with each category of GRA are shown in Figure 5-1. It should be noted that the term “Technology” refers to a class of treatment processes having a common or similar approach to remediation, whereas the term “Process Options” refers to particular treatment systems, equipment, or chemical, physical, or other processes that are considered to be potentially applicable alternatives for remediation of the Site.

5.4 Criteria for Initial Screening

In this FS, initial screening of technologies and process options is performed in several stages. In the first stage, the No Further Action GRA, the Limited Action GRA, the ICs GRA, and the Monitored Natural Attenuation GRA are retained as potential remedial alternatives for the detailed analysis phase of the FS as was discussed in Sections 5.2.1, 5.2.2, 5.2.3, and 5.2.4, respectively. This is also documented in Figure 5-1.

In the second stage, several technologies and process options that are clearly inapplicable or inappropriate for site remedial actions are eliminated from the original compiled list in Figure 5-1; the last column (Screening Comments) of Figure 5-1 lists the reasons for such eliminations. Also, in this stage, USEPA Presumptive Technologies such as carbon adsorption that are considered in this FS are retained for further consideration in the remedial alternatives development without further screening analysis for implementability, effectiveness, and cost (Figure 5-1).

In the third stage, detailed descriptions are provided for the remaining technologies and process options from Figure 5-1 and, in accordance with USEPA RI/FS guidance (USEPA, 1988), are initially screened for technical implementability alone at which point some of the technologies and process options ascertained to be clearly ineffective or unworkable at the site will be eliminated. Any surviving technologies and process options are then evaluated for effectiveness, technical and administrative implementability, and relative cost, where the emphasis is now placed on effectiveness.

Brief definitions of effectiveness, implementability, and relative cost, as they apply to the screening process are as follows:

<u>Effectiveness</u>: This evaluation focuses on the potential effectiveness of process options in handling the estimated areas or volumes of media and meeting the remediation goals, the potential impacts to human health and the environment during the construction and implementation phase; and how proven and reliable the process is with respect to the contaminants and conditions at the site.

<u>Implementability</u>: This evaluation encompasses both the technical and administrative feasibility of the technology or process option. Since the initial screening was performed based on technical implementability, therefore, this subsequent and more detailed evaluation of process options will place greater emphasis on the institutional (administrative) aspects of implementability such as the ability to obtain permits for offsite actions; the availability of treatment, storage, and disposal services; and the availability of equipment and human and other resources to implement the technology.

<u>Relative Cost</u>: Cost plays a limited role in the screening process. Both capital as well as operating and maintenance (O&M) costs are considered. The cost analysis is based on engineering judgment, and each process is evaluated as to whether costs are high, low or moderate relative to the other options within the same technology type.

At least one representative process option is selected, if possible, for each technology type to simplify the subsequent development and evaluation of remedial alternatives without limiting flexibility during remedial design. For some technology types, more than one process option may be selected if the processes are sufficiently different in their performance such that one would not adequately represent the other, or if variable Site and contaminant characteristics warrant consideration of multiple process options to address the same medium. The selected processes derived from this evaluation are then used to assemble Site-wide remedial alternatives.

5.5 Detailed Evaluations for Initial Screening of Technologies and Process Options

In this section, technologies and process options that were not eliminated in the first stage based on their clear-cut inapplicability or inappropriateness for the site remediation are evaluated for effectiveness, implementability, and relative cost following the procedures described in Section 5.4 above.

5.5.1 Phytoremediation

Phytoremediation refers to a set of innovative processes that use living plants for in-situ and ex-situ remediation of contaminated soil, sludges, sediments, groundwater, surface water, and leachate through contaminant removal, transfer, degradation, or containment. The Phytoremediation process option is grouped under the Biological Treatment technology category of the In-Situ Treatment GRA (Figure 5-1). This process option is not considered for the Ex-Situ Treatment GRA since phytoremediation (ex-situ) would not be appropriate for treatment of groundwater.

Phytoremediation is relatively inexpensive, but is limited to shallow soils, streams, and groundwater. It is also limited to low concentrations of hazardous materials since high concentrations can be toxic to plants. An important aspect of phytoremediation is that establishing vegetation on a site reduces soil erosion by wind and water, which helps prevent the spread of contaminants to other sites. Grasses appear to be ideal for phytoremediation of surface soils because their fibrous root systems form a continuous dense rhizosphere.

Phytoremediation has been used to treat the following types of contaminants: metals, pesticides, solvents, explosives, and polynuclear aromatic hydrocarbons (PAHs). Phytoremediation has been used for point and non-point source hazardous waste control.

Many times, phytoremediation is not the sole treatment option, but rather it is used in conjunction with other approaches such as removal actions or ex-situ treatment of highly contaminated wastes, or as a polishing treatment.

Description:

Phytoremediation can be accomplished through several types of mechanisms, including phytotransformation/phytodegradation, phytovolatilization, hydraulic control, rhizofiltration/constructed wetlands, enhanced rhizosphere biodegradation, phytostabilization, and phytoextraction.

Phytotransformation/Phytodegradation

Phytotransformation refers to the uptake of organic and nutrient contaminants from soil and shallow groundwater and the subsequent transformation by plants. Phytotransformation depends on the direct uptake of contaminants from soil water and the accumulation of metabolites in plant tissue. For environmental application, it is important that the metabolites that accumulate in vegetation be non-toxic or at least significantly less toxic than the parent compound. Potential applications include phytotransformation of petrochemical sites and storage areas, ammunition wastes, fuel spills, chlorinated solvents, landfill leachates, and agricultural chemicals (pesticides and fertilizers).

Phytovolatilization

Phytovolatilization is a process whereby volatile chemicals or their metabolic products are released to the atmosphere through plant transpiration, and is potentially applicable to remediation of soil and shallow groundwater contamination. It is a form of phytotransformation involving physical phase change without a chemical modification (or after a chemical modification has occurred). The volume or toxicity of contaminants is not reduced under this process, but merely transferred from one medium/phase to another medium/phase, which is not as desirable as in-situ degradation. However, it may be preferable to prolonged exposure in the soil environment and the risk of groundwater contamination.

Hydraulic Control

Depending on the type of trees, climate, and season, trees can act as organic pumps when their roots reach down towards the water table and establish a dense root mass that takes up large quantities of water. Hydraulic control is a form of containment. Shallow groundwater contaminant plume control may be achieved through water consumption in plants that increase evaporation and transpiration from a site. Trees and other plants can be used as inexpensive solar pumps that use the energy of the sun to raise contaminated water to the surface.

Rhizofiltration/Constructed Wetlands

Rhizofiltration refers to the use of plant roots to sorb, concentrate, and precipitate metal contaminants from the surface or shallow groundwater. Roots of plants are capable of sorbing large quantities of lead and chromium from soil water or from water that is passed through the root zone of densely growing vegetation.

Enhanced Rhizosphere Biodegradation

Enhanced rhizosphere biodegradation (also known as phytostimulation or plant-assisted bioremediation) takes place in the soil surrounding plant roots and is, therefore, primarily applicable to soil remediation. Phytoremediation of the rhizosphere increases soil organic carbon (primarily due to root turnover), bacteria, and mycorrhizal fungi, all factors that encourage degradation of organic chemicals in soil.

Phytostabilization

Phytostabilization primarily refers to immobilizing toxic contaminants in soils. Establishment of rooted vegetation may also prevent windblown dust, an important pathway for human exposure at hazardous waste sites. Phytostabilization is especially applicable for metal contaminants at waste sites where the best alternative is often to hold contaminants in place.

Phytoextraction

Phytoextraction refers to the use of metal-accumulating plants that translocate and concentrate metals from the soil in roots and aboveground shoots or leaves.

Initial Screening for Technical Implementability:

Phytoremediation has been used in field-scale applications, with limited effectiveness demonstrated for treatment of halogenated and non-halogenated VOCs, which are the types of contaminants addressed in this FS. Relative to other effective technologies, phytoremediation has low operational system reliability and high maintenance. Climatic or seasonal conditions may interfere or inhibit plant growth, slow remediation efforts, or increase the length of the treatment period; the site is located in Rome in Central New York, which can witness prolonged winters. While most of the contaminants of concern (trichloroethylene, and vinyl chloride) are moderately hydrophobic [log octanol-water partition coefficient (log Kow) of 1-3.5], two of the important contaminants, (cis- and trans-)1,2-dichloroethylene are water-soluble to a greater degree (log Kow <1.0) and are, therefore, not likely to be sufficiently sorbed to roots nor actively transported through plant membranes. Finally and most significantly, at the Site, chlorinated plumes generally occur at depths of 30-40 feet below ground surface, whereas phytoremediation is generally limited to shallow groundwater (typically less than 20 feet below ground surface). Thus, groundwater contamination occurs at large depths at the site, rendering impractical the application of phytoremediation processes to remediation of the groundwater plumes at the site. In the vicinity of the Six Mile Creek, the depth to water is approximately 9-10 feet and depth to bedrock is 24 feet. Thus, the leading edges of vinyl chloride plume, which have thus far reached the vicinity of the Six Mile Creek (see Plate), occur at depths of approximately 9-24 feet; however, the contamination is likely to discharge towards the centerline of the creek, and the topography in the vicinity of the creek is not conducive for constructed wetlands or other phytoremediation measures. Hence, phytoremediation processes are eliminated from further consideration in this FS because they cannot be implemented technically at the Site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Phytoremediation has already been eliminated from further consideration in this FS during the Initial Screening phase above.

5.5.2 In-Situ Biodegradation

The biological treatment processes described in the section on Monitored Natural Attenuation (see Section 5.2.4) are a form of in-situ reduction of chlorinated solvent plumes by means of anaerobic and aerobic biodegradation. In cases where this process is not occurring naturally, it can be promoted by artificially providing the required conditions. The In-Situ Biodegradation process option is grouped under the Biological Treatment technology category of the In-Situ Treatment GRA (Figure 5-1). This process option is not considered for the Ex-Situ Treatment GRA since ex-situ biodegradation of such large volumes of contaminated groundwater as encountered at the site (Section 4) would not be implementable or appropriate.

Description:

Chlorinated Solvent Plumes

Halogenated (chlorinated) aliphatic compounds may be either oxidized or reduced, depending on their chemical structure and the properties of the environment in which they are present. Due to their electronegative character, polyhalogenated aliphatic compounds behave as oxidants, i.e., electron acceptors, in the redox reaction. The greater the degree of halogenation, the greater is its oxidative state and the greater its potential for reduction. Thus, under conducive (i.e., reducing) environmental conditions, any trichloroethene (TCE) present in the groundwater is highly susceptible to reductive dechlorination due to the excess of chlorine atoms (3) over the hydrogen atoms (1) in the TCE molecule.

Upon reduction, TCE prefentially degrades to cis-1,2-dichloroethene (cis-1,2-DCE), which has an equal number (2) of chlorine and hydrogen atoms in its molecule (degradation pathway of TCE to cis-1,2-DCE is preferred over trans-1,2-DCE and 1,1-DCE). Again, under conducive (i.e., reducing) environmental conditions, cis-1,2-DCE present in the groundwater degrades through the process of reductive dechlorination to vinyl chloride. This compound (cis-1,2-DCE) can also potentially be degraded through oxidation in conducive aerobic environments, although reductive dechlorination appears to the more common degradation process for cis-1,2-DCE based on our literature review.

Since vinyl chloride has an excess of hydrogen atoms (3) over chlorine atoms (1), it is in a more reduced state compared to TCE and cis-1,2-DCE. Thus, in reducing environments (groundwater with negative redox potentials) vinyl chloride tends to form a stable end-product. Although reductive dechlorination as well as oxidation under anaerobic conditions in the presence of Fe(III) are feasible, vinyl chloride is more easily degraded under conducive aerobic conditions.

The most common reason natural reductive dechlorination does not take place is a lack of electron donors to power the reduction. Addition of electron donors can cause the biological reduction processes that otherwise would not occur. The reductive dechlorination technology requires the addition of the electron donors into the aquifer, which limits the types of chemicals appropriate for use. Additives such as organic acids and organic mulch walls, oils, and proprietary time-release compounds (e.g., Hydrogen Release Compound [HRC®]) have been used to supply electron donors. Success of this technology is dependent on the successful introduction of the donors into the full extent of the plume or source, the maintenance of anaerobic conditions, and the maintenance of adequate donor supply throughout the period of treatment. This technology is fairly new but the fundamental science of the process is identical to the more established natural attenuation treatments.

Initial Screening for Technical Implementability:

As was noted earlier, the RI report for the Chlorinated groundwater plumes (FPM, April 2004) has concluded that there is evidence of biodegradation occurring at the site by reductive dechlorination. Further enhancement of anaerobic or abiotic reductive dechlorination of TCE and cis-1,2-DCE through introduction of additives into the subsurface is technically implementable. Aerobic degradation of vinyl chloride, is also highly feasible, although, in locations where it is implemented, the existing reductive environment will need to be overcome first.

Hence, the In-Situ Biodegradation process option is retained for further consideration in this FS for remediating groundwater at the site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

In-Situ Biodegradation is a potentially highly effective process for remediating site groundwater contamination. Effectiveness of this option depends on creating and/or enhancing conducive environmental conditions for the biodegradation of chlorinated solvents through reductive dechlorination and vinyl chloride through aerobic degradation. It affords a high degree of protection. Bench-scale treatability study and/or pilot testing would probably be required to confirm its feasibility for the site and to determine the optimum design parameters.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration for groundwater treatment at the Site.

Administrative Implementability: Since this process option has been successfully employed to achieve remediation of chlorinated plumes, regulatory and/or community acceptance may be expected by demonstrating the effectiveness, safety, and potential success at remediating the site versus other options, and through presentation of supporting data, including examples of success stories from elsewhere. Care must be taken during system design and verified during treatability or bench-scale studies to preclude adverse outcomes such as unintended reactions.

Relative Cost:

In-Situ Biodegradation is a relatively low cost process option for remediating the Site.

Conclusion:

In-situ Biodegradation is a potentially viable and effective technology for implementation at the site, pending confirmation through bench scale and/or treatability studies. It affords a high degree of protection, and permanently destroys organic contaminants at the site at relatively low cost. Therefore, this process is retained for further consideration in remedial alternatives development for in-situ remediation of groundwater at the Site (Figure 5-1).

5.5.3 In-Situ Bioventing/Biosparging

The In-Situ Bioventing/Biosparging process option is grouped under the Biological Treatment technology category of the In-Situ Treatment GRA (Figure 5-1). This process option is not considered for the Ex-Situ Treatment GRA since ex-situ bioventing of such large volumes of excavated materials as encountered at the site would not be implementable or appropriate.

Description:

In-Situ Bioventing

The In-situ Bioventing process stimulates the natural in-situ biodegradation of organic contaminants in the unsaturated zone soil by providing air (or oxygen) to existing soil microorganisms. In contrast to Soil Vapor Extraction (SVE) by induced vacuum (described in Section 5.5.5) with primary emphasis on volatilization and capture of contaminants, bioventing uses low air flow rates to provide only enough oxygen to sustain microbial activity with no follow-up capture of vapors. Oxygen is commonly supplied through direct air injection into residual contamination in soil. In addition to degradation of adsorbed fuel residuals, volatile compounds are biodegraded as vapors move slowly through biologically active soil.

Bioventing techniques have been successfully used to remediate soils contaminated by petroleum hydrocarbons, nonchlorinated solvents, some pesticides, wood preservatives, and other organic chemicals. Chlorinated solvents such as vinyl chloride and cis-1,2-DCE with potential for aerobic biodegradation are also amenable in conducive environments to treatment by bioventing.

In-Situ Biosparging

The In-situ Biosparging process stimulates the natural biodegradation of organic contaminants by indigenous microorganisms by injecting air (or oxygen) and nutrients (if needed) into the saturated zone. It is similar to the bioventing process, except that while bioventing is applied to the unsaturated zone, biosparging is applied to the saturated zone. Biosparging is also similar to the Air Sparging process (Section 5.5.4) in that both processes involve injecting air (or oxygen) into the saturated zone; however, Air Sparging typically involves larger air/oxygen flow rates with greater emphasis on volatilization of contaminants.

When volatile constituents are present, biosparging is often combined with SVE (Section 5.5.5), bioventing, or combined with other remedial technologies. When biosparging is combined with vapor extraction, the vapor extraction system creates a negative pressure in the vadose zone through a series of extraction wells that control the vapor plume migration.

Advantages and Other Considerations

- The basic criteria that must be satisfied for successful bioventing/biosparging include: (i) air must be able to pass through the soil (for bioventing) or soil/saturated zone (for biosparging) in sufficient quantities to maintain aerobic conditions; and (ii) natural organics-contamination degrading microorganisms must be present in concentrations large enough to obtain reasonable biodegradation rates.

- This technology does not require expensive equipment and can be left unattended for long periods of time, except for periodic maintenance monitoring.

- Bioventing/biosparging can be used to treat large areas with minimal site disturbance.

- Bioventing may be implemented for treatment of residual contamination after an initial SVE treatment phase is conducted to remediate the contaminated soil through volatilization and capture of vapors. Similarly, biosparging may be implemented for treatment of residual contamination after an initial Air Sparging treatment phase is conducted to remediate the contaminated saturated zone through volatilization and subsequent capture of vapors by SVE.

- Biosparging should not be used if free product is present since it can create groundwater mounding, which could potentially cause free product to migrate and contamination to spread.

- Pilot studies should be performed to provide design information, including data on soil gas permeability and biodegradation parameters.

Limitations

The following factors may limit the applicability and effectiveness of the process:

- Effectiveness of the bioventing process may be limited by the presence of water table within several feet of the surface, saturated soil lenses, or low permeability soils.

- Low soil moisture content may limit biodegradation and the effectiveness of bioventing, which tends to dry out the soils. Bioventing may also be limited by heterogeneous soils where the airflow may not contact all target soil zones.

- The vapors can build up in basements within the radius of influence of air injection wells. This problem can be alleviated by extracting air near the structure of concern.

- Monitoring of off-gases at the soil surface may be required.

- Aerobic biodegradation of many chlorinated compounds may not be effective unless there is a co-metabolite present.

Initial Screening for Technical Implementability:

Remediation of the Chlorinated groundwater plumes at the Site by Biosparging is technically implementable, either by itself or as a follow-on to Air Sparging. Also, remediation of residual contamination in free-product plumes at the Site is also technically implementable, either by itself or as a follow-on to SVE.

Hence, the In-Situ Bioventing/Biosparging process option is retained for further consideration in this FS for remediating groundwater plumes at the site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

Based on demonstrated application and known site data, In-Situ Bioventing/Biosparging is a potentially highly effective process when used in conjunction with other technologies for remediating groundwater and free-product contamination at the site. The effectiveness of this process will be confirmed by site-specific pilot tests to be conducted at the Site, which will also be used to collect design data. Bioventing has been implemented at other locations within the Griffiss AFB.

In-Situ Bioventing/ Biosparging affords a potentially high degree of protection, depending on design factors.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration for groundwater treatment at the Site.

Administrative Implementability: Since this in-situ process option has been successfully employed at other sites, the technology and processes are understandable and easily implementable. Since no extraction of groundwater is needed for remediation of chlorinated plumes, regulatory and/or community acceptance may be expected by demonstrating the effectiveness, safety, and potential success at remediating the site versus other options, and through presentation of supporting data, including examples of success stories from elsewhere.

Relative Cost:

In-situ Bioventing/Biosparging is a relatively low cost process option for remediating the Site since no groundwater need to be extracted and the treatment processes are relatively inexpensive.

Conclusion:

In-situ Bioventing/Biosparging is a potentially viable and effective technology for remediating the groundwater plumes and the residual contamination in free-product plumes at the Site. It affords a potentially high degree of protection at relatively low cost. Therefore, this process is retained for further consideration in remedial alternatives development for in-situ remediation of groundwater at the Site (Figure 5-1).

5.5.4 Air Sparging

The Air Sparging process option is grouped under the Physical/Chemical Treatment technology category of the In-Situ Treatment GRA (Figure 5-1).

Description:

Air sparging is an in-situ technology in which air is injected through a contaminated aquifer for the purpose of removing organic contaminants by a combination of volatilization and aerobic biodegradation processes. Injected air traverses horizontally and vertically in channels through the soil column, resulting in removal of contaminants by volatilization. The sparged air maintains a high dissolved oxygen content, which enhances natural biodegradation.

In-situ air sparging is typically used in conjunction with Soil Vapor Extraction (SVE), which is addressed in the following Section 5.5.5, to eliminate migration of vapors into buildings and off-site locations, or to prevent their travel in unintended directions such as into uncontaminated areas. It may also be used in conjunction with bioventing to remediate contamination in the overlying unsaturated zone soils.

The air sparging process is designed to operate at high flow rates to maintain increased contact between groundwater and air to realize higher volatilization rates for VOCs and fuels. It can also potentially remove less volatile and tightly sorbed contaminants such as semivolatile organic compound (SVOCs). In addition to enhancing aerobic biodegradation when oxygen is added to the groundwater, it can also potentially enhance cometabolism of chlorinated organics when methane is added to the groundwater.

Air sparging has a medium to long duration which may last, generally, up to a few years.

Air sparging has broad appeal because, like soil vapor extraction, it is relatively simple to implement and capital costs are modest for installing the small-diameter air injection points and the air delivery/recovery system. Like most subsurface remediation techniques, in-situ air sparging relies on the interactions between complex physical, chemical, and biological processes. However, this process has been successfully demonstrated at numerous sites. Pilot testing will be necessary before designing systems for a specific application, unless reliable hydrogeological data for predicting radius of influence and other design parameters is available. Treatability studies may be necessary if air sparging is to be implemented for the purpose of aerobic biodegradation.

Advantages and Other Considerations

- Air sparging is most effective for sites with relatively permeable, homogenous soil conditions. This allows for sufficient contact between the sparged air and the media while enabling effective extraction.
- Air sparging is generally applicable for depths to groundwater greater than five (5) feet.
- Air sparging has demonstrated sensitivity to minute permeability changes, which can result in localized stripping between the sparge and monitoring wells (short-circuiting).
- Accordingly, large portions of the targeted remediation zone may be bypassed by the sparge air, which needs to be addressed/mitigated through adequate and proper design.
- Air sparging should not be used at sites with free-floating product due to the potential for product migration from groundwater mounding.

Limitations

The following factors may limit the applicability and effectiveness of the process:

- Fine grained, low permeability soils (10^{-2} cm/sec to 10^{-6} cm/sec) will limit effectiveness.
- Potential exists for uncontrolled flow of dangerous vapors as airflow through saturated zone may not be uniform, requiring installation of vapor recovery systems. The vapor recovery systems are typically designed to remove air volumes that are four (4) times or greater than the sparging air volumes to ensure full recovery, which will add to the costs disproportionately.
- Extracted vapors may require treatment, although this may be avoided by adjustment of injection and extraction rates.
- System design should consider the possibility of aquifer clogging from iron precipitation or biomass accumulation caused by increased oxygen in the aquifer.

Initial Screening for Technical Implementability:

The Chlorinated groundwater plumes at the Site contain VOCs which are amenable to treatment by Air Sparging. This process option is technically implementable for enhancing the volatilization and aerobic biodegradation potential of vinyl chloride (and potentially 1,2-DCE) prior to discharge to the Six Mile Creek.

Hence, the Air Sparging process option is retained for further consideration in this FS for remediating groundwater at the site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

Based on demonstrated application and known site data, Air Sparging is a potentially highly effective process for remediating site groundwater contamination. The effectiveness of air sparging will be confirmed by site-specific treatability studies and pilot tests to be conducted at the Site, which will also be used to collect design data. A large number of air injection points and, accordingly, a large capacity air sparging system would be needed to provide adequate coverage of the large-area plumes at the site. However, based on the results of the RI and LTMs, the air sparging system can potentially be installed only in localized areas near hot spots and/or in areas that are in the vicinity or are immediately upgradient of the Six Mile Creek.

Air sparging affords a potentially high degree of protection, depending on design factors.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration for groundwater treatment at the Site.

Administrative Implementability: Since this in-situ process option has been successfully employed at other sites, the technology and processes are understandable and easily implementable. Since no extraction of groundwater is needed for remediation of chlorinated plumes, regulatory and/or community acceptance may be expected by demonstrating the effectiveness, safety, and potential success at remediating the site versus other options, and through presentation of supporting data, including examples of success stories from elsewhere. Care must be taken during system design to preclude adverse outcomes such as short-circuiting of the airflow pathways and potential for fouling.

Relative Cost:

In-situ Air Sparging is a relatively low cost (e.g., air sparging alone) to moderate cost (e.g., air sparging together with SVE and/or off-gas treatment) process option for remediating the Site since no groundwater need to be extracted and the treatment processes are relatively inexpensive.

Conclusion:

In-situ Air Sparging is a potentially viable and effective technology for implementation at the site. It affords a potentially high degree of protection at relatively low to moderate cost. Therefore, this process is retained for further consideration in remedial alternatives development for in-situ remediation of groundwater at the Site (Figure 5-1).

5.5.5 Soil Vapor Extraction

The SVE process option is grouped under the Physical/Chemical Treatment technology category of the In-Situ Treatment GRA (Figure 5-1). The SVE process is primarily a soil remediation technology. At the Site, it will be considered for potential implementation in conjunction with Air Sparging (Section 5.5.4) for the groundwater plumes, and as a standalone system or in combination with other remediation technologies for the free-product plumes.

Description:

SVE is an in-situ process for the removal of VOCs from vadose (unsaturated) zone soils. It can also be used for remediation of saturated zone soils if dewatering is practical.

In an SVE system, vacuum is applied through extraction wells to induce the controlled flow of air and thereby remove VOCs and some fuels and SVOCs from the soil. The technology is typically applicable to extraction of volatile compounds with a Henry's law constant greater than 0.01 or a vapor pressure greater than 0.5 mm Hg (0.02-inch Hg). Other factors, such as the moisture content, organic content, and air permeability of the soil, will also affect in-situ SVE's effectiveness. In-situ SVE will not remove heavy oils, metals, PCBs, or dioxins. Because the process involves the continuous flow of air through the soil, however, it often promotes the in-situ biodegradation of low-volatility organic compounds that may be present.

Impermeable (e.g., geomembrane) covers are often placed over soil surface to prevent short-circuiting and to increase the radius of influence of the wells. Ground water depression pumps may be used to reduce ground water upwelling induced by the vacuum or to increase the depth of the vadose zone. Air injection is effective for facilitating extraction of deep contamination, contamination in low permeability soils, and contamination in the saturated zone (air sparging).

The system consists of a series of vapor extraction wells (which can be installed vertically or horizontally, depending on project needs), commonly called vapor extraction points (VEPs), monitoring wells, and air blowers to draw air through the soil and into the VEPs. It also includes piping to collect the extracted air, and systems to remove contaminants from the extracted air.

SVE is well suited for the treatment of soil located under structures where soil excavation would be impractical. Typically, dewatering is not commonly used in the construction of the SVE system unless the site has a perched water table and contamination extends below the layer on which the groundwater is perched.

Vertical extraction wells are typically used at depths of five (5) feet or greater and have been successfully applied as deep as 300 feet. Horizontal extraction wells (installed in trenches or horizontal borings) can be used as warranted by contaminant zone geometry, drill rig access, shallow water table, or other site-specific factors.

The off-gas leaving the soil may be treated above ground to recover or destroy the contaminants, or exhausted to the atmosphere depending on the contaminant quantities, concentration levels, and regulatory and other project considerations.

The typical duration of operation and maintenance for in-situ SVE is typically medium- to long-term of the order of 1 to 3 years.

Advantages and Other Considerations

- SVE can be used to treat large areas with minimal site disturbance.

- Treatment requirements (and discharge permits and requirements) for extracted vapor depend on location specific regulations. In some locations, direct discharge may be allowed for low daily organics loading [e.g. less than 1 pound/day] or for low vapor concentrations (e.g. less than 0.1 ppm total organics).

- For organic vapor concentrations lower than 200 ppm, vapor phase carbon adsorption may be cost-effective for treating SVE off-gas. Spent activated carbon will require regeneration or disposal. For organic vapor concentrations exceeding 200 ppm, thermal oxidation or catalytic oxidation may be cost-effective for treating SVE off-gas. For organic vapor concentrations exceeding 10,000 ppm, internal combustion engines (ICE) may be cost-effective for treating SVE off-gas.

- Following a SVE treatment phase, many SVE systems can be operated at reduced flow rates (bioventing) to achieve additional contaminant reductions by biodegradation.

- Pilot studies should be performed to provide design information, including extraction well radius of influence, gas flow rates, optimal applied vacuum, and contaminant mass removal rates.

Limitations

The following factors may limit the applicability and effectiveness of the process:

- Effectiveness of SVE system may be limited by high organic content or extremely dry conditions in soil, which results in high sorption capacity of VOCs with corresponding reduction of removal rates. It may also be limited by heterogeneous soils where the airflow may not contact all target soil zones.

- Soil that has a high percentage of fines and a high degree of saturation, thus hindering the operation of the in-situ SVE system, will require higher vacuums (increasing costs).

- Exhaust air from in-situ SVE system may require treatment to eliminate possible harm to the public and the environment.

- Surface capping or sealing may be needed for shallow SVE systems where air can be drawn from the surface, causing "short circuiting" and reduced effectiveness from collection of subsurface vapors.

- Condensate from SVE may be a significant stream for treatment and/or waste management depending on the moisture content of site soils.

- Short-circuiting and preferential pathways can develop due to soil heterogeneity.

Initial Screening for Technical Implementability:

Remediation of the Chlorinated groundwater plumes at the Site by SVE alone is not technically implementable; however, SVE is both technically implementable and appropriate when used in conjunction with an Air Sparging system. Also, SVE is technically implementable, either as a standalone system or in combination with other technologies, for remediation of residuals in free-product plumes.

Hence, the SVE process option is retained for further consideration in this FS for remediating groundwater plumes at the site in conjunction with Air Sparging, and as a standalone system or in combination with other remediation technologies for remediation at the Site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

Based on demonstrated application and known site data, SVE is a potentially highly effective process when used in conjunction with other technologies for remediating groundwater and free-product contamination at the site. The effectiveness of SVE will be confirmed by site-specific pilot tests to be conducted at the Site, which will also be used to collect design data.

SVE affords a potentially high degree of protection, depending on design factors.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration for groundwater treatment at the Site.

Administrative Implementability: Since this in-situ process option has been successfully employed at other sites, the technology and processes are understandable and easily implementable. Since no extraction of groundwater is needed for remediation of plumes, regulatory and/or community acceptance may be expected by demonstrating the effectiveness, safety, and potential success at remediating the site versus other options, and through presentation of supporting data, including examples of success stories from elsewhere. Care must be taken during system design to preclude adverse outcomes such as short-circuiting of the airflow pathways and potential for fouling.

Relative Cost:

In-situ SVE is a relatively low cost (e.g., SVE alone) to moderate cost (e.g., SVE in combination with other technologies and/or off-gas treatment) process option for remediating the Site since no groundwater need to be extracted and the treatment processes are relatively inexpensive.

Conclusion:

In-situ SVE is a potentially viable and effective technology for remediating the groundwater plumes at the Site when it is implemented in conjunction with Air Sparging. It affords a potentially high degree of protection at relatively low to moderate cost. Therefore, this process is retained for further consideration in remedial alternatives development for in-situ remediation of groundwater and free-product plumes at the Site (Figure 5-1).

5.5.6 In-Well/Trench Air Stripping

The In-Well/Trench Air Stripping process option is grouped under the Physical/Chemical Treatment technology category of the In-Situ Treatment GRA (Figure 5-1).

Description:

In-Well Air Stripping

For the In-Well Air Stripping system, air is injected into a vertical (circulating) well that is screened at two depths (double-screened well), thereby lifting the water in the well and forcing it out the upper screen. Typically, the lower screen is set in the groundwater saturated zone, and the upper screen is located in the unsaturated (vadose) zone. Pressurized air is injected into the well below the water table, thus aerating the water. The aerated water rises in the well and flows out of the system at the upper screen. Simultaneously, additional water is drawn in the lower screen. To accommodate site-specific conditions and/or based on considerations of stripping efficiency, a counter-current system (i.e., water flow in reverse direction to air flow) may also be specified.

Once in the well, some of the VOCs in the contaminated groundwater are transferred from the dissolved phase to the vapor phase by air bubbles. The contaminated air rises in the well to the water surface where vapors are drawn off (as a standalone system or as part of a soil vapor extraction system) and treated by an aboveground off-gas treatment system or exhausted to the atmosphere depending on the contaminant quantities, concentration levels, and regulatory and other project considerations.

The partially treated groundwater is never brought to the surface; it is forced into the unsaturated zone, and the process is repeated as water follows a hydraulic circulation pattern or cell that allows continuous cycling of groundwater. As groundwater circulates through the treatment system in situ, contaminant concentrations are gradually reduced. In-well air stripping is a pilot-scale technology. The basic in-well stripping process may be supplemented with an injection system for additives such as nutrients, electron acceptors, etc. for enhancing in-situ chemical or biological treatment.

In-Trench Air Stripping

If contaminated groundwater occurs at shallow depths (e.g., less than 20’ bgs), a subsurface trench may be utilized as a polishing system to aerate the contaminated groundwater for removing VOCs, and/or for enhancing chemical or biological treatment through aeration alone or in combination with additives.

Advantages and Other Considerations

- The duration of In-Well/Trench air stripping is short- to long-term, depending on contaminant concentrations, Henry's law constants of the contaminants, the radius of influence, groundwater flowrate, and site hydrogeology. In general, in-well air strippers are more effective at sites containing high concentrations of dissolved contaminants with high Henry's law constants.

- Because groundwater is not pumped above ground, pumping costs are reduced (which is particularly advantageous for treating deep groundwater contamination) and permitting issues related to extracted water are rendered moot. Also, problems associated with storage and discharge of extracted water are eliminated.

- In addition to groundwater treatment, through integrated design, the In-Well/Trench Air Stripping systems can provide simultaneous vadose zone treatment in the form of bioventing or soil vapor extraction.

- The In-Well Air Stripping systems operate more efficiently with horizontal conductivities greater that 10^{-3} cm/sec and a ratio of horizontal to vertical conductivities between 3 and 10. A ratio of less than 3 indicates short vertical circulation times and a small radius of influence. If the ratio is greater that 10, the vertical circulation time may be unacceptably long.

- These systems can provide treatment inside the well, in the aquifer, or a combination of both. For these systems to be effective, the contaminants must be adequately soluble and mobile so they can be transported by the groundwater. Finally, since these systems provide a wide range of treatment options, they provide some degree of flexibility to a remediation effort.

Limitations

The following factors may limit the applicability and effectiveness of the process:

- In-Well/Trench Air Stripping systems only treat the water in the stripping well; thus, the system must be adequately designed and appropriately located to capture the groundwater requiring remediation.

- Fouling of the system may occur by infiltrating precipitation containing oxidized constituents. Also, biofouling or chemically oxidized fouling of the well/trench may occur during recirculation of the groundwater.

- Inadequate or improper design may result in short-circuiting of the treatment process, i.e., previously treated water will continuously re-enter without allowing previously untreated groundwater to also undergo treatment.

Initial Screening for Technical Implementability:

The Chlorinated groundwater plumes at the Site contain VOCs which are amenable to In-Well/Trench Air Stripping. This process option is technically implementable for enhancing the aerobic biodegradation potential of vinyl chloride (and potentially 1,2-DCE prior to discharge to the Six Mile Creek. Also, the contaminated groundwater is shallow in the upgradient vicinity of the Six Mile Creek, which provides conditions suitable for installation of an In-Trench Air Stripping system.

Hence, the In-Situ Biodegradation process option is retained for further consideration in this FS for remediating groundwater at the site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

In-Well/Trench Air Stripping is a potentially highly effective process for remediating site groundwater contamination. Effectiveness of this option depends on creating optimum groundwater circulating patterns and air-water contact times and patterns (co-current/counter-current) for efficient air-stripping of contaminants, and/or on successfully enhancing conducive environmental conditions for the biodegradation of the vinyl chloride (and potentially cis-1,2-DCE) plumes at the Site. It affords a potentially high degree of protection, depending on design factors.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration for groundwater treatment at the Site.

Administrative Implementability: Since this in-situ process option has been successfully employed at other sites, the technology and processes are understood and easily implementable. Since no extraction of groundwater is needed for remediation of chlorinated plumes, regulatory and/or community acceptance may be expected by demonstrating the effectiveness, safety, and potential success at remediating the site versus other options, and through presentation of supporting data, including examples of success stories from elsewhere. Care must be taken during system design to preclude adverse outcomes such as short-circuiting of circulating patterns and potential for fouling.

Relative Cost:

In-Well/Trench Air Stripping system is a relatively low cost process option for remediating the Site since no groundwater need to be extracted and the treatment processes are relatively inexpensive.

Conclusion:

In-Well/Trench Air Stripping is a potentially viable and effective technology for implementation at the site. It affords a potentially high degree of protection at relatively low cost. Therefore, this process is retained for further consideration in remedial alternatives development for in-situ remediation of groundwater at the Site (Figure 5-1).

5.5.7 Permeable Reactive Barriers

The Permeable Reactive Barriers (PRBs) consist of reactive materials that are installed in the form of permeable walls across the flow path of a contaminant plume in the subsurface, allowing the water portion of the plume to passively move through the wall while causing the degradation or removal of contaminants. Thus, the PRBs represent an innovative technique for passive, in-situ groundwater remediation. Passive treatment walls are generally intended for long-term operation to control migration of contaminants in groundwater. The PRB is not a barrier to groundwater flow, but it is a barrier to contaminant migration. The Permeable Reactive Barriers process option is grouped under the Physical/Chemical Treatment technology category of the In-Situ Treatment GRA (Figure 5-1).

Description:

The PRBs allow the passage of groundwater while prohibiting the movement of contaminants by employing such agents as zero-valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others. Target contaminant groups for passive treatment walls are VOCs, SVOCs, and inorganics. The technology can be used, but may be less effective, in treating some fuel hydrocarbons. The contaminants will either be degraded or retained in a concentrated form by the barrier material. The wall could provide permanent containment for relatively benign residues or provide a decreased volume of the more toxic contaminants for subsequent treatment.

The process of implementing a site-specific PRB proceeds in a phased approach. Bench-scale testing is conducted first to determine the rate of degradation and residence time required to achieve the required cleanup levels. An on-site, pilot-scale study is then conducted to collect the required data and design parameters that would be required for full-scale implementation. Finally, a full-scale system is designed using the data collected during the pilot study.

The PRBs are currently constructed in two basic configurations, funnel-and-gate and continuous PRB:

Funnel and Gate

The funnel-and-gate PRB utilizes impermeable or low hydraulic conductivity (e.g., 10^{-6} cm/s) walls as a “funnel” to direct the contaminant plume to a “gate” containing the reactive media; i.e., the funnel-and-gate method is a combination of the Containment and In-Situ Treatment GRAs. The type of cutoff walls that are most likely to be used in the current practice are slurry walls or sheet piles. Innovative methods such as deep soil mixing and jet grouting are also being considered for funnel walls.

Continuous PRB

The continuous PRB completely transects the plume flow path with reactive media. Due to the funnels, the funnel-and-gate design has a greater effect on altering groundwater flow directions than does the continuous PRB. Both designs require the reactive media zone to have a permeability that is equal to or greater than the permeability of the natural aquifer material to enhance the movement of groundwater flow towards the PRB and avoid diversion of groundwater flow around or beneath the reactive zone. These continuous walls can be anchored ("keyed") into a low-permeability natural base such as clay or competent bedrock to limit the potential for flow under the wall or hung from the surface. It should be noted that "keying" is not mandatory because, in some cases, it may be possible to design a system for groundwater to flow around rather below the barrier. The appropriate configuration is usually based on site characteristics, prevention of groundwater from escaping below or around the reactive wall, and providing the optimal residence time (contact time) for reducing the contaminant concentrations to cleanup levels.

Several types of reactive barriers are being investigated for applicability to remediation by abiotic degradation of organic compounds (USEPA, 1998a). Applications under investigation include zero-valent iron, limestone, and bone char phosphate PRBs. Of these, only the Zero-valent Iron PRBs will be considered in this FS due to their field-level development and demonstration. Barriers such as organic mulch walls (e.g., mulch from X-mas trees), and HRC® and ORC® walls that enhance in-situ biodegradation have been discussed in Section 5.5.2 of this FS and retained for potential implementation at the Site.

Zero-Valent Iron PRBs

Most full-scale PRBs utilize iron metal granules or other iron bearing minerals (zero-valent iron) as the reactive media for treatment of groundwater plumes of chlorinated hydrocarbons such as TCE, DCE, and VC, and chromate (hexavalent chromium). The oxidation of the zero-valent iron by water provides a source of electrons for reductive dehalogenation of the chlorinated organic compounds. The simultaneous oxidation of iron and degradation of the chlorinated organic compounds proceeds spontaneously without the addition of catalysts or a source of energy. The products of this reaction are chloride and non-toxic hydrocarbons. The iron granules are dissolved by the process, but the metal disappears so slowly that the remediation barriers can be expected to remain effective for many years, possibly even decades.

Several studies have evaluated the potential use of zero-valent metals to degrade halogenated organic compounds dissolved in water. The in-situ chemical treatment wall using iron was initially developed at the University of Waterloo in 1992. EnviroMetal Technologies, Inc., subsequently commercialized this treatment method, which is now referred to as EnviroMetal Process. The USEPA reported 13 full-scale in-situ remediation projects between 1994 and 1998 (USEPA, 1998). As of 2001, 32 pilot-scale and 28 full-scale systems have been implemented at a number of sites in the United States (E&E, 2001), with more to follow in subsequent years. Pilot-scale studies indicated treatment efficiencies over 95% for VOCs.

Other Types of PRBs

Research is currently being conducted on the use of different types of reactive media/PRB designs to treat other contaminants, such as fuel hydrocarbons (e.g., BTEX, other aromatic VOCs) and other inorganics, but no full-scale PRBs exist for fuel hydrocarbons and limited applications for inorganics treatment have been reported.

Oxygen Release Compound® (ORC®) and Hydrogen Release Compound® (HRC®) Barriers

Yet another type of reactive walls are ORC® and HRC® injections at pre-designed intervals aligned in a line or other configurations in the saturated zone for aerobic and anaerobic biodegradation of passing plumes, respectively, as appropriate for the nature of the plume. The ORC® and HRC® injections slowly release the electron acceptors or donors, as appropriate, into the contaminated plumes wherein they will dissolve and travel with the plumes while accomplishing remediation. Systems based on this type of technology will be considered in this FS.

Advantages and Other Considerations

The process configurations and treatment train considerations for the PRBs follow:

- Removable media cassettes may be used for sites where the media must be replaced or varied during the treatment period.

- The presence of large rocks and cobble in the underlying soil matrix may increase costs or prohibit the use of techniques such as sheet piling.

- Monitoring wells should be installed upgradient and downgradient of the wall to determine effectiveness.

Limitations

The limitations of PRBs include the following:

- PRBs have the potential of treating a wide range of contaminants due to the variety of treatment media available. However, selection of materials must take into consideration the potential by-products that may introduce new contaminants into the subsurface.

- PRBs may lose their reactive capacity, requiring replacement of the reactive medium.

- PRB permeability may decrease due to chemical precipitation of metal salts or biological activity.

- They are limited to a subsurface lithology that has a continuous aquitard at a depth that is within the vertical limits of trenching equipment.

- Location of walls may be limited by factors such as: property boundaries, subsurface obstructions (utilities, boulders, etc.), surface obstructions (buildings, landscape features, etc.). Any combination of these factors may require that the wall is installed within the contaminated area.

Initial Screening for Technical Implementability:

In-situ reactive walls have been shown to be most technical- and cost-effective up to depths of 45 feet. At the Site, the chlorinated plumes generally occur at depths of 30-40 feet below ground surface. Also, depth to bedrock in the vicinity of Nosedocks/Apron 2 ranged from 24 feet bgs near Six Mile Creek to 66 feet bgs near Building 786 (FPM, April 2004). Numerous full-scale in-situ remediation projects have been implemented in the United States for the remediation of chlorinated organic compounds. Hence, it would be appropriate to consider this process option, and is therefore retained for remediation of the chlorinated plumes at the Site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

PRBs could potentially be applied at the Site for in-situ treatment of the Chlorinated VOCs plumes, with this technology's effectiveness confirmed by site-specific pilot tests to be conducted at the Site, which will also be used to collect design data. Also, iron metal would not likely lower, and could potentially increase, the concentrations of dissolved iron and manganese [up to 363 milligrams per liter (mg/L) of iron and 5.8 mg/L of manganese were detected in Site groundwater].

ORC® and HRC® injection systems have been demonstrated to be effective in achieving aerobic and anaerobic remediation, respectively.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that it would be appropriate to consider this process option for remediation of the chlorinated plumes at the Griffiss AFB Aprons site, and for remediation by ORC® and HRC® injections for remediation of aerobically and anaerobically degradable plumes, respectively.

Administrative Implementability: Since this is an in-situ process, negligible residual waste will be generated. The PRBs (as well as ORC® and HRC®) may have to be installed to a depth of 40± feet, which is within the normal working range of excavation (e.g., biopolymer trenching) and injection (e.g., hydrofracturing) methods of construction. Provided the RAOs can be met, regulatory objections for a remediation system utilizing the PRBs (as well as ORC® and HRC®) are not anticipated at this time, due to the innovative and in-situ nature of this application.

<u>Relative Cost</u>:

For PRBs, complete cost data are still not available because most sites have been demonstration scale and may have been over-designed for a safety margin. Costs are decreasing as the price of reactive iron media declines (FRTR, 2004). However, it should be noted that cost per unit of contaminant removed is also a function of the concentrations in groundwater. In general, the capital cost for a PRB system is high, and O&M costs are low to moderate depending on future fouling of the reactive media and aquifer material by inorganics precipitation/biomass. The capital costs for ORC® and HRC® systems are also typically high, with O&M costs being low to moderate (if re-injections are needed due to fouling of the reactive media).

<u>Conclusion</u>:

The zero-valent iron PRBs could potentially be applied at the Site for in-situ treatment of the Chlorinated VOCs plumes due to the potential technical and administrative implementability as well as due to the potential effectiveness of this option. Reliable cost data is unavailable at this time, although capital costs are likely to be relatively high and O&M costs are likely to be low to moderate. As was noted earlier, cost plays a limited role in the screening process. Therefore, based on the above evaluations, this process option (Zero-valent Iron PRBs) is retained for further consideration in remedial alternatives development for the areas of the chlorinated plumes at the Site that are not likely to be adversely impacted by other remedial activities for the petroleum plumes (Figure 5-1). Also, the ORC® and HRC® injection systems are retained for further consideration in remedial alternatives development for aerobically and anaerobically biodegradable plumes, respectively.

5.5.8 In-Situ Nano-Scale Bimetallic Particles Treatment

In-Situ Nano-Scale Bimetallic Particle (BMP) treatment is an innovative developing process that is based on the same chemical principles as the zero-valent reactive iron barriers. The In-Situ Nano-Scale Bimetallic Particles Treatment process option is grouped under the Physical/Chemical Treatment technology category of the In-Situ Treatment GRA (Figure 5-1).

<u>Description:</u>

Bimetallic systems (metal couples) prepared by plating a second metal onto a zero-valent iron surface, including iron/copper, iron/nickel, and iron/palladium, have been shown to accelerate solvent degradation rates relative to untreated iron metal. Palladized iron has been shown to be effective in dechlorinating halogenated aromatic compounds such as polychlorinated biphenyls (PCBs) in addition to chlorinated aliphatic compounds such as TCE, DCE, and VC. The rate enhancement observed in bimetallic systems may be attributed to corrosion-inducing effects promoted by the second, higher reduction potential metal and possibly some catalytic effects.

To implement this process, iron is doped with some deposits of palladium (or other) catalyst to increase reaction rates and introduced into the aquifer as nano-scale subcolloidal-size particles rather than placed as a monolithic wall in an excavated trench. This reduces cost by requiring less iron (BMP has much greater specific-surface area for promoting the reduction reaction) and obviating the need for trench construction. However, it requires the injection of the BMP into the aquifer, which in turn would require that all of the aquifer is effectively accessible through an injection program. An injection program would require that the injected BMP would travel from the injection spot to have a sufficient radius of influence, but also ideally would eventually adsorb to the aquifer matrix to provide a resident dechlorination power within the aquifer matrix itself. The plumes considered in this FS are all situated in relatively slow-moving groundwater [approximately 106 ft/year (FPM, April 2004)] that would minimize the effect of continued BMP migration following injection.

Initial Screening for Technical Implementability:

The In-Situ Nano-Scale BMP treatment is an innovative process that is still in the developmental state. Some published results have found the enhanced reactivity of these systems to diminish relatively quickly, whereas others have found no apparent loss of reactivity. These differences may be related to groundwater chemistry or the method used for plating the iron, but further investigation is needed (USEPA, 1998). However, it is important to note that zero-valent iron systems have not shown similar losses in reactivity in long-term laboratory, pilot, and field investigations. Intensive research of this technology is ongoing and pilot studies indicate potential for success in remediating chlorinated groundwater contamination. For example, a pilot test that was conducted using this technology in February-March 2002 at the Naval Air Engineering Station Site (Area I) in Lakehurst, New Jersey, where the estimated groundwater velocities are approximately twice those at the Site, reported injections to 65' depth resulting in 67-87% reduction in concentrations of PCE, TCE, and cis-1,2-DCE and higher reductions in specific wells (FRTR, 2004). Thus, while the technology is still undergoing rapid development, the basic principles of the technology for remediating chlorinated groundwater plumes are understood and its technically implementability is demonstrated. Hence, the innovative In-Situ BMP treatment process is retained for potential implementation for remediation of the Chlorinated groundwater plumes at the Site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

The In-Situ BMP treatment process could potentially be applied at the Site for in-situ treatment of the Chlorinated VOCs plumes, with this technology's effectiveness confirmed by site-specific pilot tests to be conducted at the Site, which will also be used to collect design data.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that it would be appropriate to consider this process option for remediation of the chlorinated plumes at the Site.

Administrative Implementability: Since this is an innovative process, regulatory and/or community acceptance would require demonstrating the effectiveness, safety, and potential success at remediating the site versus other options, and through presentation of supporting data, including examples of success stories from elsewhere. Care must be taken during system design and verified during treatability or bench-scale studies to preclude adverse outcomes such as unintended reactions.

Relative Cost:

Complete cost data are still not available because most sites have been pilot study/demonstration scale and may have been over-designed for a safety margin. In general, costs will decrease as the technology gains more implementation. It is anticipated that the overall costs of this system may be low to moderate if the technology's application is limited to hot-spot areas; and that the costs may be moderate to high if applied more widely, depending on the radius of influence of the injection, the materials longevity, and other site-specific factors.

Conclusion:

The In-Situ BMP treatment process could potentially be applied at the Site for in-situ treatment of the Chlorinated VOCs plumes due to the potential technical and administrative implementability as well as due to the potential effectiveness of this option. Reliable cost data is unavailable at this time, although costs are likely to be relatively low to moderate if the technology is applied to localized hot-spot areas, and relatively moderate to high if applied more widely. As was noted earlier, cost plays a limited role in the screening process. Therefore, based on the above evaluations, this process option (In-Situ BMP) is retained for further consideration in remedial alternatives development for the areas of the chlorinated plumes at the Site that are not likely to be adversely impacted by other remedial activities for the petroleum plumes (Figure 5-1).

5.5.9 In-Situ Chemical Oxidation

In-Situ Chemical Oxidation (ISCO) is a process by which strong oxidizing agents are introduced to the contaminated media so that contaminants are either completely oxidized into CO_2 and water, or converted to nontoxic compounds commonly found in nature that are more stable, less mobile, and/or inert. Chemical oxidants that have been shown to effectively oxidize organic compounds include hydrogen peroxide (H_2O_2), potassium permanganate ($KMnO_4$), and ozone. Typically these oxidizing agents are injected into the ground through a series of injection wells that cover the plume area. The chemical oxidation reactions are highly exothermic; hence, this process option has the additional benefit of aiding in the potential thermal stripping of volatile contaminants, particularly when they are present as phase-separated products.

Remediation by ISCO is an emerging technology; however, it is gaining increased acceptance as the number of successful full-scale deployments is increasing with improving techniques. Examples of potential contaminants that are amenable to treatment by ISCO include benzene, toluene, ethylbenzene, and xylene (BTEX), PCE, trichloroethylene (TCE), dichloroethylenes (cis- and trans-DCE), VC, methyl-tert-butyl-ether (MTBE), polyaromatic hydrocarbons(PAH) compounds, and many other organic contaminants.

Remediation by ISCO does not generate large volumes of waste material that must be disposed of and/or treated. It is also implemented over a much shorter time frame compared to conventional technologies.

These oxidants have been able to cause the rapid and complete chemical destruction of many toxic organic chemicals; other organics are amenable to partial degradation as an aid to subsequent bioremediation. In general, the oxidants have been capable of achieving high treatment efficiencies (e.g., > 90 percent) for unsaturated aliphatic (e.g., TCE) and aromatic (e.g., benzene) compounds, with very fast reaction rates (90 percent destruction in minutes). Field applications have clearly affirmed that matching the oxidant and in-situ delivery system to the COCs and the site conditions is the key to successful implementation and achieving performance goals (FRTR, 2004).

The Chemical Oxidation process option is grouped under the Physical/Chemical Treatment technology category of the In-Situ Treatment GRA (Figure 5-1).

<u>Description:</u>

In-situ oxidation technologies have recently gained more attention as a feasible alternative to remediate sites contaminated with chlorinated and non-chlorinated organic compounds. One of the primary concerns and key to successful implementation of in-situ oxidation technologies is delivering the aqueous chemical oxidants to the contaminated region. This is especially important with hydrogen peroxide (H_2O_2) because it is relatively unstable in the environment. Field demonstrations of in-situ oxidation technologies have shown treatment efficiencies for VOCs ranging between 70 and 99%. Several commercial in-situ oxidation technologies have been successfully field tested in recent years.

The peroxide, permanganate, and ozone oxidants are discussed individually below:

<u>Peroxide</u>

The use of iron-catalyzed hydrogen peroxide [H_2O_2 with soluble iron (Fe^{2+})] to oxidize organic compounds is based on Fenton's chemistry, where H_2O_2 is decomposed by Fe^{2+} to form hydroxyl radicals. The hydroxyl radicals act as strong oxidants capable of attacking the carbon-hydrogen bond and converting complex organic compounds into carbon dioxide and water. Generally, a low pH environment (2 to 4 pH) is needed to promote the generation of hydroxyl radicals, although some vendors have reportedly developed ways to apply this technology at pHs closer to neutral; these reactions become ineffective under moderate to strongly alkaline conditions. The reactions are extremely rapid and follow second-order kinetics. Using H_2O_2 has two main advantages: no organic by-products are formed during the oxidation process, and iron and hydrogen peroxide are available abundantly at low cost. A major concern with using H_2O_2 is handling large quantities of chemicals and introducing acidic solutions into the environment. In addition, special measures may be required during injection of H_2O_2 into the ground because it can readily break down into water vapor and O_2.

Permanganate

Although permanganate is typically provided as liquid or solid potassium permanganate (KMnO4), it is also available in sodium, calcium, or magnesium salts. The discussion below will be based on application of potassium permanganate.

Potassium permanganate is an effective oxidizing agent for organic contaminants. Reaction of $KMnO_4$ with organic compounds produces manganese dioxide (MnO_2) and CO_2 or an intermediate organic compound; the reaction stoichiometry is complex due to the multiple valence states and mineral forms of manganese. Since MnO_2 is naturally present in soils, the introduction of permanganate to the environment is generally not a concern. However, the production of MnO_2 particles may result in reduction of permeability.

Permanganate reactions proceed at a somewhat slower rate than the peroxide and ozone reactions, following second order kinetics. Depending on pH, the reaction can include destruction by direct electron transfer or free radical advanced oxidation. Permanganate reactions are effective over a pH range of 3.5 to 12.

Ozone addition

Ozone, like $KMnO_4$ and $H_2O_{2,}$ is also an effective oxidant for organic contaminants. Ozone gas can oxidize contaminants directly or through the formation of hydroxyl radicals. Like peroxide, ozone reactions are most effective in systems with acidic pH. The oxidation reaction proceeds with extremely fast, pseudo first order kinetics. Due to ozone's high reactivity and instability (half-life of 20 minutes), O_3 is produced on site on a real-time basis; however, one advantage of generating it on site in real-time is that it eases transportation and storage problems. Ozonation requires closely spaced delivery points (e.g., air sparging wells). In-situ decomposition of the ozone can lead to beneficial oxygenation and biostimulation (for aerobic biodegradation).

Additional Factors to Consider and Limitations

- The rate and extent of degradation of a target compound of concern are dependent on the properties of the chemical itself and its susceptibility to oxidative degradation as well as the matrix (medium) conditions, particularly pH, temperature, the concentration of oxidant, and the concentration of other oxidant-consuming substances such as natural organic matter, reduced minerals, and carbonate and other free radical scavengers. Oxidation is dependent on achieving adequate contact between oxidants and contaminants. Furthermore, since chemical oxidation reactions occur rapidly and react indiscriminately with other reduced non-target substances, the method of delivery and distribution throughout a subsurface region is of paramount importance. Failure to account for subsurface heterogeneities or preferential flow paths can result in extensive pockets of untreated contaminants. Oxidant delivery systems often employ vertical or horizontal injection wells and sparge points with forced advection to rapidly move the oxidant into the subsurface.

- Compared to the other two oxidants (peroxide and ozone), permanganate is relatively more stable and relatively more persistent in the subsurface; as a result, it can migrate by diffusive processes.

- Consideration also must be given to the effects of oxidation on the system. All three oxidation reactions can decrease the pH if the system is not buffered effectively. Other potential oxidation-induced effects include: colloid genesis leading to reduced permeability; mobilization of redox-sensitive and exchangeable sorbed metals; possible formation of toxic by-products; evolution of heat and gas; and biological perturbation. The last factor (biological perturbation) may prove to be particularly troublesome in situations where natural biodegradation (e.g., reductive dehalogenation) is occurring at the site, since the natural degradation processes may be destroyed. However, in the context of thermal remedial technologies (not the current chemical oxidations technologies), studies have shown that microbial populations that were destroyed by thermal processes during remediation were naturally re-established within 8 months of ceasing the thermal treatment (GWRTAC, 2003).

- Each oxidant chemical is effective for different contaminants, and the success of ISCO technology at a site depends on appropriately matching the oxidant and delivery system to the site contaminants and site conditions. For example, permanganate is not effective against BTEX compounds, whereas peroxide and ozone are effective (ITRC, 2001).

- In general, implementation of an in-situ oxidation proceeds in three phases: laboratory bench-scale study, on-site pilot program, and full-scale treatment. The bench-scale study determines the effectiveness of oxidation on the site's contaminants and the optimum treatment quantity. Upon successful completion of the lab study, an on-site pilot scale study is conducted, for which a series of well points are installed in a representative area of the plume (typically the highest area of contamination) to further evaluate the treatment potential of the site's contaminants. Specific system monitoring and sampling procedures are performed during the two to three month long pilot program to evaluate reaction efficiency and environmental response. If the pilot program is successful, full-scale treatment is performed using procedures similar to the pilot program, and a chemical delivery system is designed to cover the plume area.

- The applied reagents could be consumed by natural organic matter or dissolved metals such as iron and manganese that are naturally present in site soils (rather than the contaminants), thereby compromising the remediation effectiveness which may reduce the permeability of the medium, besides resulting in additional chemical usage.

- Site-specific treatability tests are required to determine the optimum type and dosage of oxidation chemicals and delivery mechanisms.

- Large quantities of hazardous oxidizing chemicals will have to be handled due to the oxidant demand of the target organic chemicals and the unproductive oxidant consumption of the formation.

Initial Screening for Technical Implementability:

The ISCO technology is an innovative process that is gaining acceptance with increasing number of full-scale deployments over time. At the Site, there is demonstrable evidence of natural degradation of the chlorinated and other plumes. Implementation of the ISCO may compromise these natural degradation processes. However, the ISCO technology has the potential for achieving rapid cleanup with a high degree of destruction when properly designed and administered. Since the reactions are rapid and the oxidants are dissipated quickly, potential also exists for application of this process for portions of the site such as high concentration areas without adversely impacting farther areas which are targeted for natural attenuation or other remediation processes. Therefore, this process option is retained for further consideration for remediating groundwater at the site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

The ISCO is a potentially highly effective process for remediating site groundwater contamination. Effectiveness of ISCO depends most critically on the effectiveness of, and ability to control, the ISCO reaction with the contaminants, and the effective delivery of the reagents to the zone to be treated. It affords a high degree of protection. Bench-scale treatability study and/or pilot testing would probably be required to confirm its feasibility for the site and to determine the optimum design parameters.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration for groundwater treatment at the Site.

Administrative Implementability: Since this is an innovative process involving injection of chemicals into groundwater, regulatory and/or community acceptance would require demonstrating the effectiveness, safety, and potential success at remediating the site versus other options, and through presentation of supporting data, including examples of success stories from elsewhere. Care must be taken during system design and verified during treatability or bench-scale studies to preclude adverse outcomes such as unintended reactions.

Relative Cost:

Important advantages of ISCO include its relatively low cost and speed of reaction.

Conclusion:

In-Situ Chemical Oxidation is a potentially viable and effective technology for implementation at the site, pending confirmation through bench scale and/or treatability studies. It affords a high degree of protection, and permanently destroys organic contaminants at the site at relatively moderate cost. Therefore, this process is retained for further consideration in remedial alternatives development for in-situ remediation of groundwater at the Site (Figure 5-1).

5.5.10 Sedimentation/Clarification

Sedimentation or clarification (which are synonymous terms) is a process that utilizes the phenomenon of gravitational settling to remove settleable suspended particles from water under quiescent hydraulic conditions, typically in a circular or rectangular tank. The sedimentation/ clarification process can be used alone or in conjunction with precipitation. The sedimentation/ clarification process option is grouped under the Physical/ Chemical Treatment technology category of the Ex-Situ Treatment GRA (Figure 5-1).

Description:

Sedimentation/clarification is one of the earliest unit operations in an ex-situ water treatment train, and is used for settling of naturally occurring entrained settleable particles (e.g., sand, grit, biological floc, humus, etc.), as well as any settleable particles generated from chemical precipitation/coagulation/flocculation processes, prior to filtration. There are primarily four types of settling. Type I or “free settling” is the settling of nonflocculent, discrete particles, in which particles settle independently of each other by accelerating until the impelling force equals the drag force and then maintaining a constant settling velocity thereafter. Type II or “floc settling” is the settling of flocculent particles, in which particles flocculate during settling thereby increasing in size and settling at increasing velocities. Type III or “zone or hindered settling” is the settling of all particles at constant velocity as a zone because the particles are so close together as to hinder independent settling. Type IV or “compression settling” is the settling of particles of high concentration and normally follows Type III settling when the zone settled particles in the lower depths are compressed under the gravitational weight of the zone settled particles above them.

The sedimentation tanks typically have a sloping bottom to collect the settled solids and an overflow weir for the supernatant (clear) liquid. The particles reaching the bottom are generally removed as an underflow, with their movement assisted by a series of slowly moving paddles, rakes, or arms. The type of settling is taken into consideration in designing these systems. The settled solids are periodically removed as sludge and typically undergo further processing (dewatering) to remove water and increase the solids content percentage.

Limitations

The limitations of sedimentation/clarification include the following:

- These processes are not effective for removal of dissolved contaminants and, acting alone, they are not effective for attainment of groundwater RAOs.
- Additional handling of the solids is necessary, but is readily accomplished.
- The collected solids (sludge) will require disposal and their costs will depend on whether the material is considered hazardous or non-hazardous; if found hazardous, the sludge may require appropriate treatment and disposal at an offsite RCRA-permitted facility.

Initial Screening for Technical Implementability:

Sedimentation/ clarification is a well-established, reliable process that is readily implemented for the treatment of groundwater because the design data, materials, equipment, and skills needed for design and conventional installation and operation are available through many vendors. In this FS ex-situ technologies are not considered as primary remedial options because of the large sizes of the plumes and estimated inordinately long cleanup times. Nevertheless, during implementation of in-situ treatment technologies such as bioslurping (for free-product plumes), air sparging, and SVE, contaminated groundwater may be collected above ground, requiring its on-site treatment and/or proper disposal. Therefore, this process option is retained for further consideration to serve as part of groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

Pretreatment by sedimentation/ clarification is a well-established, reliable process that is routinely used in water treatment. While sedimentation/clarification may not significantly remove all of the suspended particles present in the groundwater by itself, it can be very effective in removing settleable particles when used in conjunction with chemical precipitation. Organic contaminants will not be affected by this process, except for those that are bound to suspended particles naturally due to adsorption or other reasons, or as the result of a preceding precipitation step.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration to serve as part of groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations at the Griffiss AFB Aprons site.

Administrative Implementability: Since this is a well-established process, a broad range of systems is readily available from numerous vendors. Regulatory objections for a remediation system utilizing the sedimentation/clarification process are not anticipated if an ex-situ treatment of residual groundwater generated during in-situ treatment operations is proposed for the site.

Relative Cost:

The capital and O&M costs for sedimentation/clarification are considered to be moderate, excluding costs associated with sludge processing and disposal.

Conclusion:

Sedimentation/ clarification is an effective, readily implemented process for removing settle-able suspended solids, including precipitated organics and metals, from Site groundwater. Therefore, this process is retained for further consideration in remedial alternatives development to serve as part of a groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations at the Site (Figure 5-1).

5.5.11 Physical/Thermal Separation

Separation processes concentrate contaminated wastewater through physical and chemical means. Separation processes seek to detach contaminants from their medium (i.e., groundwater and/or binding material that contain them). Ex-situ Physical/Thermal Separation of waste stream can be performed by many processes, of which the following are considered for potential application in this FS: (1) distillation, (2) filtration/ultrafiltration/microfiltration, (3) freeze crystallization, (4) membrane pervaporation, and (5) reverse osmosis. These processes are evaluated and screened individually below. The Physical/Thermal Separation process option is grouped under the Physical/Chemical Thermal Treatment technology category of the Ex-Situ Treatment GRA (Figure 5-1).

In this FS ex-situ technologies are not considered as primary remedial options because of the large sizes of the plumes and estimated inordinately long cleanup times. Nevertheless, during implementation of in-situ treatment technologies such as bioslurping (for free-product plumes), air sparging, and SVE, contaminated groundwater may be collected above ground, requiring its on-site treatment and/or proper disposal. Therefore, this process option is considered to potentially serve as part of groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations (Figure 5-1).

5.5.11.1 Distillation

Description:

Distillation is a chemical separations process involving vaporization and condensation that is used to separate components of varying vapor pressures (volatilities) in a liquid or gas stream. Simple distillation involves a single stage operation in which heat is applied to a liquid mixture in a still, causing a portion of the liquid to vaporize. These vapors are subsequently cooled and condensed producing a liquid product called distillate or overhead product. The distillate is enriched with the higher volatility components. Conversely, the mixture remaining in the still is enriched with the less volatile components. This mixture is called the bottoms product. Multiple staging is utilized in most commercial distillation operations to obtain better separation of organic components than is possible in a single evaporation and condensation stage.

Initial Screening for Technical Implementability:

Distillation is an established separation process that can yield consistent and reliable results when utilized for separating volatile components from a less volatile solvent or sludge, or for fractionating components of varying volatilities (e.g., petroleum distillates). However, although the Griffiss AFB chlorinated plumes contain volatile organics, the contaminants are dissolved in the plumes at extremely low concentrations from a distillation perspective. Separation of such solutions by distillation is technically infeasible considering the degree of difficulty associated with attaining cleanup levels by this method (as well as the high energy requirements of such systems); any organic vapors that are generated prior to condensation will be overwhelmingly masked by solvent (i.e., water) vapors, rendering impractical the application of the distillation process to remediation of the groundwater chlorinated plumes at the site. The prospects for application of the distillation process are somewhat greater for the residuals in the extracted groundwater after free product is removed from the free product plumes; however, the solvent (i.e., water) volume will be large compared to contaminant volume even in this situation, due to which there will be a high degree of difficulty associated with constructing and operating a system based on this process for remediation of the residual free product plume. Hence, the distillation process is eliminated from further consideration in this FS because it cannot be implemented technically at the Site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

The distillation process has already been eliminated from further consideration in this FS during the Initial Screening phase above.

5.5.11.2 Filtration/ Ultrafiltration/ Microfiltration

Description:

Filtration is a solid-liquid physical separation process whereby suspended and colloidal particles that are not readily settleable are mechanically separated from the liquid (water) based on particle size by passing the fluid through a porous medium. As the fluid passes through the medium, either by gravity or due to induced pressure, the suspended particles are trapped on the surface of the medium and/or within the body of the medium. Filtration is typically used in groundwater treatment applications to remove contaminants which are bound to particles in suspension or that have precipitated in a previous treatment step, such as metals.

Single-media, dual-media, and multimedia filters are typically used in water treatment to filter untreated secondary effluents, or chemically treated secondary effluents and raw wastewaters. Single-media filters have one type of medium, typically sand or crushed anthracite coal. Dual-media filters have two types of media, typically layers of sand and crushed anthracite coal. Multimedia filters have three or more types of media, typically layers of gravel, garnet, sand, and crushed anthracite coal. Other types of filters include vacuum filters, plate and frame filters (pressure filters or filter presses), and belt filters (belt presses), which are often used to dewater sludges produced by processes like sedimentation and chemical precipitation. Packed beds of granular material are usually backwashed to remove the filter cake.

Ultrafiltration/microfiltration are processes by which particles are mechanically separated by forcing fluid through a semipermeable membrane. Only the particles whose sizes are smaller than the openings of the membrane are allowed to flow through.

Media filter systems can achieve particle separation in the micron range, down to as low one-micron level (micron range at the low limit to particle range). Ultrafiltration processes can achieve a filtration size range of approximately 0.003-10 micron (upper end of ionic size range at the lower limit to macromolecular range in the middle to micron range at the upper limit). Microfiltration processes can achieve a filtration size range of approximately 0.04-20 micron (macromolecular range at the lower limit to micron range in the middle to lower particle range at the upper limit).

Limitations

The limitations of filtration/ultrafiltration/microfiltration include the following:

- These processes are not effective for removal of dissolved contaminants and, acting alone, they are not effective for attainment of groundwater RAOs.

- Additional handling of the solids is necessary, but is readily accomplished.

- The collected solids will require disposal and their costs will depend on whether the material is considered hazardous or non-hazardous.

- Treatability and/or pilot testing is recommended to confirm effectiveness and obtain design information.

Initial Screening for Technical Implementability:

Filtration is a well-established, reliable process that is readily implemented for the treatment of groundwater because the design data, materials, equipment, and skills needed for design and conventional installation and operation are available through many vendors. Therefore, this process option is retained for further consideration to serve as part of groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

Pretreatment by filtration is a well-established, reliable process that is routinely used in water treatment. It is an effective method to remove contaminants which are suspended in extracted groundwater, specifically metals and organic compounds which are bound to suspended particles, either naturally or as the result of a preceding precipitation step. The granular media filters and the other types of filters described above are typically used as part of a treatment process train. They contribute to reducing the mobility and volume of hazardous substances and providing a significant degree of protection.

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that this process option would be retained for further consideration to serve as part of groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations at the Site.

Administrative Implementability: Since this is a well-established process, a broad range of systems is readily available from numerous vendors. Regulatory objections for a remediation system utilizing the filtration processes are not anticipated if an ex-situ treatment of residual groundwater generated during in-situ treatment operations is proposed for the site.

Relative Cost:

The capital costs for filtration range from low (e.g., bag filters) to high (e.g., ultrafiltration); however, costs for filtration are generally low relative to other separation processes. The Operation and Maintenance (O&M) costs are considered to be moderate compared to other ex-situ groundwater treatment process options.

Conclusion:

The filtration/ ultrafiltration/ microfiltration processes are effective, readily implemented methods to remove suspended solids, including precipitated organics and metals, from Site groundwater. Therefore, they are retained for further consideration in remedial alternatives development to serve as part of a groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations at the Site (Figure 5-1).

5.5.11.3 Freeze Crystallization

Description:

Freeze crystallization processes remove purified solvent from solution as frozen crystals. When a solution containing dissolved contaminants is slowly frozen, water ice crystals form on the surface, and the contaminants are concentrated in the remaining solution (called "mother liquor"). The ice crystals can be separated from the mother liquor, washed and melted to yield a nearly pure water stream. The contaminated waste stream, mother liquor, and any precipitated solids, are generally more amenable to subsequent treatment by conventional destruction and stabilization technologies due to the higher concentrations.

Initial Screening for Technical Implementability:

Freeze crystallization processes may have potential for implementation for remediation of small-scale sites. However, all of the groundwater contamination plumes at the Griffiss AFB Aprons site together occupy a large area of up to 2,900,000 square feet and, assuming an average plume thickness of 20 feet and porosity of 25%, contain a volume of approximately 110 million gallons. Remediation of such large systems, or even of systems that are a fraction of their size (i.e., the individual plumes or residual/entrained contaminated water from in-situ treatment systems), utilizing the freeze crystallization process is technically infeasible considering the physical size and energy requirements of the treatment systems that would be needed. Hence, the freeze crystallization process is eliminated from further consideration in this FS because it cannot be implemented technically at the Site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

The freeze crystallization process has already been eliminated from further consideration in this FS during the Initial Screening phase above.

5.5.11.4 Membrane Pervaporation

Description:

Membrane pervaporation is an innovative process that uses permeable membranes that preferentially adsorb VOCs from contaminated water. After passing through a pre-filter to remove debris and silt particles, contaminated water then passes through a heat exchanger that raises the water temperature. The heated water then enters the pervaporation module, containing membranes composed of a nonporous organophilic polymer, similar to silicone rubber, formed into capillary fibers. The membrane is permeable to organic compounds but highly resistant to degradation. The composition of the membrane causes organics in solution to adsorb to it; the VOCs and small amounts of water then diffuse by vacuum from the membrane-water interface through the membrane wall and condense into a highly concentrated liquid called "permeate." Treated water exits the pervaporation module, while the permeate travels from the module to a condenser where it separates into aqueous and organic phases. The organic phase can either be disposed of or sent offsite for further processing to recover the organics. The aqueous phase is sent back to the pervaporation unit for retreatment, where the remaining VOCs are removed along with those in untreated water. The condensed organic materials represent only a fraction of the initial wastewater volume and may be subsequently disposed of at a cost savings. The treated water is discharged from the system after further treatment.

The pervaporation technology is best suited for reducing high concentrations of VOCs to levels that can be reduced further and more economically by conventional treatment technologies, such as carbon adsorption. The technology is not practical for reducing VOC concentrations to most regulatory limits, notably drinking water standards. VOCs with water solubilities of less than two (2) percent are generally suited for removal by pervaporation. Highly soluble organics, such as alcohols, are not effectively removed by a single-stage pervaporation process. Also, low-boiling VOCs, such as vinyl chloride, tend to remain in the vapor phase after moving through the condenser.

Initial Screening for Technical Implementability:

Membrane pervaporation is an innovative process that is still in the developmental state. Because this process is still in the developmental state, field design data with regard to system sizing, quantities, durations, etc. is largely unavailable; also, the current state of knowledge makes it impractical to make any assessment of the expected operational reliability of such a system. Hence, the innovative membrane pervaporation treatment process is eliminated from further consideration in this FS because it cannot be implemented technically at the Site (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

The membrane pervaporation process has already been eliminated from further consideration in this FS during the Initial Screening phase above.

5.5.11.5 Reverse Osmosis

Description:

When two solutions of different solute concentration levels are separated by a semipermeable membrane that is permeable to the solvent but not to the solute, solvent from the lower solute concentration side will flow through the semipermeable membrane to the higher solute concentration side until the chemical potential of the solvent is equal on both sides of the membrane. This phenomenon is known as "osmosis" from the Greek word for 'push.' Since one side of the semipermeable membrane gains solvent at the expense of the other side, a pressure difference is created, which is called the osmotic pressure. (A simple way to visualize this is to imagine a cell with equal heights of the two solutions on either side of the membrane before onset of osmosis; after osmosis begins and equilibrium is attained, there will be a height difference in the liquids since solvent has moved from one side to the other; this hydraulic head will be the osmotic pressure head).

If a force is now applied to the side that received the solvent to produce a pressure greater than the osmotic pressure, the solvent will flow in the reverse direction; this process of removing solvent from a solution with higher solute concentration is called "reverse osmosis" (RO). Thus, upon application of pressure greater than the osmotic pressure to contaminant plumes [usually 200-800 pounds per square inch (psi)], the water (solvent) will pass through the semipermeable membrane leaving the contaminants behind the membrane. Most reverse osmosis systems are based on the crossflow design principle, which allows the membrane to be continually cleaned; as some of the fluid passes through the membrane the rest flows downstream, sweeping the rejected species away from the membrane.

The RO systems (also known as "hyperfiltration" systems) can achieve a high degree of separation to realize a filtration size range of 0.0005-0.005 micron (ionic size range). Reverse osmosis, ultrafiltration, and microfiltration are similar in that they all utilize semipermeable membranes, and hydrostatic pressures are applied to force the solvent (water) through the membranes. However, in ultrafiltration and microfiltration, the separation is due to mechanical filtration action and not due to reverse osmotic action. Also, finer sized particles are removed by the RO process.

Limitations

Factors that may limit the applicability and effectiveness of the RO process include:

- The presence of oil and grease contaminants may interfere with these processes by decreasing flow rate.

- The membranes are vulnerable to clogging, making these systems expensive.

- The volume of the concentrated waste is generally 10 to 20 percent of the feed volume. This concentrated waste will require additional treatment, which is usually expensive.

- RO has been demonstrated to be effective for treatment of brackish waters, aqueous metal wastes, and radionuclides, and recent findings indicate that it is useful in removing some specific organics from solution, including chlorinated organics. The effectiveness of this process is highly dependent on the chemical composition of the waste solution to be treated and the characteristics of the membrane.

Initial Screening for Technical Implementability:

Reverse osmosis is a well-established process that is readily implemented for the treatment of groundwater because the design data, materials, equipment, and skills needed for design and conventional installation and operation are available through many vendors. High operational reliability may be expected, except for issues related to membrane replacement due to clogging; prior chemical precipitation and pre-filtration (by ultrafiltration or microfiltration) may be needed to minimize clogging, increase operational reliability, and treatment effectiveness. RO systems with capacities as large as 110,000 gallons per day (gpd) are commercially available. Overall, the RO process is potentially technically implementable to serve as part of groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations (Figure 5-1).

Final Screening - Evaluation and Selection of Representative Technology Types and Process Options:

Effectiveness:

The RO process is highly effective for inorganics, ions, and certain radionuclides. It is capable of removing bacteria, salts, sugars, proteins, particles, dyes, and other constituents that have a molecular weight of greater than 150-250 daltons (e.g., molecular weight of water is 18 daltons). The separation of ions with RO is aided by charged particles, i.e., dissolved ions that carry a charge, such as salts, are more likely to be removed by the semipermeable membrane than those that are not charged, such as organics. The larger the charge and the larger the particle, the more likely it will be rejected. Thus, the primary path for dissolved organics removal would be mainly by aggregating the organics through chemical precipitation, coagulation, flocculation, or other means prior to passing through the RO system, which is not as effective a process for removing organics as it is for removing inorganics and other contaminants listed earlier. Pilot-scale treatability studies may be needed to determine the removal efficiencies of the various organic contaminants in the groundwater plumes at the Site. Concentrations in the treated water are generally in the 10-50 ppb range, which may or may not meet RAOs, and thus may need to be supplemented with polishing systems (e.g., activated carbon adsorption).

Implementability:

Technical Implementability: This evaluation criterion has already been addressed earlier under Initial Screening, where it was concluded that the RO process option is potentially technically implementable; thus, it was retained for further consideration for potential application to serve as part of groundwater treatment train for ex-situ treatment of residual groundwater generated during in-situ treatment operations at the Site.

Administrative Implementability: Since this is a well-established process, a broad range of systems is readily available from numerous vendors. Regulatory objections for a remediation system utilizing the RO process are not anticipated if an ex-situ treatment of residual groundwater generated during in-situ treatment operations is proposed for the site.

Relative Cost:

The capital and O&M costs for RO systems are high and increase with increased flow rate. All of the groundwater contamination plumes at the Site together occupy a large area of up to 2,900,000 square feet and, assuming an average plume thickness of 20 feet and porosity of 25%, contain a volume of approximately 110 million gallons. Thus, the RO systems are likely to be very expensive relative to other technology and process options for implementation at the site. However, as was noted earlier, cost plays a limited role in the screening process.

Conclusion:

The RO process is eliminated from further consideration in this FS because it is not very effective for organics removal and does not provide a higher degree of protection than other available alternative processes in spite of higher costs (Figure 5-1).

6 EVALUATION OF ALTERNATIVES

In this section, potential remedial alternatives are developed from the technologies retained during their initial screening process (Section 5.0) for the purpose of achieving the RAOs, which were identified in Section 3.3, to mitigate the potential present and/or future risks associated with the chlorinated hydrocarbon groundwater contamination at the Nosedocks / Apron 2 Chlorinated Plume6 Site. This section identifies the response action alternatives, describes the evaluation process utilized in selecting the best alternative, and evaluates the alternatives. The remedial alternatives development process is discussed in Section 6.1, including discussions on alternative development criteria, consideration of RAOs in alternatives development, and alternatives evaluation criteria and approach. The remedial alternatives (response action alternatives) are described in Section 6.2, and are comparatively evaluated relative to each other for the different evaluation criteria in Section 6.3. The selection of recommended response action is made in Section 6.4. Finally, Section 6.5 briefly summarizes the recommended alternatives and lists the steps required for implementation.

6.1 Remedial Alternatives Development

6.1.1 Alternative Development Criteria

Alternative development criteria must conform to the requirements of CERCLA, as amended by SARA, and to the extent possible, the NCP. The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste [40 CFR 300.430(a)(1)(i)]. To accomplish this goal, as discussed in the EPA document titled "Rules of Thumb for Superfund Remedy Selection" (EPA, 1997), the NCP describes the following six (6) expectations for the development of remedial alternatives, which are derived from the mandates of CERCLA Section 121 and based on previous Superfund experience [40 CFR 300.430(a)(1)(iii)(A-F)]:

1. The expectation to use treatment to address the principal threats posed by a site, wherever practicable;

2. The expectation to use engineering controls, such as containment, for waste that poses a relatively low long-term threat or where treatment is impracticable;

3. The expectation to use a combination of methods, as appropriate, to achieve protection of human health and the environment;

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6 The chlorinated plume at the Site includes relatively distinct TCE, DCE (cis-DCE), and VC plumes (the DCE plume has two distinct plume zones), which slightly overlap to form an elongated overall chlorinated plume. In the discussions in this FS, the term "chlorinated plume" is used when referring to the entire assembly of plumes. For example, the Six Mile Creek is immediately downgradient of both the overall chlorinated plume and the VC plume.

4. The expectation to use ICs, such as water use and deed restrictions, to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants or contaminants;

5. The expectation to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies; and

6. The expectation to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site.

Additionally, the following statutory preferences must be considered when developing and evaluating remedial alternatives:

- Remedial actions that involve treatment that permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances are preferred over remedial actions not involving such treatment;

- Off-site transport and disposal of hazardous substances or contaminated materials without treatment is considered the least favorable remedial alternative when practical treatment technologies are available; and

- Remedial actions using permanent solutions, alternative treatment technologies, or resource recovery technologies shall be assessed.

While the above expectations and considerations may guide the development of appropriate alternatives, the fact that a remedy is consistent with them does not constitute sufficient grounds for selection of that alternative. The selection of an appropriate waste management strategy is determined solely through the remedy selection process outlined in the NCP, i.e., all remedy selection decisions are site-specific and must be based on a comparative analysis of the alternatives using the nine evaluation criteria discussed in Section 1.3 of this FS.

The remedial alternatives were developed in this FS based on the above expectations and considerations and the RAOs developed in Section 3.3. The alternatives range from the No Action alternative to alternatives involving treatment, long-term monitoring (LTM), ICs, innovative technologies, and/or natural attenuation.

Finally, it should be noted that, based on the results of the RI (FPM, 2004), there are no current sources for continuing contamination of the chlorinated plumes. Also, groundwater is generally not considered to be a source material. No non-aqueous phase liquids (NAPLs) are present within the chlorinated plumes, thus eliminating them as potential sources for continuing contamination. It is concluded, therefore, that there are no principal threats posed at the chlorinated plumes Site by source materials, thus obviating the need for any source control measures and rendering the first expectation to use treatment moot with respect to source materials. Principal threat wastes are defined as those source materials that are considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur (EPA, 1991). Thus, the alternatives development and remedy selection process reduces to formulating a remedial strategy for addressing any low level concerns posed by groundwater contaminated with low concentrations of chlorinated organics in minimal quantities across the site for the purpose of meeting the RAOs developed in Section 3.3 and to be discussed further in the following Section 6.1.2.

6.1.2 Consideration of Remedial Action Objectives in Alternative Development

In Section 3.3, the RAOs were developed for the protection of human health and the environment.

With regard to protection of human health, because current and future uses planned for this site are limited to industrial use, the installation of production wells for potable drinking water is not likely due to the ready access to existing water supplies for the base and the City of Rome. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The groundwater use restriction included drinking of groundwater and other uses such as utilizing it for industrial purposes. These institutional control measures ensure that direct risk to human health from the low level chlorinated groundwater contamination at the Site is minimized, if not eliminated. However, the remedial alternatives that are developed in this FS will not be limited to ICs, but will also consider remedial options that would be protective of human health in the event of exposure.

With regard to the environment, the groundwater from the Site discharges into the Six Mile Creek, and the remedial alternatives that will be developed will seek to prevent/ minimize the contaminants present in the groundwater from adversely impacting the creek (surface water body) and, through uptake of that water, by plants, fish, and wildlife.

6.1.3 Alternatives Evaluation Criteria and Approach

This FS follows the basic methodology outlined in the NCP with consideration of the requirements outlined in Section 121 of the SARA. Specifically, the remedial alternatives will be comparatively evaluated with respect to the nine (9) evaluation criteria that were presented and discussed in Section 1.3.

Briefly, the remedial alternatives will be evaluated and ranked according to their effectiveness, implementability, and costs. The factors considered under each of these categories are shown below, which include the nine criteria discussed above and discussed in detail in Section 1.3:

Effectiveness

1. overall protection of human health and the environment
2. compliance with ARARs
3. long-term effectiveness and permanence
4. reduction of toxicity, mobility, or volume through treatment
5. short term effectiveness

Implementability

6. implementability (including technical feasibility, administrative feasibility, and availability of services and materials)

Costs

7. cost (including total investment for each alternative and benefit for each alternative)

State and Community Acceptance

8. state acceptance
9. community acceptance

Among the above, criteria 1 and 2 are considered to be Threshold Criteria [any alternative to be considered in the final evaluation must meet these threshold criteria], criteria 3, 4, 5, 6, and 7 are considered to be Balancing Criteria [potential tradeoffs between the alternatives are identified during the evaluation using these criteria], and criteria 8 and 9 are considered to be Modifying Criteria [sometimes tentatively evaluated as part of the FS and formally evaluated during the ROD process after the alternatives have been presented to the public]. The Modifying Criteria (state and community acceptance) were not evaluated in this FS; instead, they will be formally addressed in the ROD after comments are received on the Proposed Plan.

6.1.3.1 Effectiveness

Effectiveness is a measure of an alternative's ability to protect human health, groundwater, and the environment and meet the criteria of the identified ARARs and TBCs. Each measure (protect human health/groundwater/environment and meet criteria of ARARs and TBCs) is considered for both the long-term and short-term. A concise interpretation of these criteria follows (also discussed in detail in Section 1.3 from a slightly different perspective):

6.1.3.1.1 Overall Protection of Human Health and the Environment

This criterion is a measure of how well the alternative reduces the potential for human exposure to contaminants, contamination of groundwater, and exposure of ecological receptors, in the short-term and long-term. It considers the following:

- The net reduction in the toxicity, mobility, or volume of contaminated groundwater;
- The potential exposure pathway between humans or biota (considering future land use) and contaminated groundwater;
- The estimated quantity (amount and volume) of residual contaminated groundwater; and
- The potential exposure pathway between humans or biota and releases or emissions from the active response alternatives.

6.1.3.1.2 Compliance with ARARs

This criterion is a measure of how well the alternative meets the identified chemical, action, or location-specific ARARs and TBCs (federal, state and local) during the long-term and short-term.

6.1.3.1.3 Long-Term Effectiveness and Permanence

This is a measure of how well the alternative meets the criteria of protecting human health/environment and meets the criteria of the ARARs and TBCs after implementation.

6.1.3.1.4 Reduction of Toxicity, Mobility or Volume through Treatment

The degree to which alternatives employ treatment that reduces toxicity, mobility, or volume are also to be assessed. It considers the following:

- The potential for the proposed treatment processes to achieve remedy;
- The potential for its reversibility;
- The amount of hazardous materials that will be destroyed or treated;
- The degree of expected reduction in toxicity, mobility, or volume;
- The type and quantity of residuals that will remain following treatment; and
- Whether the alternative would satisfy the statutory preference for treatment as a principal element.

6.1.3.1.5 Short-Term Effectiveness

This is a measure of how well the alternative meets the criteria of protecting human health/environment, and meets the criteria of the ARARs and TBCs during implementation.

6.1.3.2 Implementability

Implementability is a measure of whether an alternative can be physically and administratively implemented, such as the ability to construct, install, or operate. It is also a measure of the availability of the services and materials needed to implement the alternative. Although state and community acceptance are listed separately among the alternatives evaluation criteria, they are also given consideration in the context of evaluations for implementability. A concise interpretation of the criteria governing implementability is as follows (also discussed in detail in Section 1.3 from a slightly different perspective):

6.1.3.2.1 Technical Feasibility

This criterion refers to:

- The reliability of the action with regard to implementation;
- The actual ease of field implementation (e.g., excavation, construction action);
- The ease in undertaking future actions related to the initial undertaking; and
- The ability to monitor the effectiveness of the action.

6.1.3.2.2 Administrative Feasibility

This criterion is a measure of the ease with which an alternative can be implemented in terms of permits and rights-of-entry, coordination of services to support the action (e.g., legal services), probability of continual enforcement, or the arrangement and delivery of security services.

6.1.3.2.3 Availability of Services and Materials

This criterion is a measure of the availability of goods and services needed to support implementation of the alternative. Examples of this criterion include the availability of specialized personnel (i.e., qualified environmental engineers, scientists, geologists/ hydrogeologists, technicians, and other professionals, as well as qualified environmental contractors and vendors who can provide competitive bids) and equipment, availability of the suitable storage facility for the contaminated soil (if any), materials, and activity derived waste.

6.1.3.3 Costs

Cost is a measure of the overall investment (dollars) to implement the alternative with consideration of the benefit of that investment to the public and site.

The cost of implementing each of the alternatives has been estimated using RACER (an accepted government estimating program). The exception is No Action, which has no present associated costs. A detailed summary of these costs and assumptions is presented in Appendix F.

The cost of implementing each of the alternatives has been estimated using Remedial Action Cost Engineering and Requirements (RACER). RACER is an environmental remediation/corrective action cost estimating system that has been adopted as the standard cost estimating tool for the U.S. Air Force. The exception is No Action, which has no present associated costs (an administrative cost of $50,000 is assumed in the detailed analysis for No Action). A detailed summary of these costs and assumptions is presented in Appendix F.

6.1.3.4 State and Community Acceptance

6.1.3.4.1 State (Agency) Acceptance

This criterion deals with the acceptance of the alternative by applicable federal, state and local agencies, as expressed by representatives under the agencies' authority. As was stated earlier, the remedial alternatives were not evaluated for this criterion in this FS; instead, it will be formally addressed in the ROD after comments are received on the Proposed Plan.

6.1.3.4.2 Community Acceptance

This criterion relates to the degree of acceptance of the alternative by the Griffiss community, including owners of property adjacent to the base. Public sentiment expressed during town hall meetings, public workshops, city council or county supervisor meetings, or institutional analysis is a means of determining community acceptance. As was stated earlier, the remedial alternatives were not evaluated for this criterion in this FS; instead, it will be formally addressed in the ROD after comments are received on the Proposed Plan.

6.2 Response Action Alternatives

Seven (7) alternatives were selected as potentially viable response actions that should be evaluated so that the preferred alternative can be recommended. These alternatives address the cleanup of contaminated groundwater at the Nosedocks / Apron 2 Chlorinated Plume Site in order to be protective of the human health, groundwater, and the environment. The alternatives are:

- Alternative One – No Action
- Alternative Two – Institutional Controls (ICs) and Long-Term Monitoring (LTM)
- Alternative Three – Monitored Natural Attenuation (MNA), with ICs and LTM
- Alternative Four – Air Sparging (AS) and Soil Vapor Extraction (SVE), with ICs and LTM

- Alternative Five – In-Situ Inactive Enhanced Abiotic Degradation using Permeable Reactive Barriers (PRBs), with ICs and LTM

- Alternative Six – In-Situ Active Chemical Oxidation (ISCO), with ICs and LTM

- Alternative Seven – Six Mile Creek Horizontal Air Sparging (AS) Barrier, with ICs and LTM

It is noted that, with the exception of the No Action alternative (Alternative One), all alternatives include ICs and LTM. However, the duration of the LTM varies between the alternatives.

The above remedial alternatives are described in detail below.

6.2.1 Alternative One – No Action

The Superfund program requires that the "no-action" alternative be considered as a baseline for comparison with the other alternatives. This no-action alternative does not involve any proactive treatment or removal of the groundwater contaminated with chlorinated organics at the Site.

6.2.2 Alternative Two – ICs and LTM

DESCRIPTION:

Under this alternative, ICs in the form of legally enforceable groundwater use restrictions will be implemented together with a LTM program to periodically ensure that the controls remain in place and that they remain protective of human health and the environment. Based on monitoring data collected over several years, the chlorinated groundwater plume has stabilized or shrinking in extent over time and the overall mass of contamination in the chlorinated plume within contours defined by target cleanup concentration levels is reducing over time due to hydrogeologic and natural attenuation processes. The proposed LTM will also verify that the chlorinated plume continues to be stable and that the current trend towards gradual reduction in volume of plume and mass of contaminants within the plume is also continuing over time.

The Air Force Real Property Agency (AFRPA), which is the agency that manages the Base Realignment and Closure (BRAC) bases, requires that all BRAC bases with LUC/ICs maintain a LUC/IC Layering Strategy. The Griffiss AFB has a LUC/IC program based on a Layering Strategy of mutually reinforcing controls, including specific reliance on deed restrictions (industrial use and groundwater use restrictions) for implementation of any LUC/ICs that are included in the RODs, followed by an annual inspection to ensure that LUC/ICs are being implemented.

It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plumes Site by source materials, thus obviating the need for any source control measures and rendering USEPA's first expectation to use treatment moot with respect to source materials.

The current and planned future land use for this Site is limited to industrial activities, and the installation of potable drinking water wells at the Site is not likely due to the ready access to existing water supplies for the base and the City of Rome. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized.

Institutional controls are inappropriate when a valuable natural resource such as a sole-source aquifer would remain unusable for a long period of time. However, because groundwater in the vicinity of the plumes at the Site is not used as a drinking water source, this technology is effective in preventing exposure to groundwater contaminants, and ICs are readily implemented.

Given the anticipated biosparging remedy of the Apron 2 Petroleum plume, which overlaps with the downgradient extent of the vinyl chloride plume (see Figure 2-6), implementation of this technology will not be adversely impacted given the desired aerobic environment.

MONITORING:

Based on the analysis of sampling data for the period February, 2002 – September, 2004, which was used to estimate rate constants for degradation of chlorinated organics, the chlorinated plume is estimated to naturally attenuate in 26 years. Therefore, including an additional four (4) years of monitoring beyond the estimated attenuation period (as assumed for costing purposes only), the LTM will be performed annually for a 30-year period to ensure that the remedy is protective of the human health and the environment. For this alternative, the environmental sampling will be performed as follows:

- **Site Groundwater and Surface Water Monitoring for 30 Years:** Quarterly sampling will be performed during the first year (Year 1) and semi-annual sampling will be performed for the next 29 years (Years 2-30) of the monitoring program at 10 groundwater monitoring wells and at three (3) surface water monitoring locations in the Six Mile Creek. Additionally, quarterly sampling will be performed at one (1) groundwater monitoring well upgradient of the chlorinated plume during the first year (Year 1) to verify that there are no contributions of contamination to the Site groundwater from upgradient sources (previous monitoring data indicate that there are no upgradient sources). A higher (quarterly) sampling frequency is proposed for the first year so that, in addition to providing groundwater and surface water sampling data, any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the remedial plan to ensure that it functions as intended can be identified and implemented, at an early stage. The groundwater monitoring well locations and surface water sampling locations proposed for the first five (5) years are shown in Figure 6-1.

Groundwater monitoring well locations

Among the 10 proposed groundwater sampling locations, four (4) monitoring wells are located in high concentration areas of TCE, DCE, and VC plumes to monitor the attenuation of the high concentration areas[7]; four (4) monitoring wells are located within the TCE, DCE, and VC plumes, but away from the high concentration areas, to monitor the attenuation of the low, residual contamination in the plumes; and two (2) monitoring wells are located downgradient of the chlorinated plume and immediately upgradient of the Six Mile Creek to monitor and ensure the protectiveness of the groundwater at the downgradient boundary of the Site.

Surface water sampling locations in the Six Mile Creek

Since the concentrations and amounts of contamination in the chlorinated plumes are small, any adverse impacts to the Six Mile Creek will be minimal due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. To confirm this conclusion and ensure that the remedy is protective of human health and the environment, surface water samples will be collected at one location where the approximate center of the plumes' flow path will meet the Six Mile Creek, and at an upgradient and a downgradient location of this meeting point as shown in Figure 6-1.

Sampling parameters

The groundwater and surface water samples will be analyzed for volatile organic compounds (EPA Method SW8260), and will be compared to the applicable groundwater and surface water standards, in particular, the New York State groundwater and surface water standards. For cost estimating purposes, quality control (QC) samples are assumed to be collected at the rate of 10% of the environmental samples, which include sample duplicates, equipment blanks, trip blanks, ambient blanks, and matrix spikes and blanks.

Potential modifications to the initial sampling plan

After the first five (5) years, as monitoring data is accumulated over time and depending on the five-year reviews of the project, the analytical parameters may be varied from those presented in the above paragraph, and the sampling locations may be varied from those shown in Figure 6-1 by sampling from other wells (for groundwater sampling) which have been previously installed for site characterization and monitoring during the RI/LTM phases, and from other locations in the Six Mile Creek (for surface water sampling), depending on the need for filling any data gaps in order to assure continued effective monitoring.

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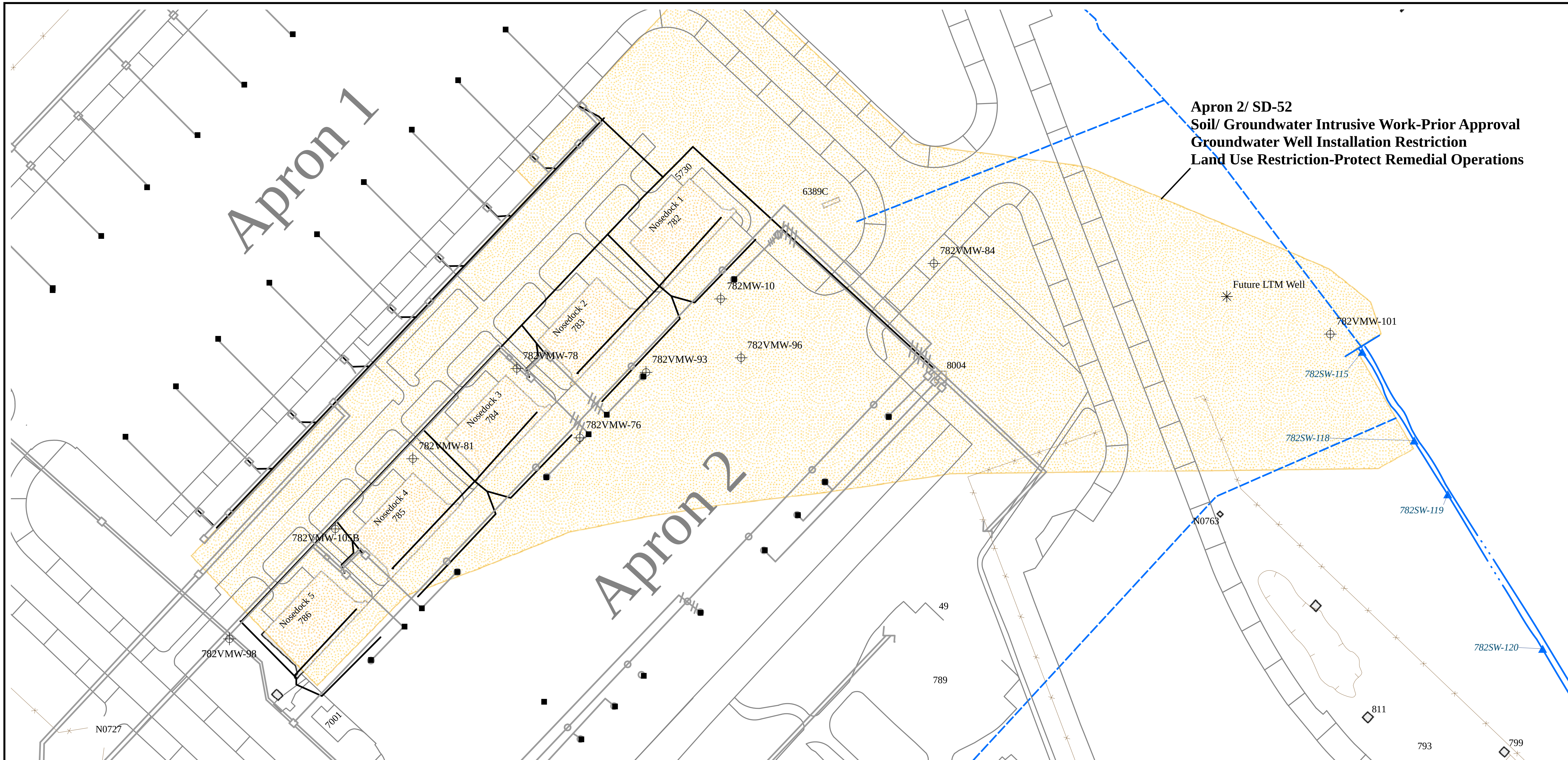
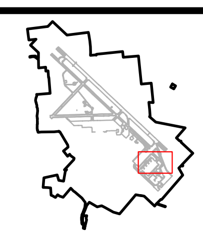
7 These are high concentration areas only relative to other portions of the current plumes; even these areas have low concentrations compared to what would normally be detected in contamination source areas.





Site Location

Base Location

Key to Features

- Hydrant
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/ Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Proposed Wells
- Existing Wells
- Surface Water Sample Locations
- Land Use Control/ Institutional Control Boundaries

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Feet

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UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 6-1
Proposed Future LTM Network

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PERIODIC PERFORMANCE EVALUATION AND CLOSURE:

If this remedial response (Alternative 2) is selected, it will be reviewed every five (5) years after its initiation to ensure that human health and the environment are being protected by the remedial response. If, upon such review, it is determined that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in a timely manner (i.e., in a reasonable time compared to other potential remedies), contingency plans will then be implemented consistent with the ROD. On the other hand, if upon such review it is determined that the Site has attained a status that is protective of the human health and the environment, then the Site will be recommended for closure, even if this were to occur earlier than the proposed 30-year LTM period.

6.2.3 Alternative Three – Monitored Natural Attenuation (MNA), with ICs and LTM

DESCRIPTION:

This alternative is a combination of the MNA process option and the process options from Alternative 2 (ICs and LTM). Thus, this alternative is an incremental enhancement over Alternative 2 by including a treatment component (MNA) in the remedial action. The purpose, scope, and implementation methodologies for ICs and LTM that were discussed in detail in Alternative 2 continue to apply to this alternative (Alternative 3) and are included herein by reference.

The USEPA defines MNA as the reliance on natural attenuation processes (within the context of a carefully controlled and monitored clean-up approach) to achieve site-specific remedial objectives within a time frame that is reasonable compared to other methods (EPA, 1999). In order for MNA to be selected as a remedy, site-specific determinations will always have to be made to ensure that natural attenuation is sufficiently protective of human health and the environment. The RI has determined that reductive dechlorination is naturally occurring at the Site (FPM, 2004). The analyses of monitoring data performed in Section 5 of this FS indicate that MNA will achieve site-specific RAOs within a time-frame that is reasonable compared to other alternatives. The proposed ICs and LTM will ensure that the MNA will be conducted and monitored in a carefully controlled manner that is consistent with the USEPA's definition of MNA to ensure that the remedy will be protective of human health and the environment.

It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plume Site by source materials, thus obviating the need for any source control measures and rendering USEPA's first expectation to use treatment moot with respect to source materials. Thus, any treatment component included in the remedial alternative only serves to further enhance its protectiveness of human health and the environment by treating the plume containing relatively low concentrations and amounts of contamination within the vicinity of the original source and at locations away from it, as appropriate.

Given the anticipated biosparging remedy of the Apron 2 Petroleum plume, which overlaps with the downgradient extent of the vinyl chloride plume (see Figure 2-6), implementation of this technology will not be adversely impacted given the desired aerobic environment under both biosparging and vinyl chloride degradation/treatment under the MNA with ICs and LTM Alternative.

MONITORING:

Based on the analysis of sampling data for the period February, 2002 – September, 2004, which was used to estimate rate constants for degradation of chlorinated organics, the chlorinated plume is estimated to naturally attenuate in 26 years. Therefore, including an additional four (4) years of monitoring beyond the estimated attenuation period (as assumed for costing purposes only), the LTM will be performed annually for a 30-year period to ensure that the remedy is protective of the human health and the environment. For this alternative, the environmental sampling will be performed as follows:

- **Site Groundwater and Surface Water Monitoring for 30 Years:** Quarterly sampling will be performed during the first year (Year 1) and semi-annual sampling will be performed for the next 29 years (Years 2-30) of the monitoring program at 10 groundwater monitoring wells and at three (3) surface water monitoring locations in the Six Mile Creek. Additionally, quarterly sampling will be performed at one (1) groundwater monitoring well upgradient of the chlorinated plume during the first year (Year 1) to verify that there are no contributions of contamination to the Site groundwater from upgradient sources (previous monitoring data indicate that there are no upgradient sources). A higher (quarterly) sampling frequency is proposed for the first year so that, in addition to providing groundwater and surface water sampling data, any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the remedial plan to ensure that it functions as intended can be identified and implemented, at an early stage. The groundwater monitoring well locations and surface water sampling locations proposed for the first five (5) years are shown in Figure 6-1.

  Groundwater monitoring well locations

  Among the 10 proposed groundwater sampling locations, four (4) monitoring wells are located in high concentration areas of TCE, DCE, and VC plumes to monitor the attenuation of the high concentration areas[8]; four (4) monitoring wells are located within the TCE, DCE, and VC plumes, but away from the high concentration areas, to monitor the attenuation of the low, residual contamination in the plumes; and two (2) monitoring wells are located downgradient of the chlorinated plume and immediately upgradient of the Six Mile Creek to monitor and ensure the protectiveness of the groundwater at the downgradient boundary of the Site.

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8 These are high concentration areas only relative to other portions of the current plumes; even these areas have low concentrations compared to what would normally be detected in contamination source areas.

Surface water sampling locations in the Six Mile Creek

Since the concentrations and amounts of contamination in the chlorinated plumes are small, any adverse impacts to the Six Mile Creek will be minimal due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. To confirm this conclusion and ensure that the remedy is protective of human health and the environment, surface water samples will be collected at one location where the approximate center of the plumes' flow path will meet the Six Mile Creek, and at an upgradient and a downgradient location of this meeting point as shown in Figure 6-1.

Sampling parameters

The groundwater and surface water samples will be analyzed for volatile organic compounds (EPA Method SW8260), and will be compared to the applicable groundwater and surface water standards, in particular, the New York State groundwater and surface water standards. The groundwater and surface water samples will also be analyzed for other parameters for the purpose of MNA verification and control (MNA parameters), including: ferrous iron/dissolved iron (II), sulfate/sulfide/ sulfite, chloride, nitrate/nitrite, total dissolved solids (TDS), dissolved oxygen (DO), pH, oxygen-reduction potential (ORP), total organic carbons (TOC), and any other parameters identified in the ROD and Proposed Plan, as appropriate. For cost estimating purposes, QC samples are assumed to be collected at the rate of 10% of the environmental samples, which include sample duplicates, equipment blanks, trip blanks, ambient blanks, and matrix spikes and blanks.

Potential modifications to the initial sampling plan

After the first five (5) years, as monitoring data is accumulated over time and depending on the five-year reviews of the project, the analytical parameters may be varied from those presented in the above paragraph, and the sampling locations may be varied from those shown in Figure 6-1 by sampling from other wells (for groundwater sampling) which have been previously installed for site characterization and monitoring during the RI/LTM phases, and from other locations in the Six Mile Creek (for surface water sampling), depending on the need for filling any data gaps in order to assure continued effective monitoring.

PERIODIC PERFORMANCE EVALUATION AND CLOSURE:

The analytical data will be used annually to assess the status and progress of MNA, including performing any conceptual, analytical, and/or computer modeling, as needed, to characterize, calibrate, and predict MNA processes and cleanup timeframes. Also, a comprehensive review of the remedy will be performed every five (5) years to ensure that human health and the environment are being protected by the remedial response. If, upon such assessments and reviews, it is determined that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in a timely manner (i.e., in a reasonable time compared to other potential remedies), contingency plans will then be implemented consistent with the ROD. On the other hand, if upon such review it is determined that the Site has attained a status that is protective of the human health and the environment, then the Site will be recommended for closure, even if this were to occur earlier than the proposed 30-year MNA/LTM period.

6.2.4 Alternative Four – Air Sparging (AS) and SVE, with ICs and LTM

DESCRIPTION:

This alternative is a combination of the Air Sparging (AS)/SVE process option and the process options from Alternative 2 (ICs and LTM). Thus, this alternative is an incremental enhancement over Alternative 2 by including a treatment component (AS/SVE) in the remedial action. The purpose, scope, and implementation methodologies for ICs and LTM that were discussed in detail in Alternative 2 continue to apply to this alternative (Alternative 4) and are included herein by reference. This alternative is designed to achieve the RAOs through active in-situ remediation by the AS/SVE process, leading to an early site closure (within approximately five years of system startup) relative to other alternatives. For cost estimating purposes, the O&M period for achieving the RAOs is assumed to be three (3) years, with an additional two years (as assumed for costing purposes only) of confirmation monitoring.

Air sparging would be used to inject pressurized air into the groundwater within the chlorinated plume (which contains volatile organics) such that the air enters the groundwater from the bottom of the contaminated zone (maximum plume thickness is 23 feet). As the injected air traverses up though the plume, the volatile organics present in the groundwater are transferred to the air medium and transported towards the surface (unsaturated zone). The SVE system is used to collect the vapors thus entering the unsaturated zone by means of vacuum extraction and safely discharge them to the atmosphere. While air sparging is the primary means for achieving groundwater cleanup, the SVE system is provided to control the vapors and prevent them from traveling in unintended directions (e.g., entering buildings) and also to prevent the contaminants in the emerging air from adsorbing on to the unsaturated zone soils.

The proposed AS/SVE system is conceptually depicted in Figure 6-2, which has been simplified to adequately describe the system for the level of analysis required for the FS. Approximately 3,185 air sparging wells (2”-dia. each) will be installed 10 feet apart from each other within the TCE, DCE, and VC plumes. The estimated radius of influence (ROI) is 10 feet, for a total coverage of approximately 1,000,000 square feet over all portions of the chlorinated plume above the New York State groundwater standards [i.e., greater than 5 ug/l for TCE in TCE plume, greater than 5 ug/l for DCE in DCE plume (in both plume zones), and greater than 2 ug/l for VC in VC plume]. The average AS well depth is estimated to be 39 feet. The operating pressure of the sparged air will be sufficient to overcome the static water pressure [approximately 10 psig (maximum)] and well friction (entry) losses, and to establish an air flow of sufficient velocity through the plume thickness (assumed to be 5 scfm per AS well). For cost estimating purposes, it is assumed that the compressed air for the AS system will be supplied by

98 15-hp blowers, each with a rated capacity of 163 scfm operating at 15 psig, and equipped with all necessary appurtenances, including intake filters and silencers. It is assumed that an overhead electrical distribution system will be constructed to power the equipment, including construction of five (5) strategically-located 40' Class 3 treated power poles. The total supply rate to all wells is 15,925 scfm. Alternatively, the final design may be based on a central, compressor-based air supply district distribution system, with the same flow and pressure specifications as above.

Approximately 1,040 soil vapor extraction wells (2"-dia. each) will be installed 17.5 feet apart from each other within the TCE, DCE (both plume zones), and VC plumes. The average SVE well depth is estimated to be 20 feet. For cost estimating purposes, it is assumed that the SVE system will consist of 32 independent vapor recovery systems (SVE blowers), each with a capacity of 1,000 scfm (approximately 30.8 scfm/SVE well). The vacuum ratings for the vapor recovery systems will be sized to realize the above listed flow rates. The estimated radius of influence is greater than 35-50 feet, and the total area covered is greater than the 1,000,000 square feet over which AS is applied. The total vapor extraction rate from all wells is 32,000 scfm, which is approximately twice the air supply (injection) rate into the saturated zone by the AS system, thus ensuring full pneumatic control and re-capture of air injected by the AS system. The vapor extraction systems will be equipped with all necessary appurtenances, including intake filters and silencers. It is assumed that an overhead electrical distribution system (same as the one for the AS system) will be constructed to power the equipment, including construction of five (5) 40' Class 3 treated power poles. Alternatively, the final design may be based installing the vapor recovery units at a central location or at a discrete number of central locations, with the same total flow specifications as above.

The AS and SVE lines would be equipped with air pressure and vacuum gauges (for AS and SVE, respectively), pressure and vacuum regulators (for AS and SVE, respectively), flow meters, valves, and other appurtenances in sufficient quantities to provide the data and controls needed to operate the system as intended to meet project design goals. All piping will be installed underground to the extent possible, except for piping near the aboveground mechanical systems (compressor, vacuum blower, etc.).

Extracted air will be vented at sufficient heights at locations selected such that no receptors will be adversely impacted. Because of the low concentrations and amounts of contaminants in the chlorinated plume, the concentrations of contaminants in the discharged vapors will be well below the levels prescribed by Federal and State regulations. Thus, no off-gas treatment is provided for the collected vapors. Also, for the same reason (i.e., low concentrations and amounts of contaminants), hydraulic control of groundwater is not needed; any escape of residual contamination in groundwater from the treatment zone, due to groundwater mounding caused by air sparging, would be minimal.

Application of air sparging will destabilize the existing groundwater environment that has been determined in the RI to be conducive to reductive dechlorination of the plume (FPM, 2004); however, the AS/SVE system will be designed to accomplish remediation through physical stripping of contaminants from groundwater followed by their collection to a degree that is necessary to achieve the RAOs within three (3) years of O&M (and additional two years of

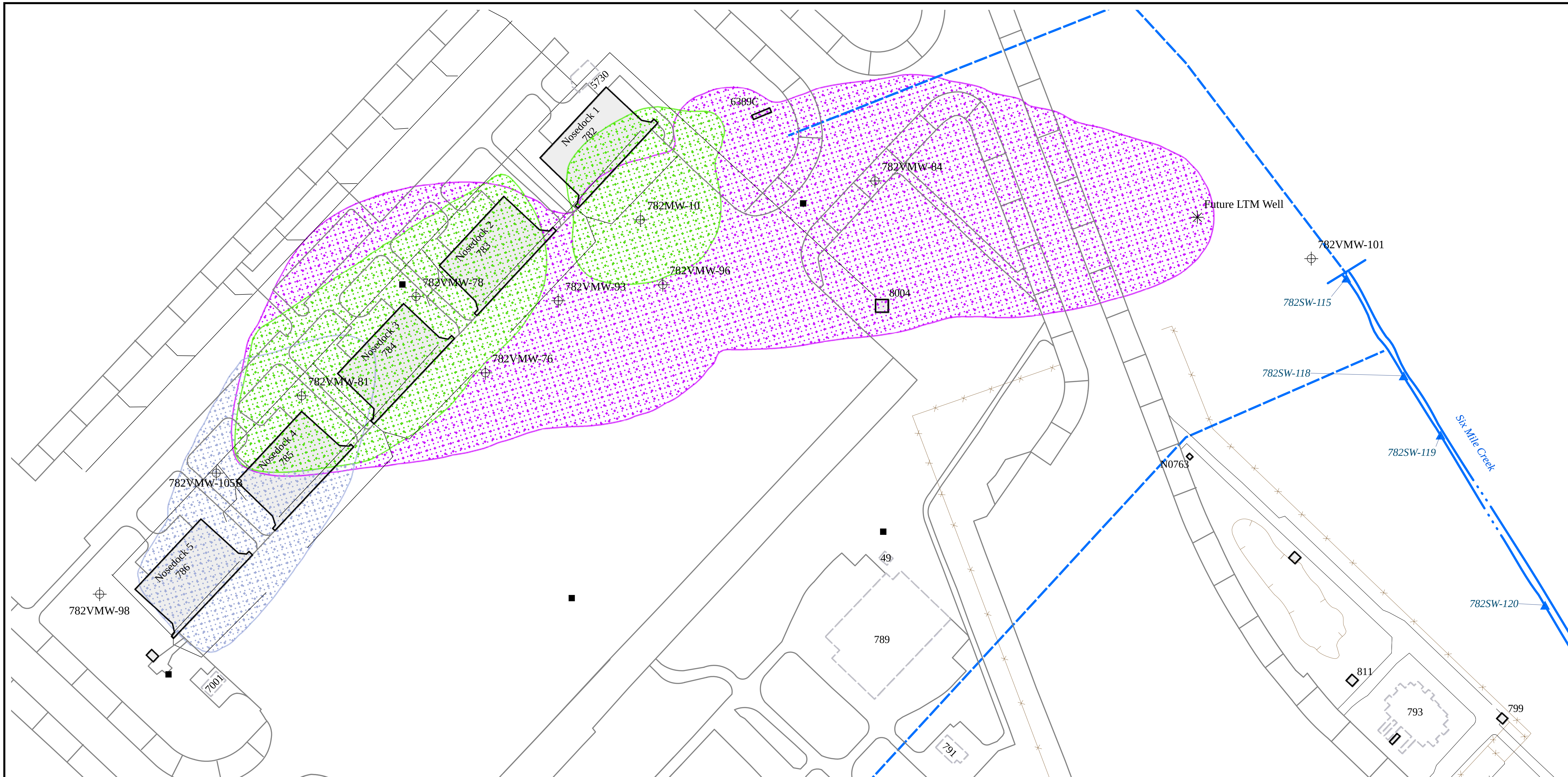
confirmation monitoring, as assumed for costing purposes only) and, thus, reliance on natural attenuation is not needed. In fact, natural attenuation is likely to be enhanced in the VC portion of the plume since VC is amenable to aerobic biodegradation.
It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plume Site by source materials, thus obviating the need for any source control measures and rendering USEPA's first expectation to use treatment moot with respect to source materials. Thus, any treatment component included in the remedial alternative only serves to further enhance its protectiveness of human health and the environment by treating the plume containing relatively low concentrations and amounts of contamination within the vicinity of the original source and at locations away from it, as appropriate.

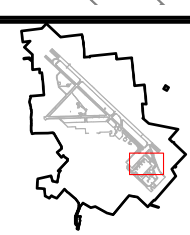
Given the anticipated biosparging remedy of the Apron 2 Petroleum plume, which overlaps with the downgradient extent of the vinyl chloride plume (see Figure 2-6), implementation of this technology will not be adversely impacted given the desired aerobic environment under both biosparging and vinyl chloride degradation/treatment under the AS and SVE, with ICs and LTM Alternative.

O&M AND MONITORING:

- **O&M for 3 Years:** Based on past experience and using professional judgment, it is assumed that the AS/SVE system will be operated continuously for three (3) years to attain the RAOs. The system performance behavior will be monitored and operational parameters adjusted (System O&M Review) will be performed weekly during the first quarter of first year of operation, monthly during the remainder of the first year of operation, and semi-annually for the second and third years. A higher System O&M Review is proposed for the initial periods of operation so that any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the system operating parameters to ensure that it functions as intended can be identified and implemented, at an early stage.

- **Site Groundwater, Surface Water, and Air Monitoring for 5 Years:** The LTM will be performed during the time the system is operational, and for two (2) additional years (as assumed for costing purposes only), for a total five (5) years of monitoring. Quarterly water sampling will be performed during the first year (Year 1) and semi-annual sampling will be performed for the next four (4) years (Years 2-5) of the monitoring program at 10 groundwater monitoring wells and at three (3) surface water monitoring locations in the Six Mile Creek. Additionally, quarterly sampling will be performed at one (1) groundwater monitoring well upgradient of the chlorinated plume during the first year (Year 1) to verify that there are no contributions of contamination to the Site groundwater from upgradient sources (previous monitoring data indicate that there are no upgradient sources). Also, quarterly air sampling will be performed during the first year (Year 1) and semi-annual sampling will be performed for the next four (4) years (Years 2-5) of the monitoring program at 10% of





Site Location

Base Location

Key to Features

- TCE Air Sparging Point
- TCE Soil Vapor Extraction Point
- DCE Air Sparging Point
- DCE Soil Vapor Extraction Point
- VC Air Sparging Point
- VC Soil Vapor Extraction Point
- Surface Water Sample Locations
- Hydrants
- Airfield
- Road
- Surface Water
- Culvert/Ditch
- Fence
- Washwaste System
- TCE Plume
- DCE Plume
- VC Plume
- Demolished Facilities
- Existing Facilities

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100 50 0 100 200

Feet

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UNITED STATES AIR FORCE
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 6-2
Alternative 4
Air Sparging and Soil Vapor Extraction Wells

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the SVE wells (104 samples). A higher (quarterly) sampling frequency is proposed for the first year so that, in addition to providing groundwater and surface water sampling data, any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the remedial plan to ensure that it functions as intended can be identified and implemented, at an early stage. The proposed groundwater monitoring well locations and surface water sampling locations are shown in Figure 6-1.

Groundwater monitoring well locations

Among the 10 proposed groundwater sampling locations, four (4) monitoring wells are located in high concentration areas of TCE, DCE, and VC plumes to monitor the reduction of contamination in the high concentration areas[9]; four (4) monitoring wells are located within the TCE, DCE, and VC plumes, but away from the high concentration areas, to monitor the reduction of contamination in the low, residual contamination in the plumes; and two (2) monitoring wells are located downgradient of the chlorinated plume and immediately upgradient of the Six Mile Creek to monitor and ensure the protectiveness of the groundwater at the downgradient boundary of the Site.

Surface water sampling locations in the Six Mile Creek

Since the concentrations and amounts of contamination in the chlorinated plumes are small, any adverse impacts to the Six Mile Creek will be minimal due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. To confirm this conclusion and ensure that the remedy is protective of human health and the environment, surface water samples will be collected at one location where the approximate center of the plumes' flow path will meet the Six Mile Creek, and at an upgradient and a downgradient location of this meeting point as shown in Figure 6-1.

Air monitoring locations

Air sampling will be performed at the rate of one (1) sample per every 10 SVE wells, which will be selected uniformly throughout the plume areas.

Sampling parameters

The groundwater and surface water samples will be analyzed for volatile organic compounds (EPA Method SW8260), and will be compared to the applicable groundwater and surface water standards, in particular, the New York State groundwater and surface water standards. The air samples will be analyzed for volatile organics (EPA methods TO-14/TO-15), and will be compared to any

9 These are high concentration areas only relative to other portions of the current plumes; even these areas have low concentrations compared to what would normally be detected in contamination source areas.

applicable standards in the New York State air regulations; however, their primary purpose is for monitoring the performance and progress of the AS/SVE active remediation system. For cost estimating purposes, quality control (QC) samples are assumed to be collected at the rate of 10% of the environmental samples, which include sample duplicates, equipment blanks, trip blanks, ambient blanks, and matrix spikes and blanks.

Potential modifications to the initial sampling plan

As monitoring data is accumulated over time and depending on quarterly and semi-annual reviews of the project, the analytical parameters may be varied from those presented in the above paragraph, and the sampling locations may be varied from those selected initially by sampling from other wells (for groundwater sampling) which have been previously installed for site characterization and monitoring during the RI/LTM phases, from other locations in the Six Mile Creek (for surface water sampling), and from other SVE wells, depending on the need for filling any data gaps in order to assure continued effective monitoring.

PERIODIC PERFORMANCE EVALUATION AND CLOSURE:

The analytical data will be used quarterly during the first year and semi-annually during the next two (2) years to assess the status and progress of this alternative (AS/SVE), including assessment of the system performance to date and prediction of cleanup timeframes. If, upon such assessments and reviews, it is determined that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in a timely manner (i.e., in a reasonable time compared to other potential remedies), contingency plans will then be implemented consistent with the ROD. On the other hand, if upon such review it is determined that the Site has attained a status that is protective of the human health and the environment, then the Site will be recommended for closure, even if this were to occur earlier than the proposed 3-year O&M period for this alternative.

6.2.5 Alternative Five – In-Situ Inactive Enhanced Abiotic Degradation using PRBs, with ICs and LTM

DESCRIPTION:

This alternative is a combination of the In-Situ Inactive Enhanced Abiotic Degradation using PRBs process option and the process options from Alternative 2 (ICs and LTM). Thus, this alternative is an incremental enhancement over Alternative 2 by including a treatment component (PRBs) in the remedial action for high concentration areas[10] of the chlorinated plume; specifically, treatment by PRBs is proposed for the portions of the plumes with concentrations greater than 20 µg/L for TCE in TCE plume, greater than 30 µg/l for DCE in DCE plume (in both plume zones), and greater than 80 µg/l for VC in VC plume. In this

10 These are high concentration areas only relative to other portions of the current plumes; even these areas have low concentrations compared to what would normally be detected in contamination source areas.

alternative, PRB walls constructed of zero-valent iron will be utilized for remediation of the TCE and DCE plumes via reductive dechlorination, and ORC® will be injected at multiple locations for remediation of the VC plume via aerobic degradation. Both types of barriers (zero-valent iron and ORC®) are collectively referred to as PRBs in this FS. The remaining portions of the plumes will be subjected to the same remedial action as under Alternative 2.

The primary objective of this alternative (Alternative 5) is to reduce the remediation time period (time to closure) compared to Alternative 2. As was discussed earlier under Alternative 2, based on the previous analysis of sampling data for the period February, 2002 – September, 2004, the chlorinated plume is estimated to naturally attenuate in 26 years and, including an additional four (4) years of confirmation monitoring (as assumed for costing purposes only), Alternative 2 was estimated to achieve Site closure in a 30-year period. Under Alternative 5, LTM will be performed for 15 years by which time it is assumed that the groundwater at the Site will be sufficiently protective of human health and the environment (including the Six Mile Creek) to achieve Site closure.

The distinguishing characteristics of this treatment component are that it is based on innovative technologies and that treatment is accomplished in-situ through passive control. The purpose, scope, and implementation methodologies for ICs and LTM that were discussed in detail in Alternative 2 continue to apply to this alternative (Alternative 5) and are included herein by reference.

This alternative is designed to achieve the RAOs through passive, in-situ remediation by placing the PRBs in the path of the groundwater plume and allowing the water portion of the plume to passively move through the wall while causing the degradation or removal of the chlorinated organic contaminants at the Site. The PRB is not a barrier to groundwater flow, but it is a barrier to contaminant migration. The contaminants will either be degraded while migrating downgradient upon passing through and receiving treatment from the PRBs, or retained in a concentrated form by the barrier material. Passive treatment walls are generally intended for long-term operation to control migration of contaminants in groundwater.

As was noted earlier in Section 5.5.2, the RI report for the Chlorinated groundwater plumes (FPM, 2004) has concluded that there is evidence of biodegradation occurring at the site by reductive dechlorination. While TCE and cis-1,2-DCE (cis-DCE) are easily amenable to reductive dechlorination under suitable conditions, since vinyl chloride has an excess of hydrogen atoms (3) over chlorine atoms (1), it is in a more reduced state compared to TCE and cis-1,2-DCE and, thus, in reducing environments (groundwater with negative redox potentials) vinyl chloride tends to form a stable end-product. Although reductive dechlorination as well as oxidation under anaerobic conditions in the presence of Fe(III) are feasible, vinyl chloride is more easily degraded under conditions conducive to aerobic degradation.

Therefore, in this alternative, continuous PRB walls containing zero-valent iron as the active substance are used for the remediation by abiotic reductive dechlorination of the high concentration portions of the TCE and cis-DCE plumes, and ORC® injection wells are used for the remediation of the high concentration portions of the vinyl chloride plume under aerobic conditions created by the ORC® wells.

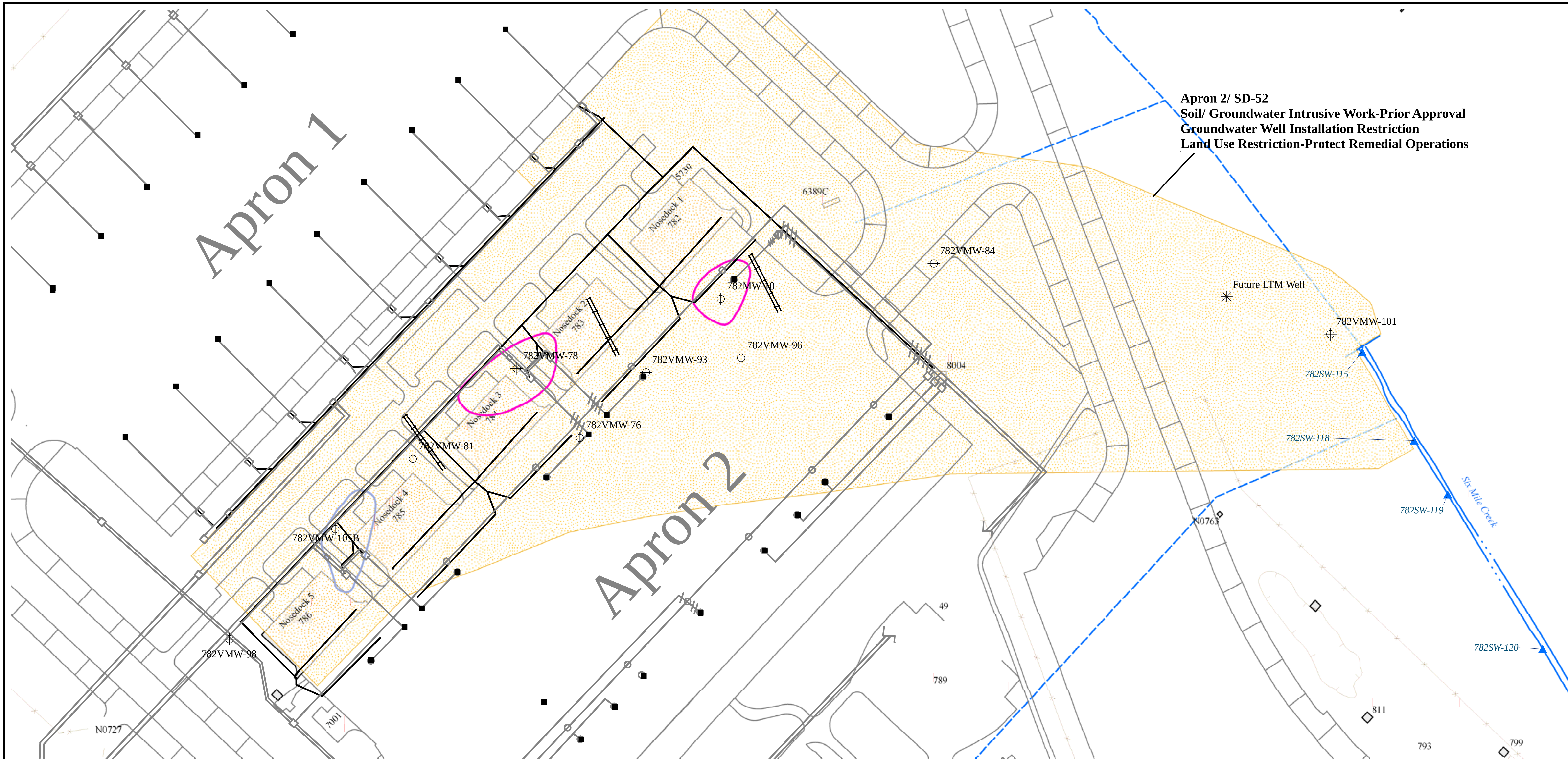
The PRB system is conceptually depicted in Figure 6-3. For remediation of high concentrations (> 20 µg/l) of TCE plume, a continuous PRB system is proposed in this alternative to completely transect the plume flow path with zero-valent iron reactive media. There are two high concentration (> 30 µg/l) zones for the DCE plume (Figure 6-3). For remediation of high concentrations of DCE plume, continuous PRB systems are proposed to completely transect the plume flow path downgradient of both zones with zero-valent iron reactive media. The three zero-valent iron PRB walls are each 150 feet long (perpendicular to flow direction), four (4) feet wide (along flow direction), and 45 feet deep with PRB material in 25 feet of saturated thickness containing 500 cubic yards of zero-valent iron (no PRB in overlying 20 feet of unsaturated zone).

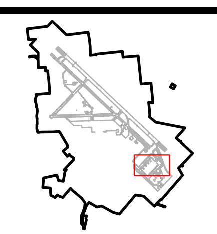
As shown in Figure 6-3, ORC® injection wells will be installed for aerobic degradation of the areas of the VC plume with concentrations greater than 80 ug/l. Sixty (60) 2”-dia., 45 feet deep ORC® injection wells will be installed 10 feet apart from each other over an approximately 100’ X 55’ area, in 10 rows at six (6) injection points per row. These wells will be located at the leading ege of the VC plume. An estimated 4,500 lb of ORC® material will be injected through these wells. Modifications to the ORC® injection well location/configuration may be modified during the design stage.

The PRB reactive media zones will be designed to have permeabilities that are equal to or greater than the permeability of the natural aquifer material to enhance the movement of groundwater flow towards the PRBs and avoid diversion of groundwater flow around or beneath the reactive zones, and will be designed to provide optimal residence times (contact times) for reducing the contaminant concentrations to cleanup levels.

It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plumes Site by source materials, thus obviating the need for any source control measures and rendering USEPA’s first expectation to use treatment moot with respect to source materials. Thus, any treatment component included in the remedial alternative only serves to further enhance its protectiveness of human health and the environment by treating the plume containing relatively low concentrations and amounts of contamination within the vicinity of the original source and at locations away from it, as appropriate.

Given the anticipated biosparging remedy of the Apron 2 Petroleum plume, which overlaps with the downgradient extent of the vinyl chloride plume (see Figure 2-6), implementation of this technology will not be adversely impacted given the desired aerobic environment under both biosparging and vinyl chloride degradation/treatment within the ORC® injection area in this alternative.




Site Location


Base Location

Key to Features

- Hydrant
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Proposed Wells
- Existing Wells
- Surface Water Sample Locations
- TCE Contamination 20 µg/L
- DCE Contamination 30 µg/L
- Permeable Reactive Barriers with Zero-valent Iron
- Land Use Control/ Institutional Control Boundaries

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Figure 6-3
Alternative 5
Permeable Reactive Barriers

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MONITORING:

- **PRB Performance Monitoring for First Year:** For each of the three (3) zero-valent iron PRB walls (one PRB wall for TCE plume and two PRB walls for the two zones of DCE plume), three (3) upgradient and three (3) downgradient 2”-dia. monitoring wells will be installed 50 feet apart from each other to verify hydraulic control and to monitor the treatment performance of the PRB walls in order to verify that they are accomplishing treatment as intended (total 18 wells). Quarterly monitoring will be performed at these wells during the first year of system installation.

  To monitor the effectiveness of ORC® treatment for the VC plume, two (2) 2”-dia. monitoring wells will be installed within the portion of the plume undergoing treatment, and one (1) 2”-dia. monitoring well will be installed downgradient of this area [total three (3) wells]. Quarterly monitoring will be performed at these wells during the first year of system installation.

- **Site Groundwater and Surface Water Monitoring for 15 Years:** Quarterly water sampling will be performed during the first year (Year 1) and semi-annual sampling will be performed for the next 14 years (Years 2-15) of the monitoring program at 10 groundwater monitoring wells and at three (3) surface water monitoring locations in the Six Mile Creek. Additionally, quarterly sampling will be performed at one (1) groundwater monitoring well upgradient of the chlorinated plume during the first year (Year 1) to verify that there are no contributions of contamination to the Site groundwater from upgradient sources (previous monitoring data indicate that there are no upgradient sources). A higher (quarterly) sampling frequency is proposed for the first year so that, in addition to providing groundwater and surface water sampling data, any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the remedial plan to ensure that it functions as intended can be identified and implemented, at an early stage. The proposed groundwater monitoring well locations and surface water sampling locations are shown in Figure 6-1.

  Groundwater monitoring well locations

  Among the 10 proposed groundwater sampling locations, four (4) monitoring wells are located in high concentration areas of TCE, DCE, and VC plumes to monitor the reduction of contamination in the high concentration areas; four (4) monitoring wells are located within the TCE, DCE, and VC plumes, but away from the high concentration areas, to monitor the reduction of contamination in the low, residual contamination in the plumes; and two (2) monitoring wells are located downgradient of the chlorinated plume and immediately upgradient of the Six Mile Creek to monitor and ensure the protectiveness of the groundwater at the downgradient boundary of the Site.

Surface water sampling locations in the Six Mile Creek

Since the concentrations and amounts of contamination in the chlorinated plumes are small, any adverse impacts to the Six Mile Creek will be minimal due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. To confirm this conclusion and ensure that the remedy is protective of human health and the environment, surface water samples will be collected at one location where the approximate center of the plumes' flow path will meet the Six Mile Creek, and at an upgradient and a downgradient location of this meeting point as shown in Figure 6-1.

Sampling parameters

The groundwater and surface water samples will be analyzed for volatile organic compounds (EPA Method SW8260), and will be compared to the applicable groundwater and surface water standards, in particular, the New York State groundwater and surface water standards. For cost estimating purposes, QC samples are assumed to be collected at the rate of 10% of the environmental samples, which include sample duplicates, equipment blanks, trip blanks, ambient blanks, and matrix spikes and blanks.

Potential modifications to the initial sampling plan

As monitoring data is accumulated over time and depending on quarterly and semi-annual reviews of the project, the analytical parameters may be varied from those presented in the above paragraph, and the sampling locations may be varied from those selected initially by sampling from other wells (for groundwater sampling) which have been previously installed for site characterization and monitoring during the RI/LTM phases, from other locations in the Six Mile Creek (for surface water sampling), and from other SVE wells, depending on the need for filling any data gaps in order to assure continued effective monitoring.

PERIODIC PERFORMANCE EVALUATION AND CLOSURE:

The analytical data will be used annually to assess the status and progress of the PRB remedy. Also, a comprehensive review of the remedy will be performed every five (5) years to ensure that human health and the environment are being protected by the remedial response. If, upon such assessments and reviews, it is determined that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in the 15-year target period for Site closure, contingency plans will then be implemented consistent with the ROD or, alternatively, the monitoring period may be extended to approach the LTM period for Alternative 2 (30 years). On the other hand, if upon such review it is determined that the Site has attained a status that is protective of the human health and the environment, then the Site will be recommended for closure, even if this were to occur earlier than the proposed 15-year PRB/LTM period.

6.2.6 Alternative Six – In-Situ Active Chemical Oxidation (ISCO), with ICs and LTM

DESCRIPTION:

This alternative is a combination of the ISCO process option and the process options from Alternative 2 (ICs and LTM). Thus, this alternative is an incremental enhancement over Alternative 2 by including a treatment component (chemical oxidation) in the remedial action for high concentration areas11 of the chlorinated plume; specifically, treatment by chemical oxidation is proposed for the portions of the plumes with concentrations greater than 20 µg/L for TCE in TCE plume, greater than 30 µg/L for DCE in DCE plume (in both plume zones), and greater than 80 µg/L for VC in VC plume. The remaining portions of the plumes will be subjected to the same remedial action as under Alternative 2.

The primary objective of this alternative (Alternative 6) is to reduce the remediation time period (time to closure) compared to Alternative 2. As was discussed earlier under Alternative 2, based on the analysis of sampling data for the period February, 2002 – September, 2004, the chlorinated plume is estimated to naturally attenuate in 26 years and, including an additional four (4) years of confirmation monitoring (as assumed for costing purposes only), Alternative 2 was estimated to achieve Site closure in a 30-year period. Under this alternative (Alternative 6), LTM will be performed for 10 years by which time it is assumed that the groundwater at the Site will be sufficiently protective of human health and the environment (including the Six Mile Creek) to achieve Site closure.

The distinguishing characteristics of this treatment component are that it is based on an innovative technology and that treatment is accomplished rapidly by in-situ, active treatment. In general, the chemical oxidation processes have been capable of achieving high treatment efficiencies (e.g., > 90 percent) for unsaturated aliphatic (e.g., TCE) and aromatic (e.g., benzene) compounds, with very fast reaction rates (90 percent destruction in minutes). ISCO affords a high degree of protection, and permanently destroys organic contaminants at the site at relatively moderate cost.

The reactive medium is assumed to be 50% solution of hydrogen peroxide (H_2O_2)for cost estimation purposes. However, permanganate or other oxidants may also be utilized in the design depending on the results of the bench-scale and treatability/pilot studies. For cost estimation purposes, one (1) bench-scale and one (1) pilot-scale study is assumed for assuring technical feasibility and for determining the design parameters (including specific oxidant to be used, injection rate and pressure, radius of influence, and reaction rate).

The purpose, scope, and implementation methodologies for ICs and LTM that were discussed in detail in Alternative 2 continue to apply to this alternative (Alternative 6) and are included herein by reference.

11 These are high concentration areas only relative to other portions of the current plumes; even these areas have low concentrations compared to what would normally be detected in contamination source areas.

The ISCO system is conceptually depicted in Figure 6-4. For remediation of high concentrations (> 20 µg/L for TCE) of TCE plume, high concentrations (> 30 µg/L for DCE) of DCE plume (in two zones), and high concentrations (> 80 µg/L for VC) of VC plume, the oxidant will be injected in these areas through eighty (80) 2”-dia. subsurface injection points (wells) in two (2) rounds that are set three (3) months apart. The material will be injected at the rate of one (1) gpm/well. Approximately 300 lb of the oxidant will be injected per point, for a total of 24,000 lb/round or 48,000 lb for both rounds.

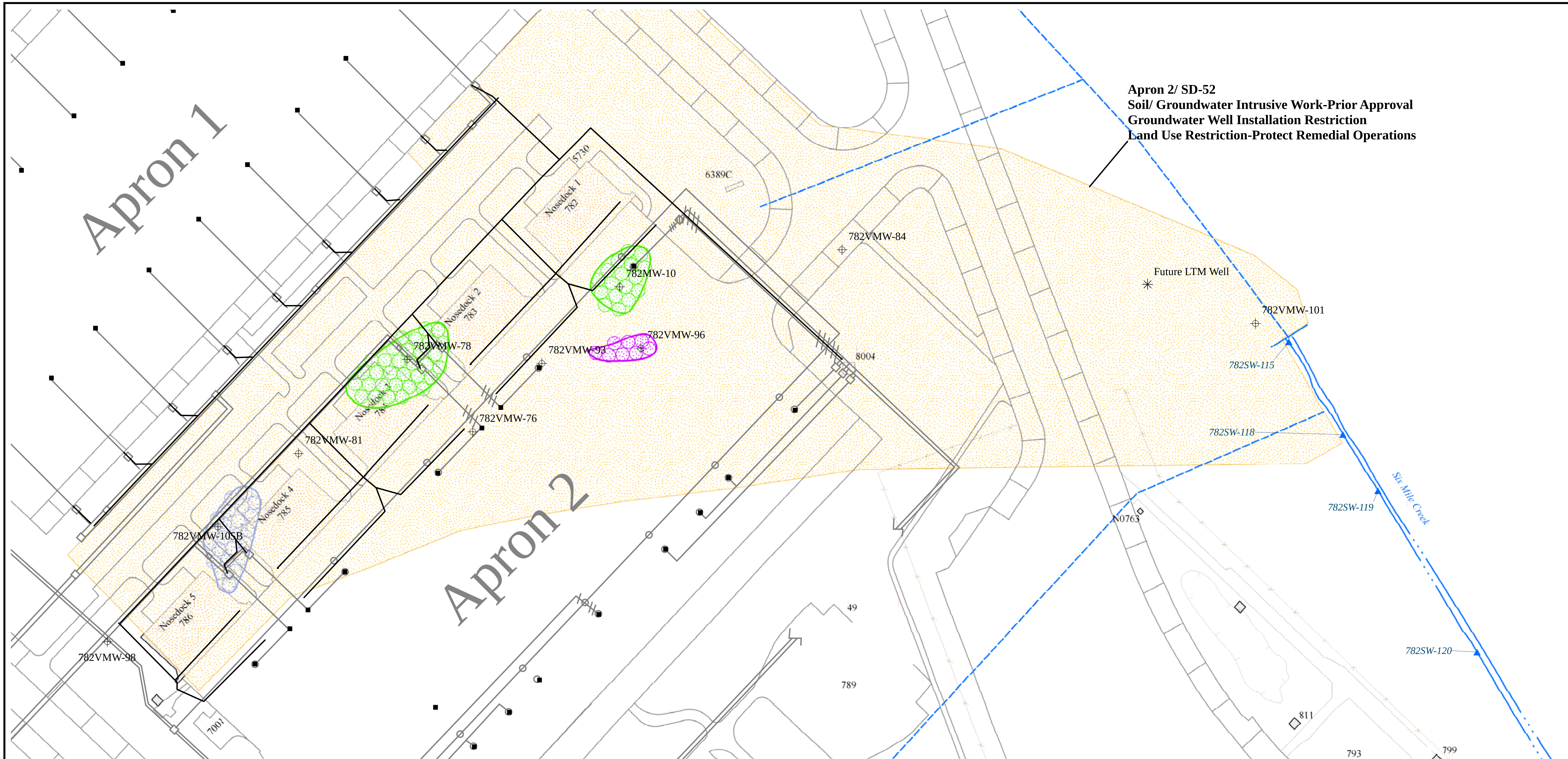
Application of chemical oxidation will destabilize the existing groundwater environment that has been determined in the RI to be conducive to reductive dechlorination of the plume (FPM, 2004); however, the ISCO system will be designed to accomplish rapid remediation in the high concentration areas of the plumes to a degree that is necessary to achieve the RAOs within eight (8) years of system construction (and additional two years of confirmation monitoring, as assumed for costing purposes only) and, thus, reliance on natural attenuation is not needed for the high concentration areas undergoing ISCO treatment.

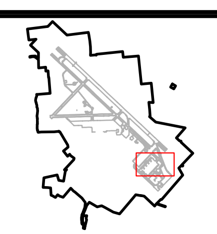
It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plumes Site by source materials, thus obviating the need for any source control measures and rendering USEPA’s first expectation to use treatment moot with respect to source materials. Thus, any treatment component included in the remedial alternative only serves to further enhance its protectiveness of human health and the environment by treating the plume containing relatively low concentrations and amounts of contamination within the vicinity of the original source and at locations away from it, as appropriate.

Given the anticipated biosparging remedy of the Apron 2 Petroleum plume, which overlaps with the downgradient extent of the vinyl chloride plume (see Figure 2-6), implementation of this technology will not be adversely impacted given the desired aerobic environment under both biosparging and vinyl chloride degradation/treatment under the ISCO, with ICs and LTM Alternative.

MONITORING:

- **ISCO Performance Monitoring for First Year:** For each of the four (4) high concentration areas [greater than 20 ug/l for TCE in TCE plume, greater than 30 ug/l for DCE in DCE plume (in two zones), and greater than 80 ug/l for VC in VC plume], two (2) 2”-dia. monitoring wells will be installed within the portion of the plume undergoing ISCO treatment, and one (1) 2”-dia. monitoring well will be installed downgradient of this area [total three (3) wells/plume zone or total 12 wells for all four (4) high concentration areas]. Quarterly monitoring will be performed at these wells during the first year of system installation.





Site Location

Base Location

Key to Features

- Hydrant
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/ Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Existing Monitoring Well
- Future LTM Well
- Surface Water Sample Locations
- TCE Contamination 20 µg/L
- DCE Contamination 30 µg/L
- VC Contamination 80 µg/L

- TCE Chemical Oxidation Points
- DCE Chemical Oxidation Injection Points
- VC Chemical Oxidation Injection Points
- Land Use Control/ Institutional Control Boundaries

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Figure 6-4
Alternative 6
In-Situ Active Chemical Oxidation

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- **Site Groundwater and Surface Water Monitoring for 10 Years:** Quarterly water sampling will be performed during the first year (Year 1) and semi-annual sampling will be performed for the next nine (9) years (Years 2-10) of the monitoring program at 10 groundwater monitoring wells and at three (3) surface water monitoring locations in the Six Mile Creek. Additionally, quarterly sampling will be performed at one (1) groundwater monitoring well upgradient of the chlorinated plume during the first year (Year 1) to verify that there are no contributions of contamination to the Site groundwater from upgradient sources (previous monitoring data indicate that there are no upgradient sources). A higher (quarterly) sampling frequency is proposed for the first year so that, in addition to providing groundwater and surface water sampling data, any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the remedial plan to ensure that it functions as intended can be identified and implemented, at an early stage. The proposed groundwater monitoring well locations and surface water sampling locations are shown in Figure 6-1.

  Groundwater monitoring well locations

  Among the 10 proposed groundwater sampling locations, four (4) monitoring wells are located in high concentration areas of TCE, DCE, and VC plumes to monitor the reduction of contamination in the high concentration areas; four (4) monitoring wells are located within the TCE, DCE, and VC plumes, but away from the high concentration areas, to monitor the reduction of contamination in the low, residual contamination in the plumes; and two (2) monitoring wells are located downgradient of the chlorinated plume and immediately upgradient of the Six Mile Creek to monitor and ensure the protectiveness of the groundwater at the downgradient boundary of the Site.

  Surface water sampling locations in the Six Mile Creek

  Since the concentrations and amounts of contamination in the chlorinated plumes are small, any adverse impacts to the Six Mile Creek will be minimal due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. To confirm this conclusion and ensure that the remedy is protective of human health and the environment, surface water samples will be collected at one location where the approximate center of the plumes' flow path will meet the Six Mile Creek, and at an upgradient and a downgradient location of this meeting point as shown in Figure 6-1.

  Sampling parameters

  The groundwater and surface water samples will be analyzed for volatile organic compounds (EPA method 8260), and will be compared to the applicable groundwater and surface water standards, in particular, the New York State groundwater and surface water standards. For cost estimating purposes, QC samples are assumed to be collected at the rate of 10% of the environmental samples, which include sample duplicates, equipment blanks, trip blanks, ambient blanks, and matrix spikes and blanks.

Potential modifications to the initial sampling plan

As monitoring data is accumulated over time and depending on quarterly and semi-annual reviews of the project, the analytical parameters may be varied from those presented in the above paragraph, and the sampling locations may be varied from those selected initially by sampling from other wells (for groundwater sampling) which have been previously installed for site characterization and monitoring during the RI/LTM phases, from other locations in the Six Mile Creek (for surface water sampling), and from other SVE wells, depending on the need for filling any data gaps in order to assure continued effective monitoring.

PERIODIC PERFORMANCE EVALUATION AND CLOSURE:

The analytical data will be used annually to assess the status and progress of the ISCO remedy. Also, a comprehensive review of the remedy will be performed after five (5) years to ensure that human health and the environment are being protected by the remedial response. If, upon such assessments and reviews, it is determined that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in the 10-year target period for Site closure, contingency plans will then be implemented consistent with the ROD or, alternatively, the monitoring period may be extended to approach the LTM period for Alternative 2 (30 years). On the other hand, if upon such review it is determined that the Site has attained a status that is protective of the human health and the environment, then the Site will be recommended for closure, even if this were to occur earlier than the proposed 10-year ISCO/LTM period.

6.2.7 Alternative Seven – Six Mile Creek Horizontal Air Sparging (AS) Barrier, with ICs and LTM

DESCRIPTION:

This alternative is a combination of the AS process option as a horizontal barrier immediately upgradient of the Six Mile Creek, and the process options from Alternative 2 (ICs and LTM). Thus, this alternative is an incremental enhancement over Alternative 2 by including a treatment component (AS) in the remedial action to provide enhanced protection for the Six Mile Creek from the site groundwater discharges. The purpose, scope, and implementation methodologies for ICs and LTM that were discussed in detail in Alternative 2 continue to apply to this alternative (Alternative 7) and are included herein by reference.

This alternative is similar to Alternative 2 in all respects, except for the additional barrier of protection (horizontal AS well) that is provided immediately upgradient of the Six Mile Creek. For cost estimating purposes, the O&M period for the horizontal AS barrier is assumed to be 30 years, which is the same as the LTM period for this alternative. As was discussed earlier under Alternative 2, based on the previous analysis in of sampling data for the period February, 2002 – September, 2004, the chlorinated plume is estimated to naturally attenuate in 26 years and, including an additional four (4) years of confirmation monitoring (as assumed for costing purposes only), Alternative 7 was estimated to achieve Site closure in a 30-year period.

Air sparging would be used to inject pressurized air into the groundwater across the plume width and upgradient of the Six Mile Creek (which at this discharge point is expected to have residual or negligible concentrations of contaminants). As the injected air traverses up though the groundwater, any volatile organics that may be present are transferred to the air medium and transported towards the surface (unsaturated zone), and are eventually discharged to ambient air as aerially-distributed (non-point source) emissions. The concentrations of contaminants in the emitted air are estimated to be negligibly low and, thus, no off-gas treatment would be required. No SVE system is provided since it is not needed for controlling and collecting the vapors due to the absence of buildings or other habitable structures in this area near the creek.

The proposed horizontal AS barrier is conceptually depicted in Figure 6-5. The horizontal AS barrier system will consist of a 450-foot long, 4"-dia. PVC pipe, slotted almost along its entire length in the subsurface, and installed at a depth of about 30 feet (saturated thickness is only about 10 feet near the creek). The operating pressure of the sparged air will be sufficient to overcome the static water pressure [approximately 4.5 psig (maximum)] and well friction (entry) losses, and to establish an air flow of sufficient velocity through the saturated zone thickness (assumed to be 0.7 scfm per foot of horizontal AS well). For cost estimating purposes, it is assumed that the compressed air for the AS system will be supplied by two (2) 15-hp blowers, each with a rated capacity of 163 scfm operating at 15 psig, and equipped with all necessary appurtenances, including intake filters and silencers. It is assumed that the system will be provided with access to electrical power supply.

The AS line would be equipped with air pressure gauges, pressure regulators, flow meters, valves, and other appurtenances in sufficient quantities to provide the data and controls needed to operate the system as intended to meet project design goals. All piping will be installed underground to the extent possible, except for piping near the aboveground mechanical systems (compressor, vacuum blower, etc.).

It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plume Site by source materials, thus obviating the need for any source control measures and rendering USEPA's first expectation to use treatment moot with respect to source materials. Thus, any treatment component included in the remedial alternative only serves to further enhance its protectiveness of human health and the environment by treating the plume containing relatively low concentrations and amounts of contamination within the vicinity of the original source and at locations away from it, as appropriate.

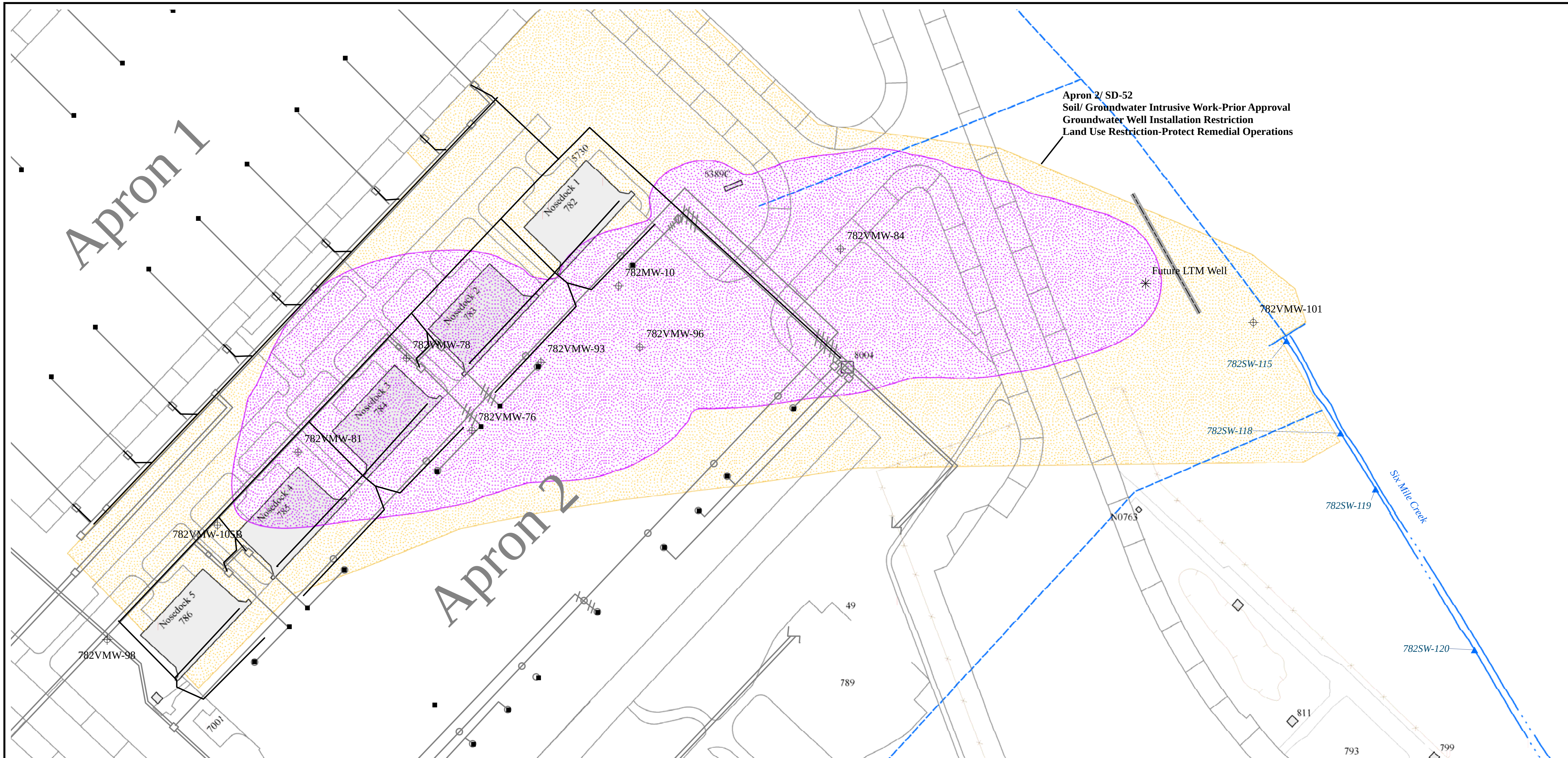
Given the anticipated biosparging remedy of the Apron 2 Petroleum plume, which overlaps with the downgradient extent of the vinyl chloride plume (see Figure 2-6), implementation of this technology will not be adversely impacted given the desired aerobic environment under both biosparging and vinyl chloride degradation/treatment under the AS Barrier, with ICs and LTM Alternative.

O&M AND MONITORING:

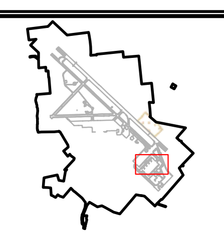
- **O&M for 30 Years:** The horizontal AS barrier system will be operated continuously for the entire LTM period (i.e., for 30 years). The system performance behavior will be monitored and operational parameters adjustments (System O&M Review) will be performed monthly during the first quarter of first year of operation, quarterly during the remainder of the first year of operation, and semi-annually for the remaining 29 years. A higher System O&M Review is proposed for the initial periods of operation so that any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the system operating parameters to ensure that it functions as intended can be identified and implemented at an early stage.

- **Site Groundwater, Surface Water, and Air Monitoring for 30 Years:** The LTM will be performed for 30 years (same period as for Alternative 2). Quarterly water sampling will be performed during the first year (Year 1) and semi-annual sampling will be performed for the next 29 years (Years 2-29) of the monitoring program at 10 groundwater monitoring wells and at three (3) surface water monitoring locations in the Six Mile Creek. Additionally, quarterly sampling will be performed at one (1) groundwater monitoring well upgradient of the chlorinated plume during the first year (Year 1) to verify that there are no contributions of contamination to the Site groundwater from upgradient sources (previous monitoring data indicate that there are no upgradient sources). A higher (quarterly) sampling frequency is proposed for the first year so that, in addition to providing groundwater and surface water sampling data, any uncertainties concerning system behavior can be closely monitored and characterized, and any adjustments that may have to be made to the remedial plan to ensure that it functions as intended can be identified and implemented, at an early stage. The proposed groundwater monitoring well locations and surface water sampling locations are shown in Figure 6-1.

  One (1) vapor sample will be collected from the subsurface and analyzed annually for 30 years to verify that ambient air standards are met.



Site Location



Base Location

Key to Features

- Hydrant
- Airfield
- Washwaste System
- Stream/ Creek
- Culvert/ Ditch
- Pipeline
- Fence

Facilities

- Demolished
- Existing
- Non Lease Qualify
- Existing Monitoring Well
- Future LTM Well
- Surface Water Sample Locations
- VC Contamination 2 µg/L
- Horizontal Air Sparging Well
- Land Use Control/ Institutional Control Boundaries

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Figure 6-5
Alternative 7
Six Mile Creek
Horizontal Air Sparging Barrier

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Groundwater monitoring well locations

Among the 10 proposed groundwater sampling locations, four (4) monitoring wells are located in high concentration areas of TCE, DCE, and VC plumes to monitor the reduction of contamination in the high concentration areas[12]; four (4) monitoring wells are located within the TCE, DCE, and VC plumes, but away from the high concentration areas, to monitor the reduction of contamination in the low, residual contamination in the plumes; and two (2) monitoring wells are located downgradient of the chlorinated plume and immediately upgradient of the Six Mile Creek to monitor and ensure the protectiveness of the groundwater at the downgradient boundary of the Site.

Surface water sampling locations in the Six Mile Creek

Since the concentrations and amounts of contamination in the chlorinated plumes are small, any adverse impacts to the Six Mile Creek will be minimal due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. To confirm this conclusion and ensure that the remedy is protective of human health and the environment, surface water samples will be collected at one location where the approximate center of the plumes' flow path will meet the Six Mile Creek, and at an upgradient and a downgradient location of this meeting point as shown in Figure 6-1.

Air monitoring locations

Air sampling will be performed at the rate of one (1) sample per year by collecting a vapor sample from the subsurface in the vicinity of the horizontal AS well.

Sampling parameters

The groundwater and surface water samples will be analyzed for volatile organic compounds (EPA Methods SW8260), and will be compared to the applicable groundwater and surface water standards, in particular, the New York State groundwater and surface water standards. The air samples will be analyzed for volatile organics (EPA methods TO-14/TO-15), and will be compared to any applicable standards in the New York State air regulations. For cost estimating purposes, QC samples are assumed to be collected at the rate of 10% of the environmental samples, which include sample duplicates, equipment blanks, trip blanks, ambient blanks, and matrix spikes and blanks.

12 These are high concentration areas only relative to other portions of the current plumes; even these areas have low concentrations compared to what would normally be detected in contamination source areas.

Potential modifications to the initial sampling plan

As monitoring data is accumulated over time and depending on the periodic reviews of the project, the analytical parameters may be varied from those presented in the above paragraph, and the sampling locations may be varied from those selected initially by sampling from other wells (for groundwater sampling) which have been previously installed for site characterization and monitoring during the RI/LTM phases, and from other locations in the Six Mile Creek (for surface water sampling), depending on the need for filling any data gaps in order to assure continued effective monitoring.

PERIODIC PERFORMANCE EVALUATION AND CLOSURE:

If this remedial response (Alternative 7) is selected, it will be reviewed every five (5) years after its initiation to ensure that human health and the environment are being protected by the remedial response. If, upon such review, it is determined that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in a timely manner (i.e., in a reasonable time compared to other potential remedies), contingency plans will then be implemented consistent with the ROD. On the other hand, if upon such review it is determined that the Site has attained a status that is protective of the human health and the environment, then the Site will be recommended for closure, even if this were to occur earlier than the proposed 30-year LTM period.

6.3 Evaluation of Response Action Alternatives

The following evaluation analyzes the effectiveness, implementability, and cost (discussed in detail in Sections 1.3 and 6.1.3) of each of the seven (7) response action alternatives identified in Section 6.2 for the Nosedocks / Apron 2 Chlorinated Plume Site at the former Griffiss AFB. The state and community acceptance criteria were not evaluated in this FS; instead, they will be formally addressed in the ROD after comments are received on the Proposed Plan.

6.3.1 Alternatives Evaluation Methodology

The evaluations for the individual criteria are presented briefly below and detailed in Table 6-1, Comparative Evaluation of Remedial Alternatives. Since the seven (7) different alternatives considered in this FS are likely to satisfy the different evaluation criteria identified in Section 6.1.3 to varying degrees and not necessarily with a consistent pattern relative to each other, a scoring system was adopted to aid in the ranking of the alternatives for the purpose of remedy selection. The scoring system is based on qualitatively assigning a numerical score of zero (“0”) to the worst or least successful alternative, and a numerical score of four (“4”) to the best or most successful alternative, with respect to its meeting the objectives of a given criterion under consideration. The assigned scores do not have any physical significance (i.e., they are not absolute numbers); however, the scores were qualitatively assigned by considering the trade-off between the different alternatives and using professional judgment to provide, at least, a preliminary ranking of the degree to which all the seven (7) alternatives fulfill any given criterion relative to each other.

For selecting recommended alternatives, the results of the evaluations for the individual criteria and their qualitative scores are then comprehensively considered in the discussions presented below and summarized in Table 6-2, Selection of Recommended Remedial Alternatives. Towards this end, for each alternative a total effectiveness score was determined by adding its scores for the individual effectiveness criteria from Table 6-1; specifically, for each alternative the total effectiveness score in Table 6-2 is the sum its scores for the overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. It should be noted that this methodology of totaling the effectiveness score without weighting factors implicitly assumes that all of the above five individual criteria are equally important.

To provide a common basis for the comparative evaluation of total effectiveness of the alternatives, the ratio of total effectiveness score to estimated cost in millions of dollars was computed (Table 6-2), which provides a relative assessment of the total degree of effectiveness that each alternative yields per one million dollars spent on the remedy, i.e., higher the total effectiveness score to estimated cost ratio for a given alternative, the more cost effective would be that alternative relative to others with lower ratios.

Finally, for the purpose of selecting the recommended alternatives, the cost-effectiveness as calculated above, the alternatives' implementability score, and the limitations of the methodology which are discussed above, were taken into consideration in the overall assessment that was qualitatively performed using professional judgment and past experience for each alternative to determine its potential for meeting the program goals and the RAOs, while being cost-effective and implementable. The recommended alternatives are discussed in the following section and summarized in Table 6-2.

In conclusion, a scoring system was developed to clarify the relative merits of the various alternatives with respect to the evaluation criteria and to form a common basis for their comparative evaluation. With regard to evaluating the degree of fulfillment of the individual criteria, the common basis is the 0 (worst) – 4 (best) scoring system with which to compare the alternatives to each other. With regard to evaluating the overall cost-effectiveness of the alternatives, the common basis is the computed ratio of total effectiveness score per million dollars of spending on that remedy. The limitations of the methodology are that it is qualitative both in definition and assignment of scores. However, while the results of the ranking methodology were used to aid in clarifying the evaluations, such usage was not to the exclusion of other considerations, and the selection of recommended alternatives was made based on an understanding and overall assessment of the strengths and limitations of each alternative with regards to its potential for meeting the program goals and RAOs.

6.3.2 Evaluations for Individual Criteria

The evaluations that were performed for the individual criteria are briefly presented below. They are further discussed in detail in Table 6-1.

For convenience, the alternatives are re-listed below from Section 6.2:

- Alternative One – No Action
- Alternative Two – Institutional Controls (ICs) and Long-Term Monitoring (LTM)
- Alternative Three – Monitored Natural Attenuation (MNA), with ICs and LTM
- Alternative Four – Air Sparging (AS) and Soil Vapor Extraction (SVE), with ICs and LTM
- Alternative Five – In-Situ Inactive Enhanced Abiotic Degradation using Permeable Reactive Barriers (PRBs), with ICs and LTM
- Alternative Six – In-Situ Active Chemical Oxidation (ISCO), with ICs and LTM
- Alternative Seven – Six Mile Creek Horizontal Air Sparging (AS) Barrier, with ICs and LTM

6.3.2.1 Overall Protection of Human Health and the Environment

- Alternative One – No action would not reduce the potential for future groundwater contamination or potential exposure of humans and the environment to contaminated groundwater. However, since the concentrations are small and the RI has determined that natural attenuation processes are occurring at the Site, therefore, a score of 1.0 was given for this alternative.

- Alternative Two – ICs and LTM will provide overall protection of human health and the environment considering that the Site is dedicated for industrial use, groundwater will not be permitted to be used as drinking water, and residual concentrations of contaminants are low and, thus, unlikely to adversely impact the environment. Therefore, this alternative was assigned a score of 3.0; however, this score is less than that given to Alternatives 3, 4, 5, 6, and 7, all of which include this alternative (ICs and LTM) as well as a treatment component.

TABLE 6-1
COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES

ALTERNATIVE*	THRESHOLD CRITERIA				BALANCING CRITERIA				BALANCING CRITERIA (CONTD.)					MODIFYING CRITERIA			
	Overall Protection of Human Health and the Environment		Compliance with ARARs		Long-term Effectiveness and Permanence		Reduction of Toxicity, Mobility, or Volume Through Treatment		Short-term Effectiveness		Implementability		Estimated Cost (using RACER)	State Acceptance		Community Acceptance	
	Comment	Score**	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score	[All Present Worth]	Comment	Score	Comment	Score
1. No Action	This alternative does not provide overall protection of human health and the environment. It will not be in compliance of the ARARs for the proposed remedial aciton and will not achieve the remedial action objectives (RAOs) for this Site within a reasonable time compared to other alternatives. However, since the concentrations and amounts of contaminants in the chlorinated plumes are small, residual risks for on-site groundwater will asymptotically decrease over the long-term through natural attenuation processes. Any adverse impacts to the Six Mile Creek will be minimal in the interim due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek.	1.0	This alternative will not be in compliance of the ARARs for the proposed remedial aciton.	0.0	This alternative will not achieve the RAOs for this Site within a reasonable time compared to other alternatives. However, since the concentrations and amounts of contaminants in the chlorinated plumes are small, residual risks for on-site groundwater will asymptotically decrease over the long-term through natural attenuation processes. Any adverse impacts to the Six Mile Creek will be minimal in the interim due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek.	2.0	No treatment proposed.	0.0	This alternative will not achieve the RAOs for this Site and, thus, will also not be effective in the short-term in protecting human health and the environment during implementation of the alternative.	0.0	This alternative is technically incapable of achieving the RAOs, and is unlikely to receive administrative approvals. The availability of services and materials for implementing this alternative is a non-issue since no action is proposed.	0.0	$50,000 (for administrative work)	This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.		This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.	
2. Institutional Controls (ICs) & Long-Term Monitoring (LTM)	This alternative will provide overall protection of human health and the environment. It will be in compliance of the ARARs and will achieve RAOs. Since the concentrations and amounts of contaminants in the chlorinated plumes are small, residual risks for on-site groundwater will asymptotically decrease over the long-term through natural attenuation processes. Any adverse impacts to the Six Mile Creek will be minimal in the interim due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply, which are expected to remain reliable, adequate, and effective for protection of humans in the long-term.	3.0	This alternative will be in compliance of the ARARs. Although no treatment is proposed, the ICs and LTM will ensure that the proposed protective controls remain in place, that they remain protective, that they are effective in preventing exposure to hazardous substances for as long as the substances at the Site pose a threat to human health and the environment, and that the chlorinated groundwater plume has stabilized or shrinking in extent over time and the overall mass of contamination in the chlorinated plume within contours defined by target cleanup concentration levels is reducing over time due to hydrogeologic and natural attenuation processes, thereby meeting chemical-specific ARARs. Contingency plans will be implemented to ensure that action-specifc ARARs are met, including ensuring that the water in the Six Mile Creek will not exceed surface water standards due to groundwater discharges from the Site. The proposed remedial action will not adversely impact wetlands, floodplains, and fish and wildlife, and will ensure that location-specific ARARs are met.	3.0	Since the concentrations and amounts of contaminants in the chlorinated plumes are small, residual risks for on-site groundwater will asymptotically decrease over the long-term through natural attenuation processes. Any adverse impacts to the Six Mile Creek will be minimal in the interim due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply, which are expected to remain reliable, adequate, and effective for protection of humans in the long-term.	3.0	No treatment proposed. However, LTM will periodically assess site contamination levels and will register any reductions in toxicity, mobility, and/or volume of chlorinated groundwater contamination due to natural attenuation processes that have been determined by the RI to be occurring at the Site.	3.0	The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply, thus preventing unanticipated independent withdrawals of groundwater by individuals. The proposed groundwater use restrictions will be protective of human health during the construction and implementation of the remedy until the RAOs have been met. With regards to the environment, any adverse impacts will be minimal in the short-term due to the low concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek.	3.0	This alternative measures high on technical feasibility, due to the ease of undertaking the proposed action and related future actions, and the ability to monitor its effectiveness with the proposed, well-designed LTM program. The agency managing the property requires a Land-Use Controls/ Institutional Controls program based on a Layering Strategy of mutually reinforcing controls and, therefore, there is a good understanding about coordination of services, enforcement of ICs, and other associated tasks that need to be performed for receiving agency approvals/permits. Thus, this alternative measures moderate to high on administrative feasibility despite the absence of a treatment component. Professional services and materials are easily and competitively available for implementing the ICs and the LTM.	3.0	$1,480,000 (with 30-year LTM)	This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.		This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.	
3. Monitored Natural Attenuation (MNA), with ICs and LTM	This alternative will provide overall protection of human health and the environment. It will be in compliance of the ARARs and will achieve RAOs. The RI has determined that reductive dechlorination is occurring at the Site. Analyses of monitoring data performed in this FS indicate that MNA will achieve site-specific remediation objectives within a time-frame that is reasonable compared to other alternatives. Considering that the concentrations and amounts of contaminants in the chlorinated plumes are small even prior to the implementation of the remedy, residual risks in terms of amounts and concentrations of contaminants remaining in the groundwater at the Site after achieving the RAOs will be minimal. Accordingly, any adverse impacts to the Six Mile Creek through discharge of groundwater from the Site will be negligible. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized.	3.5	This alternative will be in compliance of the ARARs. The RI has determined that reductive dechlorination is occurring at the Site. Analyses of monitoring data performed in this FS indicate that MNA will achieve site-specific remediation objectives within a time-frame that is reasonable compared to other alternatives, thereby meeting chemical-specific ARARs. Contingency plans will be implemented to ensure that action-specifc ARARs are met, including ensuring that the water in the Six Mile Creek will not exceed surface water standards due to groundwater discharges from the Site. The proposed remedial action will not adversely impact wetlands, floodplains, and fish and wildlife, and will ensure that location-specific ARARs are met.	3.5	The RI has determined that reductive dechlorination is occurring at the Site. Considering that the concentrations and amounts of contaminants in the chlorinated plumes are small even prior to the implementation of the remedy, residual risks in terms of amounts and concentrations of contaminants remaining in the groundwater at the Site after achieving the RAOs will be minimal. Accordingly, any adverse impacts to the Six Mile Creek through discharge of groundwater from the Site will be negligible. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply, which are expected to remain reliable, adequate, and effective for protection of humans in the long-term.	3.5	The RI has determined that reductive dechlorination is occurring at the Site. Analyses of monitoring data performed in this FS indicate that "monitored natural attenuation" will achieve site-specific remediation objectives within a time-frame that is reasonable compared to other alternatives, which will result in reductions in toxicity, mobility, and/or volume of chlorinated groundwater contamination at the Site.	3.0	The groundwater monitoring system that will be needed for implementing this alternative is already largely in place. A few additional monitoring wells may need to be installed. As for the case of Alternative 2 (Institutional Controls & LTM), human health will be protected with this alternative during the construction and implementation of the remedy until the RAOs have been met due to public water supply and proposed restrictions on groundwater use. With regards to the environment, any adverse impacts will be minimal in the short-term due to the low concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek.	3.5	This alternative measures high on technical feasibility as in the case of Alternative 2 described above. However, compared to Alternative 2, a greater degree of evaluation is required during its implementation in that the LTM should not only verify continued effectiveness of the remedy in protecting human health and the environment and continued progress towards achieving the RAOs, but it must also demonstrate the continued effectiveness of the MNA. This alternative also measures high on administrative feasibility for reasons cited above for Alternative 2 and also because the MNA is a cost-effective, innovative solution that is increasingly receiving favorable response from the agencies when it can be substantiated through data and/or modeling. Professional services and materials are easily and competitively available for implementing the MNA, ICs, and the LTM.	3.5	$1,565,000 (with 30-year LTM)	This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.		This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.	
4. Air Sparging (AS) & Soil Vapor Extraction (SVE), with ICs and LTM	This alternative will provide overall protection of human health and the environment. It will be in compliance of the ARARs and will achieve RAOs. However, after achieving the RAOs, any residual risks that remain may take longer to undergo natural attenuation compared to alternatives that are based on reductive dechlorination of the contamination since the air sparging process will disturb the existing anaerobic environment in the groundwater, which will need time to restore to its present state. Any adverse impacts to the Six Mile Creek through discharge of groundwater from the Site will be minimal. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply. It is generally effective in the short-term also. Off-gas from SVE is discharged without treatment; however, risks due to this approach will be minimal.	3.5	This alternative will be in compliance of the ARARs. Air sparging and SVE are well-established technologies for achieving site-specific remediation objectives, thereby meeting chemical-specific ARARs. The off-gas from the SVE system will be discharged to the ambient atmosphere; however, the concentrations of contaminants in the discharged vapors will be well below levels prescribed by the Federal and State air regulations. Any residual contamination remaining in the groundwater due to the ineffectiveness of the air sparging technology to remove asymptotically low concentrations will be below applicable groundwater standards. Contingency plans will be implemented to ensure that action-specifc ARARs are met, including ensuring that the water in the Six Mile Creek will not exceed surface water standards due to groundwater discharges from the Site. The proposed remedial action will not adversely impact wetlands, floodplains, and fish and wildlife, and will ensure that location-specific ARARs are met.	4.0	Although air sparging and SVE are well-established remediation technologies, they are ineffective at asymptotically low concentrations. However, after achieving the RAOs, any residual risks that remain may take longer to undergo natural attenuation compared to alternatives that are based on reductive dechlorination of the contamination since the air sparging process will disturb the existing anaerobic environment in the groundwater, which will need time to restore to its present state. Any adverse impacts to the Six Mile Creek will be minimal due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply, which are expected to remain reliable, adequate, and effective for protection of humans in the long-term.	3.5	Air sparging and SVE are well-established technologies that are expected to achieve remediation objectives within relatively short time-frames, in the process reducing the toxicity, mobility, and/or volume of chlorinated groundwater contamination at the Site. All areas of the plumes may be targeted with these technologies.	4.0	This alternative involves construction of 3,185 AS and 1,040 SVE wells, mechanical (compressors and blowers) systems, electrical and other control systems, and all associated piping and appurtenances. Mitigation measures will be taken, including air monitoring, to minimize adverse impacts during implementation. No off-gas treatment is proposed due to low concentrations of contamination in the groundwater; the environment will be minimal to none, although such adverse impacts cannot be eliminated in principle due to potential exposure to fugitive vapors. This alternative is expected to achieve RAOs in a much shorter time (3 years) compared to other alternatives (up to 30 years), thus limiting any adverse impacts due to unlikely exposures to fugitive vapors to a short duration. The Six Mile Creek and the associated environment will be protected during the implementation of this remedy.	3.5	This alternative scores low on technical feasibility because of the extensive construction it entails (installation of 3,185 AS and 1,040 SVE wells, and thousands of feet of associated aboveground and underground piping, as well as numerous fittings, instrumentation, mechanical equipment and systems, electrical and control systems, concrete and other construction work, etc.) and because of the high level-of-effort needed for operating and maintaining the system. It scores well on administrative feasibility since it is a well-established technology, and is considered a presumpting technology by the agencies. This alternative also measures high on administrative feasibility for reasons cited above for Alternative 2. Professional services and materials are easily and competitively available for implementing this alternative.	2.0	$31,090,000 (with 3-year O&M and 5-year LTM)	This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.		This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.	
5. In-Situ Inactive Enhanced Abiotic Degradation using Permeable Reactive Barriers (PRBs), with ICs & LTM	This alternative will provide overall protection of human health and the environment. It will be in compliance of the ARARs and will achieve RAOs. The treatment systems (PRBs) will be designed so that all contaminated groundwater will come into contact with them within the lifetime of the barrier material and undergo remediation. However, since this is an innovative technology, site-specifc treatability studies would be needed, although pilot test data from other sites appears to hold promise. Any adverse impacts to the Six Mile Creek through discharge of groundwater from the Site will be minimal. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized.	4.0	The treatment systems (PRBs) will be designed so that all contaminated groundwater will come into contact with them within the lifetime of the barrier material and undergo remediation. Since this is an innovative technology, the dependability of the PRBs at remaining effective until they come into contact with all contaminated groundwater (15 years), as well as their effectiveness at meeting chemical-specific ARARs are not well-established, although pilot test data from other sites appears to hold promise. Therefore, site-specifc treatability studies would be needed. Contingency plans will be implemented to ensure that action-specifc ARARs are met, including ensuring that the water in the Six Mile Creek will not exceed surface water standards due to groundwater discharges from the Site. The proposed remedial action will not adversely impact wetlands, floodplains, and fish and wildlife, and will ensure that location-specific ARARs are met.	4.0	This alternative employs an innovative technology (PRB/zero-valent for TCE and DCE, and ORC for VC) for achieving the RAOs. The technology enhances the natural degradation processes that are presently occurring at the Site, which will result in minimizing long-term residual risks after the RAOs have been achieved. However, the effectiveness of this technology to achieve the RAOs over the long-term (15-year design period) needs to be established through treatability studies. Any adverse impacts to the Six Mile Creek through discharge of groundwater from the Site in the interim (i.e., after RAOs have been achieved but before residual risks are eliminated) will be minimal. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply, which are expected to remain reliable, adequate, and effective for protection of humans in the long-term.	4.0	This alternative employs an innovative technology (PRB/zero-valent for TCE and DCE, and ORC for VC) to achieve in-situ cleanup and reductions in toxicity, mobility, and/or volume of chlorinated groundwater contamination at the Site. However, since it is a barrier system, coverage and remediation of the entire plume is more dependent on geohydrologic conditions compared to other active technlogies such as air sparging and SVE, which can be implemented with relatively large radii of influence. Also, LTM will periodically assess site contamination levels and will register any reductions in toxicity, mobility, and/or volume of chlorinated groundwater contamination due to natural attenuation processes that have been determined by the RI to be occurring at the Site.	3.5	This alternative involves construction of three (3) 150' L X 45' D X 4' W PRBs downgradient of the TCE and DCE plumes and 60 ORC injection wells (each 45'-deep) over a 100'x55' area for VC plume. Workers will be protected from exposure to chemicals to industry standards during construction. No adverse impacts to the community are expected during construction. Impact to environment will be limited to soil disturbance in excavation areas. Any excavated soils will be analyzed for contamination, and properly disposed of as needed. The human health will be protected with this alternative during the construction and implementation of the remedy; however, due to its innovative nature, treatability studies will need to be conducted to determine potential for achieving RAOs within a reasonable time (15 years). With regards to the environment, the Six Mile Creek will be protected from the migrating plume after the barriers are in place.	4.0	This alternative measures low to moderate on technical feasibility for the following reasons: (i) it is an innovative technology, and the construction of these systems is still an evolving trade; (ii) there is limited design data (e.g., reliable data on required residence times, quantities/concentrations of reactive elements needed, data on preventing unintended side-reactions, etc.) and case-study data (e.g., success stories, failures, etc.), and its effectiveness is still based on an evolving science; (iii) there is no substantial body of reliable long-term field monitoring data and product life-span data (e.g., PRB clogging, becoming inert, etc.), and its implementation is still dependent on an evolving technology, and (iv) bench-scale and/or treatability studies would be required. There is a great impetus on the part of the agencies to encourage and adopt innovative technologies and, therefore, this alternative has a moderate to high administrative feasibility. The choice of vendors for this technology is limited and, thus, the potential for obtaining competitive bids is limited.	3.0	$4,920,000 (with 15-year LTM)	This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.		This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.	

TABLE 6-1
COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES

ALTERNATIVE*	THRESHOLD CRITERIA				BALANCING CRITERIA				BALANCING CRITERIA (CONTD.)					MODIFYING CRITERIA			
	Overall Protection of Human Health and the Environment		Compliance with ARARs		Long-term Effectiveness and Permanence		Reduction of Toxicity, Mobility, or Volume Through Treatment		Short-term Effectiveness		Implementability		Estimated Cost (using RACER)	State Acceptance		Community Acceptance	
	Comment	Score**	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score	[All Present Worth]	Comment	Score	Comment	Score
6. In-Situ Active Chemical Oxidation, with ICs & LTM	This alternative will provide overall protection of human health and the environment. It will be in compliance of the ARARs and will achieve RAOs. This alternative employs an innovative technology (chemical oxidation) to remediate high concentration areas (hot spots) within the TCE, DCE, and VC plumes. In all other respects, this alternative is similar to Alternative 2 (Institutional Controls and LTM) described above.	3.5	This alternative employs an innovative technology (chemical oxidation) for remediating the hot spots. In all other respects, this alternative is similar to Alternative 2 (Institutional Controls and LTM). Thus, as in the case of Alternative 2, the ICs and LTM will ensure that the chemical-specific ARARs are met. Contingency plans will be implemented to ensure that action-specifc ARARs are met, including ensuring that the water in the Six Mile Creek will not exceed surface water standards due to groundwater discharges from the Site. The proposed remedial action will not adversely impact wetlands, floodplains, and fish and wildlife, and will ensure that location-specific ARARs are met.	3.5	This alternative employs an innovative technology (chemical oxidation) for remediating the hot spots. With respect to the lower concentration portions of the plumes, this alternative is similar in implementation and long-term effectiveness to Alternative 2 (Institutional Controls and LTM). Since the concentrations and amounts of contaminants in the chlorinated plumes are small, residual risks for on-site groundwater will asymptotically decrease over the long-term, through natural attenuation processes. Any adverse impacts to the Six Mile Creek will be minimal in the interim due to the low, residual concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek. Property deeded by the USAF has included groundwater use restrictions that ensure that groundwater of unacceptable quality is not utilized. The community and workers will generally be protected since the Site is used for industrial purposes and has public water supply, which are expected to remain reliable, adequate, and effective for protection of humans in the long-term.	3.5	This alternative employs an innovative technology (chemical oxidation) to achieve in-situ cleanup and reductions in toxicity, mobility, and/or volume of chlorinated groundwater contamination at the Site in hot spot areas. However, this technology is only applied to the hot spots within the three plumes (TCE, DEC, and VC). Also, LTM will periodically assess site contamination levels and will register any reductions in toxicity, mobility, and/or volume of residual chlorinated groundwater contamination due to natural attenuation processes that have been determined by the RI to be occurring at the Site.	3.5	This alternative involves construction activity consisting of the injection of two (2) rounds of hydrogen peroxide (50% solution) through 80 injection points in the hot spot areas of TCE, DCE, and VC plumes. Workers will be protected from exposure to chemicals to industry standards during construction. No adverse impacts to the community are expected during construction. The human health will be protected with this alternative during the construction and implementation of the remedy until the RAOs have been met due to public water supply and proposed restrictions on groundwater use. With regards to the environment, any adverse impacts will be minimal in the short-term due to the low concentrations of contamination in the groundwater, low groundwater seepage rates, and dilution in the creek.	3.5	This alternative measures low to moderate on technical feasibility for the following reasons: (i) it is an innovative technology, and the construction of systems based on this technology is still an evolving trade; (ii) there is limited design data (e.g., radius of influence of injection, residence times, quantities/concentrations of reactive elements needed, data on preventing unintended side-reactions, etc.) and case-study data (e.g., success stories, failures, etc.), and its effectiveness is still based on an evolving science; (iii) there is limited long-term field monitoring data, and its implementation is still dependent on an evolving technology, and (iv) bench-scale and/or treatability studies would be required. There is a great impetus on the part of the agencies to encourage and adopt innovative technologies and, therefore, this alternative has a moderate to high administrative feasibility. The materials and professional services needed for applying this alternative are relatively easily available.	3.5	$2,925,000 (with 10-year LTM)	This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.		This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.	
7. Six Mile Creek Horizontal Air Sparging (AS) Barrier, with ICs & LTM	This alternative will provide overall protection of human health and the environment. This alternative seeks to protect the Six Mile Creek from contamination receiving contaminated groundwater from the Site. It will provide protection to the creek from receiving high concentrations of contaminated groundwater; however, considering that (1) the concentrations in the groundwater are low, (2) seepage rates are low, (3) it will undergo dilution in the creek, and (4) the effectiveness of the technology is limited since air sparging is not very efficient at asymptotically low concentrations, this alternative does not add to Alternative 2 (which it resembles in all other respects) substantively in providing protection to the environment.	3.5	This alternative seeks to prevent any groundwater contamination from reaching the Six Mile Creek, by operating an air sparging system through a horizontal well located across the width of the plume immediately upgradient of the creek. With respect to groundwater at the Site, similar to Alternative 2 (Institutional Controls and LTM), the ICs and LTM will ensure that the chemical-specific ARARs are met. Contingency plans will be implemented to ensure that action-specifc ARARs are met, including ensuring that the water in the Six Mile Creek will not exceed surface water standards due to effluent groundwater discharges from the Site. The proposed remedial action will not adversely impact wetlands, floodplains, and fish and wildlife, and will ensure that location-specific ARARs are met.	3.5	This alternative seeks to prevent any groundwater contamination from reaching the Six Mile Creek, by operating an air sparging system through a horizontal well located across the width of the plume immediately upgradient of the creek. This technology is ineffective at asymptotically low concentrations, and thus will have limited impact on contaminant levels in groundwater reaching the creek. This alternative is similar to Alternative 2 in all other respects.	3.0	This alternative seeks to prevent any groundwater contamination from reaching the Six Mile Creek, by operating an air sparging system through a horizontal well located across the width of the plume immediately upgradient of the creek, leading to reduction in toxicity, mobility, and/or volume of chlorinated groundwater contamination at the Site. However, although air sparging is a well-established remediation technology, it is ineffective at asymptotically low concentrations and, thus, will have limited impact in achieving any significant reductions in toxicity, mobility, and/or volume of chlorinated groundwater contamination at the barrier; however, as discussed for Alternative 2, such reductions will occur due to natural attenuation processes that have been determined by the RI to be occurring at the Site.	3.0	The AS technology is ineffective at asymptotically low concentrations, and thus its short-term effectiveness will be limited. While mitigation measures will be taken, including air monitoring, to minimize adverse impacts, during implementation this alternative is potentially less protective of humans relative to other technologies that require lesser level of construction activity. No off-gas treatment is proposed due to low concentrations of contamination in the groundwater; however, potential for adverse impacts from off-gas to humans and environment, although small, cannot be eliminated due to potential exposure to fugitive vapors. The Six Mile Creek and the associated environment will be protected during the implementation of this remedy. No adverse impacts to the community are expected during construction. The human health will be protected with this alternative during the construction and implementation of the remedy until the RAOs have been met due to public water supply and proposed restrictions on groundwater use.	3.5	This alternative scores moderate to high on technical feasibility because it is relatively easy to implement and drilling of a horizontal well is also an established technology. It entails construction and operation and maintenance of mechanical and electrical systems, along with construction of the well and associated piping, which lowers its technical feasibility. It scores well on administrative feasibility since it is a well-established technology, and is considered a presumpting technology by the agencies. This alternative also measures high on administrative feasibility for reasons cited above for Alternative 2. Professional services and materials are easily and competitively available for implementing this alternative.	3.5	$2,785,000 (with 30-year O&M and LTM)	This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.		This criterion will be addressed in the ROD, after comments on the RI/FS report and the Proposed Plan.	

* All the alternatives, except the No Action alternative, include a 5-year review to determine its effectiveness and/or progress towards achieving the RAOs for the Site.
**Scoring: 0 = the worst, i.e. least successful and 4 = the best, i.e. most successful

* All the alternatives, except the No Action alternative, include a 5-year review to determine its effectiveness and/or progress towards achieving the RAOs for the Site.
**Scoring: 0 = the worst, i.e. least successful and 4 = the best, i.e. most successful

TABLE 6-2
SELECTION OF RECOMMENDED REMEDIAL ALTERNATIVES

ALTERNATIVE	EFFECTIVENESS: Overall Protection of Human Health and the Environment	EFFECTIVENESS: Compliance with ARARs	EFFECTIVENESS: Long-term Effectiveness and Permanence	EFFECTIVENESS: Reduction of Toxicity, Mobility, or Volume Through Treatment	EFFECTIVENESS: Short-term Effectiveness	Total Effectiveness Score	ESTIMATED COST	COST-EFFECTIVENESS OF REMEDIAL ALTERNATIVE [= Total Effectiveness Score per One Million Dollars of Estimated Cost]	IMPLEMEN-TABILITY	RECOMMENDATIONS/ COMMENTS
	Score*	Score	Score	Score	Score	Total Score	[Present Worth]		Score	
1. No Action	1.0	0.0	2.0	0.0	0.0	3.0	$50,000 (admin.)	Not Applicable - no remedial action	0.0	REJECTED ALTERNATIVE. Not effective or implementable.
2. Institutional Controls (ICs) & Long-Term Monitoring (LTM)	3.0	3.0	3.0	3.0	3.0	15.0	$1,480,000 (with 30-year LTM)	10.1	3.0	VIABLE ALTERNATIVE, BUT CEDED IN FAVOR OF ALTERNATIVE 3. Judged to be second-most cost-effective alternative. Although total estimated costs are lower by $85,000 (approximately 5%) compared to Alternative 3, this marginal cost advantage is overridden by the slightly greater cost-effectiveness and implementability of Alternative 3. Also, Alternative 3 includes treatment as part of the remedial response. Therefore, cede Alternative 2 in favor of Alternative 3.
3. Monitored Natural Attenuation (MNA), with ICs and LTM	3.5	3.5	3.5	3.0	3.5	17.0	$1,565,000 (with 30-year LTM)	10.9	3.5	RECOMMENDED ALTERNATIVE. This alternative is protective of human health and the environment, is judged to be the most cost-effective among all alternatives considered, measures high on technical and adminstrative implementability, and includes treatment as part of the remedial response.
4. Air Sparging (AS) & Soil Vapor Extraction (SVE), with ICs and LTM	3.5	4.0	3.5	4.0	3.5	18.5	$31,090,000 (with 3-year O&M and 5-year LTM)	0.6	2.0	REJECTED ALTERNATIVE. The second-most effective alternative among all considered. However, the estimated remedial costs are an order of magnitude higher compared to other alternativess and approximately 20 times the costs for Alternative 3, with only a marginal increase in effectiveness. This alternative has the highest total costs ($32 million), lowest cost-effectiveness, and lowest implementability among all the alternatives considered (except Alternative 1 - No Action). Rejected.
5. In-Situ Inactive Enhanced Abiotic Degradation using Permeable Reactive Barriers (PRBs), with ICs & LTM	4.0	4.0	4.0	3.5	4.0	19.5	$4,920,000 (with 15-year LTM)	4.0	3.0	REJECTED ALTERNATIVE. The most effective alternative among all considered. However, the estimated remedial costs are triple (3x) the costs for Alternative 3, with only a marginal increase in effectiveness. Alternatives 6 and 7 are available to serve as contingencies for the recommended alternative (Alternative 3), since both of them have lower total estimated costs, higher effectiveness-to-cost ratios, and slightly higher implementability compared to this alternative. Rejected.
6. In-Situ Active Chemical Oxidation, with ICs & LTM	3.5	3.5	3.5	3.5	3.5	17.5	$2,925,000 (with 10-year LTM)	6.0	3.5	RECOMMENDED ALTERNATE CONTINGENCY ALTERNATIVE. This alternative is the third-most effective alternative. The total estimated cost for this alternative is almost twice for that for the recommended alternative, but is within the range of acceptability in terms of the total amount. Its implementability is about the same as that for the recommended alternative. It is recommended that a selected remedy have a contingency plan that can be implemented to meet the remedial action goals, if it is determined after implementation of the selected remedy that they cannot be met by the selected remedy alone. In particular, the recommended alternative (Alternative 3), which is MNA, is recommended to have a contingency plan. Therefore, this alternative (Alternative 6) is recommended as the alternate contingency alternative for its cost effectiveness, in the event natural attenuation has ceased at the site.
7. Six Mile Creek Horizontal Air Sparging (AS) Barrier, with ICs & LTM	3.5	3.5	3.0	3.0	3.5	16.5	$2,785,000 (with 30-year O&M and LTM)	5.9	3.5	RECOMMENDED PRIMARY CONTINGENCY ALTERNATIVE. This alternative has a reasonable effectiveness-to-cost ratio and implementability. In addition, it has the advantage of acting as a last line of defense in the most unlikely scenario of the Six Mile Creek being adversely impacted by groundwater discharges from the Site. Reliable monitoring data collected over a period of several years indicate that the chlorinated plumes are stable or shrinking, and that the concentrations are low and decreasing over time. However, this alternative is retained as a recommended primary contingency alternative if the RAOs cannot be met by the recommended alternative (Alternative 3) or if surface water standards in the creek are exceeded.

*Scoring: 0 = the worst, i.e. least successful and 4 = the best, i.e. most successful

It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plumes Site by source materials, thus obviating the need for any source control measures and rendering USEPA's first expectation to use treatment moot with respect to source materials. Thus, any treatment component included in the remedial alternative only serves to further enhance its protectiveness of human health and the environment by treating the plume containing relatively low concentrations and amounts of contamination within the vicinity of the original source and at locations away from it, as appropriate.

- <u>Alternative Three</u> – The RI has determined that reductive dechlorination is occurring at the Site. In addition, the evaluations in this FS further support the feasibility of MNA as a remedy for this Site. Together with ICs and LTM, this alternative will be protective of human health and the environment. Hence, it is assigned a score of 3.5, which is a higher score than that for Alternative 2 since it includes treatment (MNA).

- <u>Alternative Four</u> – This alternative will provide overall protection of human health and the environment since the entire plume will be actively remediated. In addition, it includes ICs and LTM to further the protection. However, since this alternative (which involves air sparging) can potentially destabilize the existing subsurface environment that is conducive to reductive dechlorination of the chlorinated plume in its natural state (although this is no longer critical if the plume is remediated), and since off-gas will be discharged to the atmosphere without treatment (although the concentrations in emissions will be minimal), a score of 3.5 was assigned (instead of the maximum score of 4.0).

- <u>Alternative Five</u> – This alternative will provide overall protection of human health and the environment. In addition, the PRBs will treat the relatively high concentration zones of the plumes without any adverse impacts. In addition, it includes ICs and LTM to further the protection. Hence, this alternative was deemed the best among all considered at meeting the objectives of this criterion with minimal or no adverse side-effects and, accordingly, was assigned the maximum score of 4.0.

- <u>Alternative Six</u> – This alternative will provide overall protection of human health and the environment. The chemical oxidation applied in the relatively high concentration areas of the plumes will achieve rapid remediation. In addition, it includes ICs and LTM to further the protection. However, the chemicals must be stored and handled with care to prevent accidents. Hence, this alternative was assigned a score of 3.5 (instead of the maximum score 4.0).

- <u>Alternative Seven</u> – Similar to Alternative 2, which it closely resembles except for the horizontal air sparging barrier located immediately upgradient of the Six Mile Creek, this alternative will provide overall protection of human health and the environment. However, since it includes treatment at the downgradient edge of the plume to protect the Six Mile Creek from receiving high concentrations of contamination (although this is considered unlikely), it scored higher than Alternative 2 for this criterion; accordingly, it is assigned a score of 3.5.

6.3.2.2 Compliance with ARARs

- Alternative One – This alternative will not be in compliance with the ARARs. Therfore, it is assigned a score of 0.0.

- Alternative Two – This alternative (ICs and LTM) will be in compliance of the ARARs (discussed in detail in Table 6-1). However, they will be met over a long period of time (30 years) and minimal impacts due to residual contamination may occur in the interim (albeit at levels low enough not to adversely impact the overall protection of human health and the environment). Therefore, it is assigned a score of 3.0.

- Alternative Three – This alternative (MNA) will be in compliance of the ARARs. Analyses of monitoring data performed in this FS indicate that MNA will achieve site-specific remediation within a time-frame that is reasonable compared to other alternatives. In addition, this alternative also includes ICs and LTM (same as for Alternative 2). However, the remediation time-frame (estimated 30 years) for this alternative is longer than that for other alternatives, e.g., alternatives based on more active remediation. Therefore, this alternative is assigned a score of 3.5, which is a higher score than that for Alternative 2 since it includes treatment (MNA), but less than the score for other alternatives that are estimated achieve ARARs in a shorter period of time.

- Alternative Four – This alternative (AS/SVE) will be in compliance of the ARARs, as discussed in detail in Table 6-1. Site closure is estimated to be achieved within five (5) years of start of remedy. Hence, this alternative was given the maximum score of 4.0.

- Alternative Five – This alternative (PRBs) will be in compliance of the ARARs, as discussed in detail in Table 6-1. Site closure is estimated to be achieved within 15 years, which is 15 years less than that for Alternative 2. Although this alternative is estimated to achieve compliance of the ARARs in a longer time-period compared to Alternative 4, it is considered to be a reasonably moderate time-frame for achieving the ARARs and, hence, this alternative was also given the maximum score of 4.0.

- Alternative Six – This alternative (ISCO) will be in compliance of the ARARs, as discussed in detail in Table 6-1. Site closure is estimated to be achieved within 10 years, which is 20 years less than that for Alternative 2, which is considered to be a reasonably moderate time-frame for achieving compliance of the ARARs. However, the ISCO will potentially destabilize the exisiting subsurface environment that is presently conducive to reductive dechlorination of chlorinated organics contamination and, thus, any residual contamination that may remain is likely to take longer to achieve acompliance of the ARARs. The AS/SVE system (Alternative 4) can also similarly destabilize the existing system; however, the AS/SVE system is well established and is estimated to achieve the ARARs in a shorter time (five years). This alternative also includes ICs and LTM

(Alternative 2). Hence, this alternative (Alternative 6) is assigned a score of 3.5, which is higher than that for Alternative 2, but less than the maximum score.

- Alternative Seven – Similar to Alternative 2, which it closely resembles except for the horizontal air sparging barrier located immediately upgradient of the Six Mile Creek, this alternative will be in compliance of the ARARs (discussed in detail in Table 6-1), but they will be met over a long period of time (30 years). However, this alternative will protect the creek from even a minimal residual contamination and will be in compliance of location-specific ARARs to a greater degree than Alternative 2. Therefore, it is assigned a score of 3.5, which is higher than for Alternative 2, but less than the maximum score.

6.3.2.3 Long-Term Effectiveness and Permanence

- Alternative One – This alternative will not be achieve the RAOs for this Site within a reasonable time compared to other alternatives. However, the residual contamination at the Site is likely to decrease asymptotically over time due to natural attenuation process, whereupon long-term effectiveness and permanence will be maintained by default. Therfore, it is assigned a score of 2.0.

- Alternative Two – Upon implementing the ICs and LTM, any immediate risks are eliminated, and residual risks due to low concentration of contaminants are estimated to decrease asymptotically over an estimated LTM period of 30 years, after which long-term effectiveness and permanence will be maintained. However, since no treatment is included, reliance for long-term effectiveness and permanence mainly rests on maintaining the ICs for the foreseeable future. Therefore, this alternative is given a score of 3.0.

- Alternative Three – Once treatment (MNA) is accomplished and the RAOs are met, long-term effectiveness and permanence are established since the contaminants have been permanently degraded to levels below the cleanup goals. However, the remediation time-frame (estimated 30 years) for this alternative is longer than that for other alternatives, e.g., alternatives based on more active remediation and, thus, this alternative has less certainty than the others with shorter estimated time-frames as to how quickly long-term effectiveness and permanence are irreversibly established. Therefore, this alternative is assigned a score of 3.5, which is a higher score than that for Alternative 2 since it includes treatment (MNA), but less than the maximum score.

- Alternative Four – This alternative (AS/SVE) will rapidly achieve cleanup goals. However, AS is less effective at asymptotically low concentrations, and any residual risks that remain may take longer to naturally attenuate since air sparging will disturb the existing anaerobic environment in the groundwater, which will need time to restore to its natural state. Therefore, this alternative is assigned a score of 3.5, which is a higher score than that for Alternative 2 since it includes treatment (MNA), but less than the maximum score.

- Alternative Five – This alternative (PRBs) enhances the natural degradation processes that are occurring at the Site without any detrimental side effects. Once the RAOs are met (in the estimated 15 years), long-term effectiveness and permanence will be maintained. Therefore, this alternative is judged to be the best at fulfilling the requirements of this criterion and, accordingly, is assigned the maximum score of 4.0.

- Alternative Six – This alternative is estimated to achieve the RAOs resulting in site closure within 10 years, after which long-term effectiveness and permanence will be maintained. However, any residual risks that remain may take longer to naturally attenuate since chemical oxidation will disturb the existing anaerobic environment in the groundwater, which will need time to restore to its natural state. Therefore, this alternative is assigned a score of 3.5, which is a higher score than that for Alternative 2 since it includes treatment (ISCO), but less than the maximum score.

- Alternative Seven – This alternative is similar to Alternative 2, except that a horizontal air sparging barrier located immediately upgradient of the Six Mile Creek will provide an additional degree of protection to the creek from groundwater discharges. The long-term effectiveness and permanence of this remedy will be similar to that for Alternative 2 and, therefore, it is assigned a score of 3.0, which is same as that for Alternative 2.

6.3.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

- Alternative One – No treatment is proposed. Therfore, it is assigned a score of 0.0.

- Alternative Two – No treatment is proposed. However, based on the RI and analyses conducted in this FS, the chlorinated plume is estimated to naturally attenuate in 26 years and attain closure within 30 years. As discussed in Section 5, the natural attenuation processes at the Site include reductive dechlorination leading to reduction in toxicity, mobility, and volume of contaminants to that extent. Also, LTM will periodically assess site contamination levels to register any reductions in toxicity, mobility, and volume of contaminants. Therefore, this alternative is given a score of 3.0.

- Alternative Three – The RI has determined that reductive dechlorination is occurring at the Site. Per the analyses conducted in this FS, MNA will achieve the RAOs in a reasonable time-frame compared to other alternatives, resulting in reductions in toxicity, mobility, and volume of the chlorinated contaminants at the Site. However, degradation is only one component of the MNA, and occurs less rapidly and with less engineering control compared to other alternatives involving direct treatment methods. Therefore, this alternative is given a score of 3.0, which is the same score as that for Alternative 2.

- Alternative Four – This alternative (AS/SVE) will rapidly achieve cleanup goals, and is considered to have the greatest potential among all the alternatives for reducing the toxicity, mobility, and volume of the chlorinated contaminants at the Site. Hence, it is given the maximum score of 4.0.

- Alternative Five – This alternative (PRBs) is designed to achieve in-situ cleanup and reductions in toxicity, mobility, and volume of the chlorinated contaminants at the Site. However, this alternative is less subject to engineering controls and more dependent on in-situ geohydrologic and other natural conditions compared to Alternative 4; at the same, it accomplishes greater reductions compared to alternative 2, which is mainly dependent on natural processes. Therefore, this alternative is assigned a score of 3.5, which is higher than that for Alternative 2 but less than that for Alternative 4.

- Alternative Six – This alternative is designed to achieve in-situ cleanup and reductions in toxicity, mobility, and volume of the chlorinated contaminants at the Site. However, the ISCO treatment is only applied in higher concentration areas of the plumes, whereas AS/SVE is applied in all areas of the plumes. Therefore, this alternative is assigned a score of 3.5, which is higher than that for Alternative 2 but less than that for Alternative 4.

- Alternative Seven – This alternative is similar to Alternative 2, except that a horizontal air sparging barrier located immediately upgradient of the Six Mile Creek will provide an additional degree of protection to the creek from groundwater discharges. The reduction in toxicity, mobility, and volume of the chlorinated contaminants will be similar to that for Alternative 2 and, therefore, it is assigned a score of 3.0, which is same as that for Alternative 2.

6.3.2.5 Short-Term Effectiveness

- Alternative One – This alternative will not achieve the RAOs and, thus, will also not be effective in the short-term in protecting human health and the environment during implementation of the alternative. Therefore, it is assigned a score of 0.0.

- Alternative Two – The community and workers will be protected because of groundwater use restrictions and other ICs. The groundwater monitoring system needed for the LTM is already largely in place; thus, any short-term construction-related adverse impacts are minimized. No treatment is proposed; however, minimal adverse impacts are expected in the short-term from groundwater discharges to the Six Mile Creek. Therefore, this alternative is given a score of 3.0.

- Alternative Three – The community and workers will be protected because of groundwater use restrictions and other ICs. The groundwater monitoring system needed for the LTM is already largely in place; thus, any short-term construction-related adverse impacts are minimized. Treatment by MNA is proposed, which affords an additional layer of protection to humans and the environment from short-term adverse impacts compared to Alternative 2. However, treatment by MNA occurs less rapidly and with less engineering control compared to other alternatives involving direct treatment methods. Therefore, this alternative is given a score of 3.5, which is higher than that for Alternative 2, but less than the maximum score of 4.0.

- Alternative Four – This alternative (AS/SVE) involves extensive construction work related to installation of AS and SVE wells and associated systems. However, mitigation measures will be taken, including air monitoring, to minimize adverse impacts during construction. No off-gas treatment is proposed; however, any adverse short-term impacts are considered to be minimal due to low residual concentrations in groundwater. Therefore, this alternative is also given a score of 3.5.

- Alternative Five – This alternative (PRBs) involves construction of three (3) in-situ zero-valent iron PRB barriers and one in-situ ORC® barrier. As detailed in Table 6-1, safety and mitigation measures will be taken to protect workers and community during construction activities. In general, this alternative will perform treatment and achieve the RAOs while mitigating any short-term adverse impacts. Therefore, this alternative is given a maximum score of 4.0.

- Alternative Six – This alternative (ISCO) involves construction activity for the purpose of injecting hydrogen peroxide (or other approved chemical oxidant) into the higher concentration areas of the chlorinated plume. The chemical oxidants require careful handling and storage, which shall be done to industry standards. Also, workers will be protected from the chemicals during construction; they will also be trained in this regard. Minimal adverse impacts are expected in the short-term from groundwater discharges to the Six Mile Creek. Therefore, this alternative is assigned a score of 3.5.

- Alternative Seven – This alternative is similar to Alternative 2, except that a horizontal air sparging barrier located immediately upgradient of the Six Mile Creek will provide an additional degree of protection to the creek from groundwater discharges. Mitigation measures will be taken during construction of the barrier system. Short-term impacts to the considered minimal; the Six Mile Creek will be protected during construction. No off-gas treatment is provided; however, no adverse impacts arising from this are expected. Therefore, this alternative is assigned a score of 3.5.

6.3.2.6 Implementability

- Alternative One – This alternative will not achieve the RAOs and is unlikely to receive administrative approvals. Therefore, it is assigned a score of 0.0.

- Alternative Two – As discussed in detail in Table 6-1, the technical implementability of this alternative is high because of the ease of undertaking the proposed action and, although no treatment is included, it measures moderate to high on administrative feasibility in terms of understanding and capability to implement ICs and LTM. Therefore, this alternative is given a score of 3.0.

- Alternative Three – Similar to Alternative 2, and as discussed in detail in Table 6-1, this alternative is also high on technical feasibility because of the ease of undertaking the proposed action. However, a greater degree of evaluation and oversight is required during its implementation to demonstrate and confirm the effectiveness of the remedy. This alternative measures high on administrative feasibility because the MNA is a cost-effective and innovative remedial treatment option that is increasingly receiving favorable response from the agencies. Therefore, this alternative is given a score of 3.5, which is higher than that for Alternative 2, but less than the maximum score of 4.0.

- Alternative Four – As discussed in Table 6-1, this alternative (AS/SVE) scores low on technical implementability because of the extensive construction it entails. Therefore, although it scores high on administrative feasibility since it is a well-established technology and is considered a presumptive technology by the agencies, it is assigned a score of 2.0.

- Alternative Five – As discussed in Table 6-1, this alternative has low to moderate technical implementability, primarily owing to the fact that it is an innovative technology (PRB) with limited design data and limited case-study data on long-term performance. It has moderate to high administrative feasibility because of the interest on the part of agencies to encourage adoption of innovative technologies. Therefore, this alternative is given a score of 3.0, which is the same score as that for Alternative 2 (Alternative 5 is harder to implement technically and easier to implement administratively, while the opposite is approximately true for Alternative 2).

- Alternative Six – As discussed in Table 6-1, similar to Alternative 5, this alternative has low to moderate technical implementability, primarily owing to the fact that it is an innovative technology (ISCO) with limited design and case-study data. It has moderate to high administrative feasibility because of the interest on the part of agencies to encourage adoption of innovative technologies. However, unlike the case for Alternative 5 for which the choice of vendors is limited, the materials and professional services needed for applying this alternative are relatively easily available. Therefore, this alternative is given a score of 3.5.

- Alternative Seven – This alternative scores moderate to high on technical implementability because installing horizontal wells is a fairly well-established technology. It also scores high on administrative feasibility to the extent that it is based on an established technology (AS). In other respects, this alternative is similar to Alternative 2 for implementability. Therefore, this alternative is assigned a score of 3.5.

6.3.2.7 Costs

Note: All costs are reported on present-worth basis. The cost estimates were prepared using RACER and are considered accurate at the time this report was prepared. The costs reflect the descriptions for the alternatives provided in Section 6.2 above. The cost estimate sheets appear in Appendix F.

- Alternative One – This alternative has no associated costs. A nominal cost of $50,000 was assumed for administrative expenses.

- Alternative Two – The estimated cost for this alternative is approximately $1,480,000, including costs for 30 years of LTM.

- Alternative Three – The estimated cost for this alternative is approximately $1,565,000, including costs for 30 years of MNA/LTM.

- Alternative Four – The estimated cost for this alternative is approximately $31,090,000, including costs for three (3) years of O&M for the AS/SVE system and total five (5) years of LTM since system startup.

- Alternative Five – The estimated cost for this alternative (PRBs) is approximately $4,920,000, including costs for 15 years of LTM.

- Alternative Six – The estimated cost for this alternative (ISCO) is approximately $2,925,000, including costs for 10 years of LTM.

- Alternative Seven – The estimated cost for this alternative (horizontal AS barrier near the Six Mile Creek) is approximately $2,785,000, including costs for 30 years of LTM.

6.4 Selection of Recommended Alternatives

The evaluations that were performed for the selection of recommended alternatives are discussed below and summarized in Table 6-2.

Following the methodology described in Section 6.3.1 for selecting the recommended alternatives, first, for each alternative a total effectiveness score was determined by adding the scores from Table 6-1 for the overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. The cost-effectiveness ratio of total effectiveness score to estimated cost in millions of dollars was computed next (Table 6-2); the higher the total effectiveness score to estimated cost ratio for a given alternative, the more cost effective would be that alternative relative to others with lower ratios.

Finally, taking into consideration the detailed comparative evaluations that were performed in Section 6.3.2 and Table 6-1, the cost-effectiveness ratios and implementability scores for the alternatives from Table 6-2, and the inherent limitations and qualitative nature of the ranking methodology (discussed in Section 6.3.1), an overall assessment was qualitatively performed using professional judgment and past experience for each alternative to determine its potential for meeting the program goals and the RAOs, while being cost-effective and implementable. The recommended alternatives are discussed below and summarized in Table 6-2.

- **Alternative One – No Action**

  REJECTED ALTERNATIVE.

  No action would not reduce the potential for future groundwater contamination or potential exposure of humans and the environment to contaminated groundwater. It is not effective or implementable. Therefore, this alernative is rejected.

- **Alternative Two – Institutional Controls (ICs) and Long-Term Monitoring (LTM)**

  VIABLE ALTERNATIVE, BUT CEDED IN FAVOR OF ALTERNATIVE 3.

  The ICs and LTM will provide overall protection of human health and the environment considering that the Site is dedicated for industrial use, groundwater will not be permitted to be used as drinking water, and residual concentrations of contaminants are low and, thus, unlikely to adversely impact the environment.

  Based on an assessment of this alternative with regard to fulfilling the requirements of the individual evaluation criteria, the cost-effectiveness of this alternative is considered to be a close second to Alternative 3. Although total estimated costs are lower compared to Alternative 3, this marginal cost advantage is overridden by the slightly greater cost-effectiveness and implementability of Alternative 3. Also, Alternative 3 includes treatment as part of the remedial response. Therefore, Alternative 2 is ceded in favor of Alternative 3.

  It is noted in this context that, as was discussed earlier in Section 6.1.1, there are no principal threats posed at the chlorinated plumes Site by source materials, thus obviating the need for any source control measures and rendering USEPA's first expectation to use treatment moot with respect to source materials. Thus, any treatment component included in the remedial alternative only serves to further enhance its protectiveness of human health and the environment by treating the plume containing relatively low concentrations and amounts of contamination within the vicinity of the original source and at locations away from it, as appropriate.

- **Alternative Three – Monitored Natural Attenuation (MNA), with ICs and LTM**

  RECOMMENDED ALTERNATIVE.

  The RI has determined that reductive dechlorination is occurring at the Site. In addition, the evaluations in this FS further support the feasibility of MNA as a remedy for this Site. Together with ICs and LTM, this alternative will be protective of human health and the environment.

  This alternative is judged to be the most cost-effective among all the alternatives that were considered in this FS. Its total estimated cost ($1,565,000) is also only marginally greater than that for Alternative 2 ($1,480,000). It is high on technical feasibility because of the ease of undertaking the proposed action, and also measures high on administrative feasibility because the MNA is a cost-effective and innovative remedial treatment option that is increasingly receiving favorable response from the agencies. Therefore, this alternative is selected as the recommended alternative for remediation of the Nosedocks / Apron 2 Chlorinated Plume Site at the former Griffiss AFB.

Please note that, as was discussed in Section 6.2.3, if this alternative is implemented at the Site, the analytical data collected as part of the MNA/LTM program will be used annually to assess the status and progress of MNA, and a comprehensive review of the remedy will be performed every five (5) years to ensure that human health and the environment are being protected by the remedial response. If, upon such assessments and reviews, it is determined that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in a timely manner (i.e., in a reasonable time compared to other potential remedies), contingency plans will then be implemented consistent with the ROD. Towards this end, as will be discussed below, Alternative 7 is selected as the recommended primary contingency alternative, and Alternative 6 is selected as the recommended alternate contingency alternative.

On the other hand, if upon such review it is determined that the Site has attained a status that is protective of the human health and the environment, then the Site will be recommended for closure following the requirements for closure contained in the ROD, even if this were to occur earlier than the proposed 30-year MNA/LTM period.

- **<u>Alternative Four</u> – Air Sparging (AS) and Soil Vapor Extraction (SVE), with ICs and LTM**

  REJECTED ALTERNATIVE.

  This alternative will provide overall protection of human health and the environment since the entire plume will be actively remediated, and is judged to be the second-most effective alternative among all considered. In addition, it includes ICs and LTM to further the protection. However, this alternative can potentially destabilize the existing subsurface environment that is at present conducive to reductive dechlorination of the chlorinated plume in its natural state, which can be a detriment to any future cleanup operations based on reductive dechlorination and/or natural attenuation unless the proposed treatment by AS/SVE is taken to completion.

  It is judged to be the least cost-effective among all alternatives considered, and its total estimated cost ($31,090,000) exceeds the total estimated costs for all other alternatives by an order of magnitude. Although it has high administrative feasibility, it scores low on technical implementability because of the extensive construction and O&M work that is involved. Hence, this alternative is rejected.

- **Alternative Five – In-Situ Inactive Enhanced Abiotic Degradation using Permeable Reactive Barriers (PRBs), with ICs and LTM**

  REJECTED ALTERNATIVE.

  This alternative will provide overall protection of human health and the environment, and is judged to be the most effective alternative among all considered. The PRBs will treat the relatively high concentration zones of the plumes without any adverse impacts. In addition, it includes ICs and LTM to further the protection. However, it is judged to rate near the lower end on cost-effectiveness and the total estimated costs are triple the costs for Alternative 3 (recommended alternative), with only a marginal increase in effectiveness. This alternative has low to moderate technical implementability, primarily owing to the fact that it is an innovative technology (PRB) with limited design data and limited case-study data on long-term performance, and moderate to high administrative feasibility because of the interest on the part of agencies to encourage adoption of innovative technologies.

  The high effectiveness, moderate implementability, and only moderately high costs makes this alternative a potential choice as a recommended contingency alternative. However, Alternatives 6 and 7 are available to serve as contingencies for the recommended alternative (Alternative 3), since both of them have lower total estimated costs, higher effectiveness-to-cost ratios, and slightly higher implementability compared to Alternative 5. Therefore, this alternative is rejected.

- **Alternative Six – In-Situ Active Chemical Oxidation, with ICs and LTM**

  RECOMMENDED ALTERNATE CONTINGENCY ALTERNATIVE.

  This alternative will provide overall protection of human health and the environment. The chemical oxidation applied in the relatively high concentration areas of the plumes will achieve rapid remediation. In addition, it includes ICs and LTM to further the protection. However, the chemicals must be stored and handled with care to prevent accidents.

  It is judged to be the third-most effective alternative among all alternatives considered, and is also considered to be the third-most cost effective solution and at par with Alternative 7 in this regard. However, the total estimated cost is slightly greater than that for the recommended alternative (Alternative 3), with only a marginal increase in effectiveness. As discussed in Table 6-1, similar to Alternative 5, this alternative has low to moderate technical implementability, primarily owing to the fact that it is an innovative technology (ISCO) with limited design and case-study data, and moderate to high administrative feasibility because of the interest on the part of agencies to encourage adoption of innovative technologies. However, unlike the case for Alternative 5 for which the choice of vendors is limited, the materials and professional services needed for applying this alternative are relatively easily available.

Based on the discussions in the above paragraph, this alternative is rejected as a primary remedial alternative, but is retained for consideration as a potential contingency alternative. Compared to Alternative 5, both Alternatives 6 and 7 are available to serve as more preferable contingencies for the recommended alternative (Alternative 3), since both of them have lower total estimated costs, higher effectiveness-to-cost ratios, and slightly higher implementability. Although this alternative (Alternative 6) has a slightly higher overall cost ($2,925,000) compared to Alternative 7 ($2,785,000), this alternative can be used if natural attenuation has stopped as implmentation of this technology may have long-term affects on natural biodegradation mechanisms in the subsurface. As discussed in previous sections, ISCO is expected to reduce toxicity, mobility, and volume of the chlorinated contaminants at the site. Therefore, this alternative (Alternative 6) is selected as the recommended alternate contingency alternative for remediation of the Nosedocks / Apron 2 Chlorinated Plume Site at the former Griffiss AFB.

- **Alternative Seven – Six Mile Creek Horizontal Air Sparging (AS) Barrier, with ICs and LTM**

  RECOMMENDED PRIMARY CONTINGENCY ALTERNATIVE.

  Similar to Alternative 2, which it closely resembles except for the horizontal air sparging barrier located immediately upgradient of the Six Mile Creek, this alternative will provide overall protection of human health and the environment. However, since it includes treatment at the downgradient edge of the plume to protect the Six Mile Creek from receiving high concentrations of contamination (although this is considered unlikely), it is judged to be slightly more effective than Alternative 2. It is less effective compared to the recommended alternative (Alternative 3) which includes treatment of the overall plume. Also, it is less cost-effective compared to Alternative 3, with total estimated costs exceeding those for Alternative 3 by more than one-and-a-half times. This alternative scores moderate to high on technical implementability because installing horizontal wells is a fairly well-established technology. It also scores high on administrative feasibility to the extent that it is based on an established technology (AS).

  Based on the discussions in the above paragraph, this alternative is rejected as a primary remedial alternative, but is retained for consideration as a potential contingency alternative. Compared to Alternative 5, both Alternatives 6 and 7 are available to serve as more preferable contingencies for the recommended alternative (Alternative 3), since both of them have lower total estimated costs, higher effectiveness-to-cost ratios, and slightly higher implementability. Alternative 7 has slightly lower overall costs ($2,785,000) when compared to Alternative 6 ($2,925,000) and provides treatment at the downgradient edge of the plume only. This alternative will provide an additional degree of protection to Six Mile Creek from groundwater discharges, suggesting this alternative may be used successfully in combination with other treatment alternatives as a polishing step. In the event, surface water standards in the creek are exceeded, Alternative 7 can be implemented ot further enhance treatment provided by the recommended Alternative 3

(Monitored Natural Attenuation). Therefore Alternative 7 is selected as the primary contingency alternative and Alternative 6 is selected as the alternate contingency alternative for remediation of the Nosedocks/Apron 2 Chlorinated Plume Site at the former Griffiss AFB.

6.5 Summary of Recommended Alternatives and Implementation Measures

Based on the evaluations in Section 6.4, the following are the results of the detailed analyses of alternatives:

RECOMMENDED ALTERNATIVE:

- Alternative Three **–** Monitored Natural Attenuation (MNA), with ICs and LTM

  Implement upon completion of all tasks that are required and needed to be completed prior to design and construction of the system, including but not limited to the following steps: receive and address comments on the RI/FS report(s); prepare, present, and receive comments on the Proposed Remedial Action Plan (PRAP or Proposed Plan); prepare Record of Decision, including evaluating state and community acceptance criteria based on comments received on the RI/FS report(s) and Proposed Plan, identifying the selected primary and contingency remedies, and specifying the procedures, requirements, and protocols for performing, monitoring, and concluding remedial action.

RECOMMENDED PRIMARY CONTINGENCY ALTERNATIVE:

- Alternative Seven **–** Six Mile Creek Horizontal Air Sparging (AS) Barrier, with ICs and LTM

  To be implemented only if it is determined based on annual and five-year reviews of MNA/LTM performance that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in a timely manner (i.e., in a reasonable time compared to other potential remedies) or if surface water standards in the creek are exceeded.

RECOMMENDED ALTERNATE CONTINGENCY ALTERNATIVE:

- Alternative Six **–** In-Situ Active Chemical Oxidation (ISCO), with ICs and LTM

  To be implemented only if it is determined based on annual and five-year reviews of MNA/LTM performance that the selected remedy needs to be complemented and/or supplemented with other actions in order to achieve the RAOs in a timely manner (i.e., in a reasonable time compared to other potential remedies).

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APPENDIX A

NOSEDOCKS/APRON 2 CHLORINATED PLUME SAMPLING RESULTS
FEBRUARY 2003 – SEPTEMBER 2004

Appendix A
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-76								782VMW-77					
Sample ID			NA	782VMW7638BA	782M7620CA	782M7620DA	782M7638EA	782M7638FA	782M7638GA	782M7638HA	NA	782VMW7730BA	782VM7730CA	782M7730DA	782M7730EA	782M7730FA
Date of Collection			2/26/2002	2/4/2003	6/27/2003	9/17/2003	12/10/2003	4/1/2004	7/1/2004	9/22/2004	2/26/2002	2/5/2003	6/25/2003	9/16/2003	12/10/2003	4/1/2004
Pump Intake Depth (ft TOIC)			38	38	38	38	38	38	38	38	30	30	30	30	30	30
VOCs (µg/L)																
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	U	U	2.5 F	U	1.9	U	U	U	U
benzene	1	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	1.9 UJ	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	1.47	1.6	1.4	2.0	1.7	1.2	1.8	1.6	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	9.97	9.6	7.4	9.3	8.5	5.1	8.5	7.7	U	U	U	0.23 F	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	U	U	U	0.22 F	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	U	0.71	0.34 F	U	U	U	U	U	0.12 F	3.3	U	U	U	U
trans-1,2-dichloroethene	5*	1	0.35 F	U	0.41 F	0.61 F	0.69 F	0.57 F	0.66 F	0.62 F	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	16.39	13	19	18	23	16	16	16	0	U	U	U	U	U
Total Chlorinated Solvents:			17.86	14.6	20.81	20.61	25.39	17.77	18.46	18.22	0.0	0.0	0.0	0.22	0.0	0.0
Metals (µg/L)																
aluminum	2000	200		759	1550	182 R	181 F	438	481	U		92 F	79.8 F	9700	U	186 F
antimony	3	50		U	U	U	U	U	U	U		U	U	8.5 R	U	U
arsenic	25	30		U	U	U	U	U	U	U		27.8	10.2 F	373	U	31.3
barium	1000	50		761	839	U	932	706	846	892		109	75	647	75.4	126
beryllium	3	4		U	U	945	U	U	U	U		U	U	0.90 F	0.3 F	0.3 F
cadmium	5	5		U	U	0.40 F	U	U	U	U		U	U	U	U	0.7 F
calcium	--	1100		81900	84800	89200	90900	74500	86900	87400		146000	140000	186000	138000	161000
chromium	50	10		2.7 F	3.1 F	U	U	U	1.4 F	U		U	U	12	U	U
cobalt	--	60		U	U	U	U	U	U	U		U	U	8.8 F	U	U
copper	200	10		6.4	6.7 F	U	U	U	4.3 F	U		U	U	23	U	U
iron	300	200		7460	5420	6470	6270	2480	4810	5220		26100	9280	363000	6620	42200
lead	25	25	Data not available	U	U	U	U	U	U	U	Data not available	U	U	15.2 F	U	U
magnesium	35000	1000		21800	21800	24700	23600	17400	21800	21800		22700	22300 B	30600	21700	25400
manganese	300	10		1270	1310	1490	1370	1050	1300	1340		U	3990	5770	3520	4170
molybdenum	--	15		2.1 F	U	U	U	U	U	U		3.1 F	U	4.5 F	U	U
nickel	100	20		U	2.7 F	U	U	U	U	U		U	U	14.9 F	U	U
potassium	--	1000		3620	2930	2960	2720	3630	3160	2820		1350	1460 B	4340	1700	1570
selenium	--	30		U	U	U	U	U	U	U		U	U	20.9 F	U	U
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U
sodium	20000	1000		23400	21100	23200	21600	17400	19600	21400		9140	8700 B	9850	9620	11600
thallium	0.5	80		U	U	U	U	U	U	U		U	U	46.8 F	U	U
vanadium	--	10		U	2.4 F	U	U	U	U	U		U	U	19.9	U	U
zinc	2000	20		13.5 F	U	5.1 F	3.1 F	10.3 F	6.1 F	U		6.2 F	U	49.6	2.2 F	18.5 F
mercury	0.7	1		0.25	U	U	U	U	U	U		U	U	U	U	U
Natural Attenuation Parameters (mg/L)																
chloride	250	--	38.77	32.2	26.7	26.1	33.9	27.8	33.5	33	2.37	3.2	2.7 B	5.1	4.1	7.5
nitrate	10	--	U	0.081	U	U	U	0.18	0.095	U	0.43 F	0.79	1.3	0.44	1.2	1
sulfate	25	--	1.04	33.2 B	U	7.6	7.0	U	U	U	13.58	11.2	12.6 B	U	24.7	17.5
sulfide	--	--	U	U	U	U	U	0.044 F	0.065 F	U	U	U	U	U	U	U
Total alkalinity	--	--	321	250	301	327	410	303	332	330	455	374	454	434	648	444
Total Organic Carbon	--	--	3.19	4.4	2.1	2.6	2.6	1.7	U	2.6	3.67	7	3	U	3.3	3.9
Field Parameters																
Ferrous Iron (Field Kit)	--	--	NS	3.1	2.8	2.5	4.6	0.0	1.5	2.6	NS	NS	4.1	NS	2.6	0.0
pH	--	--	7.00	7.15	6.66	6.94	7.28	7.07	7.16	6.75	6.76	6.82	6.77	6.91	7.06	6.75
Temperature (Celsius)	--	--	13.01	6.30	19.23	17.73	12.05	11.23	17.50	15.10	11.11	3.60	18.10	12.56	10.36	9.49
Redox (mV)	--	--	-135	-53	-121	-148	-124	-51	-107	-115	-94	115	-94	-34	-46	182
Dissolved Oxygen (mg/L)	--	--	0.82	5.08	1.16	0.00	1.81	1.00	0.40	1.91	0.82	2.47	1.31	4.78	1.38	1.00

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-78								782VMW-80							
Sample ID			NA	782VM7840BA	782M7824CA	782M7840DA	782M7840EA	782M7840FA	782M7840GA	782M7840HA	NA	782VMW8033BA	782M8019CA	782M8033DA	782M8033EA	782M8033FA	782M8033GA	782M8033HA
Date of Collection			2/26/2002	1/31/2003	6/26/2003	9/17/2003	12/10/2003	4/1/2004	7/2/2004	9/22/2004	2/22/2002	2/3/2003	6/27/2003	9/16/2003	12/10/2003	4/1/2004	7/1/2004	9/22/2004
Pump Intake Depth (ft TOIC)			40	40	40	40	40	40	40	40	33	33	33	33	33	33	33	33
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	0.21 F	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	0.4 F	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	U	U	5.4 F	U	U	U	U	1.9 F	1.6 F	U	U
benzene	1	0.4	U	0.23 F	U	U	0.31 F	U	0.28 F	U	0.59	0.64	.48 F	0.76	0.73	0.44 F	0.64	0.58
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	39.84	64	46	59	55	69	60	47	3.12	1.6	.92 F	1.7	1.3	0.43 F	1.2	1.3
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	U	U	U	U	U	U	U	U	36.01	41	36	46	37	17	38	29
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	0.4 F	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	U	0.21 F	U	U	U	U	U	U	U	0.30 F	U	0.33 F	0.28 F	0.21 F	0.2 F	0.27 F
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	8.26	0.34 F	U	U	U	U	U	U	0.07 F	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	1.08	3.6	3.8	5.5	4.3	3	3.7	4.6	0.16 F	U	U	0.24 F	0.23 F	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	0.12 R	U	U	U	U	U	U
vinyl chloride	2	1.1	4.91	15	22	28	20	17	12	21	1.39	1.2	0.74 F	0.85 F	0.67 F	0.76 F	0.65 F	0.38 F
Total Chlorinated Solvents:			44.75	82.81	71.8	92.5	79.3	89	75.7	72.6	4.51	3.1	1.66	3.12	2.48	1.4	2.05	1.95
Metals (µg/L)																		
aluminum	2000	200		477	340	137 R	154 F	155 F	42 F	U		170 F	1470	270	222	735	343	82.3 F
antimony	3	50		U	U	U	U	U	U	U		U	U	5.8 UR	U	U	U	U
arsenic	25	30		U	U	U	U	U	U	U		U	U	U	U	U	U	U
barium	1000	50		355	409	368	321	356	346	396		479	482	559	494	457	509	530
beryllium	3	4		U	U	0.50 F	U	U	U	U		U	.3 F	U	0.3 F	U	U	U
cadmium	5	5		U	U	U	U	U	U	U		U	U	U	U	U	U	U
calcium	--	1100		81800	82700	87200	83100	87600	87400	93200		95800 M	95100	102000	93800	102000	96900	97200
chromium	50	10		2.1 F	U	U	U	U	U	U		U	U	U	U	U	U	U
cobalt	--	60		U	U	U	U	U	U	U		U	U	U	U	U	U	U
copper	200	10		U	U	U	2.6 F	U	U	U		U	U	U	2.3 F	U	1.8 F	U
iron	300	200		5180	9130	6460	4320	6490	10300	9950		4610 M	9960	3790	3360	5120	3300	2390
lead	25	25	Data not available	U	U	U	U	U	U	U	Data not available	U	U	U	U	U	U	U
magnesium	35000	1000		18800	17500	19600	17700	18100	17700	17700		31200	32200	36200	35000	37400	36000	36700
manganese	300	10		998	1140	1290	1130	1370	1400	1540		2150	1960	1520	1270	1610	1200	1140
molybdenum	--	15		2.9 F	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		2.6 F	U	2.6 F	2.5 F	3 F	2.2 F	1.7 F		U	U	U	U	U	U	U
potassium	--	1000		2760	2610	2700	2590	2560	2360	2420		1170	1340	1170	1140	1420	1300	1130
selenium	--	30		U	U	U	U	U	U	U		U	U	U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		30500	33900	35500	35500	38100	36600	38900		5300	5300	5680	5170	5990	5630	6200
thallium	0.5	80		U	U	U	U	U	U	U		U	6.7 F	U	U	U	U	U
vanadium	--	10		U	U	U	U	U	U	U		U	1.7 F	U	U	U	U	U
zinc	2000	20		4.5 F	U	U	2.3 F	18.1 F	U	U		2.7 F	U	U	U	U	9.5 F	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	57.01	85.1	75.6 B	69	74.8	77.9	71.8	92.2	10.71 R	19.2	21.6	23.7	28.2	37.5	35.6	35.8
nitrate	10	--	U	U	U	U	U	U	U	U	0.13 F	U	U	U	U	U	0.037 F	U
sulfate	25	--	5.75	8.3	6.2 B	19.9	9.0	9.0	10.1	10.1	6.37	15.1	U	13.2	9.9	3.1	6.5	9.2
sulfide	--	--	U	U	U	U	U	U	0.082 F	U	U	U	U	U	U	U	0.21 F	U
Total alkalinity	--	--	247.00	206	258	259	311	286	289	248	365	272 B	328	346	424	268	360	353
Total Organic Carbon	--	--	3.20	1.9	1.5	U	1.8	1.6	U	1.4	2.24	2.8	1.6	2.1	1.6	1.8	U	1.7
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	0.0	2.0	3.0	3.0	1.8	1.4	3.0	NS	3.8	3.7	2.9	1.6	3.0	0.2	2.2
pH	--	--	6.89	9.71	6.50	7.10	5.98	6.96	6.89	7.52	7.21	6.85	6.41	6.75	7.03	7.15	7.02	6.32
Temperature (Celsius)	--	--	12.35	11.80	14.59	13.78	11.87	10.54	12.80	14.00	9.99	10.93	12.94	14.81	10.64	19.30	18.70	13.30
Redox (mV)	--	--	-170	-119	-124	-151	-80	-90	-73	-134	-115	-9	-127	-134	-73	-90	-74	22
Dissolved Oxygen (mg/L)	--	--	0.79	4.83	2.20	0.00	0.00	0.00	0.44	1.10	0.56	0.67	1.20	0.00	1.30	2.07	1.97	1.01

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
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UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-81								782VMW-82					
Sample ID			NA	782VMW8146BA	782M8121CA	782M8146DA	782M8146EA	782M8146FA	782M8146GA	782M8146HA	NA	782VM8246BA	782M8220CA	782M8246DA	782M8246EA	782M8246FA
Date of Collection			2/21/2002	1/30/2003	6/26/2003	9/16/2003	12/12/2003	3/31/2004	7/1/2004	9/22/2004	2/22/2002	1/30/2003	6/25/2003	9/16/2003	12/12/2003	3/31/2004
Pump Intake Depth (ft TOIC)			46	46	46	46	46	46	46	46	46	46	46	46	46	46
VOCs (µg/L)																
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	0.30 F	0.42 F	0.35 F	0.23 F	0.38 F	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	0.23 F	0.23 F	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	0.51 F
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	1.3 F	U	U	U	U	U	U	U	U	U
benzene	1	0.4	U	U	U	U	U	U	U	U	0.22 F	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	18.66	27 M	28	23	26	22	18	21	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	21.23	11 M	14	15	17	14	12	13	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	1.08	.3 F	U	U	U	U	U	U	0.05 F	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	1.32	U	1.5	1.4	1.2	1.3	1.3	1.6	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	10	15	14	16	9.2	7.2	12	U	U	U	U	U	U
Total Chlorinated Solvents:			41.21	48	58.5	53.4	60.2	45.2	38.5	46	0.0	0.0	0.0	0.0	0.0	0.0
Metals (µg/L)																
aluminum	2000	200	43.7 F**	176 F	94	92.1 F	U	U	U	U		183 F	305	88.9 F	U	38.1 F
antimony	3	50	U	U	U	5.8 UR	U	U	U	U		U	U	5.8 UR	U	U
arsenic	25	30	U	U	U	U	U	U	U	U		U	4.6 F	U	U	U
barium	1000	50	290	327	382	454	419	487	530	474		726	635	693	649	683
beryllium	3	4	U	U	U	0.30 F	U	U	U	U		.5 F	U	0.40 F	U	U
cadmium	5	5	U	U	U	U	U	U	U	U		U	U	U	U	U
calcium	--	1100	53000 B**	65000 M	51000 B	65700	66600	66000	61200	61200		58300	50100 B	53700	52800	59600
chromium	50	10	U	1.3 F	U	U	U	U	U	U		U	U	U	U	U
cobalt	--	60	U	U	U	U	U	U	U	U		U	U	U	U	U
copper	200	10	U	U	U	U	U	U	U	U		U	U	U	U	U
iron	300	200	577 **	1700 M	1560	1650	1220	2170	5080	1160		3280	4380	4360	3150	2940
lead	25	25	U	U	U	U	U	U	U	U		U	U	U	U	U
magnesium	35000	1000	15200 **	17800	15200 B	19000	19200	18900	17900	17400	Data not available	15000	13700 B	14800	14900	16600
manganese	300	10	432 B*	625 M	386	506	537	550	491	499		484	398	422	401	415
molybdenum	--	15	6.0 F	10.1 J	6.1 F	4.2 F	4 F	U	3.2 F	U		U	U	U	U	U
nickel	100	20	U	U	U	U	U	2.6 F	U	U		U	U	U	U	U
potassium	--	1000	9320	4790 J	4650	4270	3530	3570	3340	3030		812	813 F	810 F	734 F	674 F
selenium	--	30	U	U	U	U	U	U	U	U		U	U	U	U	U
silver	50	10	U	U	U	U	U	U	U	U		U	U	U	U	U
sodium	20000	1000	45700	49500	41400	47500	48200	47300	43000	42300		60300	44200 B	45900	40400	35400
thallium	0.5	80	U	U	U	U	U	U	U	U		U	7.2 F	U	U	U
vanadium	--	10	U	U	U	U	U	U	U	U		U	U	U	U	U
zinc	2000	20	U	4.4 F	U	U	4.6 F	U	U	U		2.7 F	U	U	2.6 F	8.3 F
mercury	0.7	1	U	U	U	U	U	U	U	U		U	U	U	U	U
Natural Attenuation Parameters (mg/L)																
chloride	250	--	62.18 R	100	55.7 B	73.8	80.3	67.3	63.7	64.2	118.69 R	95	60.4 B	62.5	58	67.3
nitrate	10	--	U	U	U	U	U	U	U	U	0.17 F	U	U	U	U	U
sulfate	25	--	3.77	3.9	8 B	6.6	11.4	7.1	7.7	9.5	11.18 R	8.6	10.9 B	13.4	13.3	12.4
sulfide	--	--	U	U	U	U	U	0.048 F	0.12 F	0.083 F	U	U	U	U	U	0.07 F
Total alkalinity	--	--	210	188	217	224	298	272	261	228	162	159	187 B	183	234	198
Total Organic Carbon	--	--	9.9	1.1	U	U	U	U	U	1	1.63	1.3	1.6	U	U	U
Field Parameters																
Ferrous Iron (Field Kit)	--	--	NS	1.4	0.5	1.2	0.8	4.1	0.6	1.6	NS	2.0	1.4	1.4	0.6	0.2
pH	--	--	7.62	7.66	7.07	7.21	8.01	7.51	7.41	7.83	7.27	8.73	6.77	7.59	8.12	7.34
Temperature (Celsius)	--	--	12.04	10.64	17.78	15.91	10.62	10.98	15.10	14.50	9.47	10.80	14.13	13.03	9.94	10.48
Redox (mV)	--	--	-190	-35	-166	-161	-135	-111	-113	-140	-172	-126	-155	-172	-125	-98
Dissolved Oxygen (mg/L)	--	--	0.89	1.43	1.36	0.00	0.00	0.80	1.00	0.91	0.63	3.69	2.32	2.51	0.00	1.20

Notes:

B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-83								782VMW-84							
Sample ID			NA	782VM8333BA	782M8318CA	782M8333DA	782M8333EA	782M8333FA	782M8333GA	782M8333HA	NA	782VMW8440BA	782M8423CA	782M8440DA	782M8440EA	782M8440FA	782M8440GA	782M8440HA
Date of Collection			2/28/2003	2/4/2003	6/30/2003	9/19/2003	12/15/2003	4/2/2004	7/1/2004	9/22/2004	2/21/2002	2/6/2003	6/27/2003	9/17/2003	12/10/2003	4/2/2004	7/2/2004	9/21/2004
Pump Intake Depth (ft TOIC)			33	33	33	33	33	33	33	33	36	40	40	40	40	40	40	40
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	0.37 F	0.23 F	0.22 F	U	U	0.2 F	0.2 F	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	0.16 F	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	1.7 F	1.6 F	U	2.8 F	U	U	U	U	U	U	U	U
benzene	1	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	0.19 UJ	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	0.12 F	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	0.47 F	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	U	0.45 F	0.48 F	0.40 F	0.3 F	0.55 F	0.47 F	0.26 F	2.67	1.7	0.8 F	1.2	0.56 F	0.7 F	0.59 F	0.62 F
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	U	U	U	U	U	U	U	U	1.89 F	3.6	4.1 F	5.6	4.5 F	6.2 F	5.6 F	4.8 F
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	6.05	7.3	6.6	5.3	2.0	7.2	6.3	4.5	U	0.34 UJ	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	0.31 F	U	U	U	U	U	U	U	0.05 F	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	56.75 DL	55	37	57	58	64	40	44
Total Chlorinated Solvents:			6.5	7.75	7.08	5.7	2.3	7.75	6.77	4.76	59.42	56.7	37.8	58.2	58.56	64.7	40.59	44.62
Metals (µg/L)																		
aluminum	2000	200		145 F	102 F	167 R	154 F	289	49.5 F	U		347	236	91 R	117 F	82.2 F	U	48.7 F
antimony	3	50		U	U	5.8 UR	U	U	U	U		U	U	5.8 UR	U	U	U	U
arsenic	25	30		U	U	U	U	U	U	U		U	U	U	U	U	U	U
barium	1000	50		103	110	127	103	96.7	80.6	77.5		282	282	292	258	260	241	258
beryllium	3	4		U	.6 F	0.40 F	U	U	U	U		U	U	0.40 F	U	0.3 F	U	1.5 F
cadmium	5	5		U	U	U	U	U	U	U		U	U	U	U	0.6 F	U	U
calcium	--	1100		80400	80300	95000	80700	74200	64800	67200		99200	108000	109000 R	107000	115000	113000	121000
chromium	50	10		1.3 F	U	U	U	U	U	U		1.6 F	U	U	U	U	U	1.1 F
cobalt	--	60		2.2 F	1.5 F	1.7 F	1.7 F	2 F	U	U		U	U	U	1.6 F	U	U	U
copper	200	10		9	4.1 F	6.0 F	8.2 F	6 F	3.7 F	2.6 F		U	1.7 F	U	2 F	U	1.9 F	U
iron	300	200		234	93 F	194 F	245	382	102 F	44.8 F		17100	18200	20200	18400	19500	19200	21000
lead	25	25		U	U	U	U	U	U	U		U	U	U	U	U	U	U
magnesium	35000	1000	Data not available	11600	11400	15600	11700	8860	9280	8540	Data not available	18400	20400	22400	20500	21800	21200	23200
manganese	300	10		919	826	1570	1080	1280	961	978		2320	2460	2640	2460	2710	2640	2840
molybdenum	--	15		U	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		3.3 F	U	2.5 F	2.8 F	3.4 F	U	U		U	U	U	U	U	U	U
potassium	--	1000		2230	1890	2650	2660	2330	2110	2190		3990	3570	3820	3560	3610	3520	3490
selenium	--	30		U	U	U	U	U	U	U		U	U	U	U	U	U	U
silver	50	10		U	2 F	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		75200	53200	59900	85200	58800	41200	35300		19100	20200	22400	20700	22200	21200	22600
thallium	0.5	80		U	U	U	U	U	U	U		U	6.2 F	U	U	U	U	U
vanadium	--	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
zinc	2000	20		6.1 F	U	U	3.3 F	U	U	U		6.4 F	U	U	4 F	U	U	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	NS	66.4	41.7	90.4	105	19.2	46.1	37.1	44.97	44	67.1	61	85.2	56.4	54.2	49.1
nitrate	10	--	0.43 F	0.33	1.9	0.85	0.56	0.14	0.1	0.15	0.14 F	U	U	U	U	U	0.062	U
sulfate	25	--	103.68 R	11.5 B	11.1	12.7	14.1	14	7.6	8.5	0.41 F	2.9	U	35.3	12.7	U	U	U
sulfide	--	--	U	1.0	U	U	U	U	0.073 F	U	U	U	U	U	U	U	0.049 F	U
Total alkalinity	--	--	312	243	273	268	353	348	256	236	315	269	315	316	350	325	321	303
Total Organic Carbon	--	--	2.54	2.2	1.4	1.3	2.0	1.5	U	1.4	15.87	7.1	6.6	7.8	6.8	6.7	6.3	7.4
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NS	7.4	4.9	4.2	5.5	0.0	1.2	5.0
pH	--	--	7.01	7.28	7.02	6.96	6.10	7.40	6.99	6.94	7.09	6.89	6.26	6.66	5.82	6.77	6.67	7.20
Temperature (Celsius)	--	--	7.73	10.10	14.00	13.78	12.62	11.40	13.50	14.80	12.42	11.28	14.43	13.22	10.52	12.17	14.80	13.60
Redox (mV)	--	--	89	62	120	161	288	250	115	146	-133	-46	-119	-125	-76	-84	-78	-124
Dissolved Oxygen (mg/L)	--	--	8.41	0.83	7.18	4.71	0.00	4.00	0.60	0.56	0.46	1.52	0.77	2.61	0.00	1.20	0.89	0.66

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-85								782VMW-86							
Sample ID			NA	782VMW8536BA	782M8536CA	782M8536DA	782M8536EA	782M8536FA		782M8536HA	NA	782VMW8633BA	782M8633CA	782M8633DA	782M8633EA	782M8633FA		782M8633HA
Date of Collection			2/25/2002	1/31/2003	6/30/2003	9/18/2003	12/11/2003	4/2/2004	Jul-04	9/21/2004	2/25/2002	2/4/2003	6/30/2003	9/18/2003	12/11/2003	4/2/2004	Jul-04	9/21/2004
Pump Intake Depth (ft TOIC)			37	36	36	36	36	36		36	35	33	33	33	33	33		33
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,1-dichloroethane	5*	0.4	0.27 F	.36 F	0.34	0.38 F	0.3 F	0.25 F		0.23 F	U	U	U	U	U	U		U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
acetone	50	10	U	U	U	U	U	U		U	U	U	U	U	U	U		U
benzene	1	0.4	1.0	1.2	0.61	1.4	0.57	2.1		0.55	2.8	0.63	0.41 F	0.38 F	0.26 F	0.26 F		U
bromomethane	5*	0.5	U	U	U	U	U	U		U	U	0.19 UJ	U	U	U	U		U
bromodichloromethane	--	0.5	U	U	U	U	U	U		U	U	U	U	U	U	U		U
chloroform	7	0.3	U	U	U	U	U	U		U	U	U	U	U	U	U		U
chlorbenzene	5*	0.5	U	U	U	U	U	U		U	U	U	U	U	U	U		U
cis-1,2-dichloroethene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	Not Sampled Semi-Annual	U	U	U	U	U	U	U	Not Sampled Semi-Annual	U
ethylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
isopropylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
xylene (m+p)	5*	2	U	U	U	U	U	U		U	U	U	U	U	U	U		U
methylene chloride	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
n-butylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
n-propylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
MTBE	10	5	1.7 F	2	1.6 F	1.4	0.79 F	0.76 F		U	3.10 F	5.4	4.1 F	7.0	3.5 F	4.1 F		6.4
o-xylene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
p-isopropyltoluene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
naphthalene	10	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
sec-butylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U		U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U		U	U	U	U	U	U	U		U
toluene	5*	1	0.14 F	U	U	U	U	U		U	0.16 F	U	0.30 F	U	U	U		U
trans-1,2-dichloroethene	5*	1	0.08 F	U	U	0.22 F	U	0.23 F		0.24 F	U	U	U	U	U	U		U
trichlorofluoromethane	5*	1	U	0.12 UJ	U	U	U	U		U	U	U	U	U	U	U		U
vinyl chloride	2	1.1	U	U	0.22 F	0.35 F	0.34 F	0.46 F		0.25 F	U	U	U	U	U	U		U
Total Chlorinated Solvents:			0.0	0.0	0.22	0.57	0.34	0.69		0.49	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Metals (µg/L)																		
aluminum	2000	200		74.8 F	103 F	55.2 F	335	296		142 F		749	2910	84.3 F	878	1060		125 F
antimony	3	50		U	U	U	U	U		U		U	U	U	U	U		U
arsenic	25	30		U	U	U	U	U		U		U	U	U	U	U		U
barium	1000	50		534	613	646	602	632		657		1350	1620	1530	1410	1580		1640
beryllium	3	4		U	.6 F	U	U	U		1.3 F		U	.8 F	0.30 F	U	U		1.1 F
cadmium	5	5		U	U	U	U	0.5 F		U		U	.4 F	U	U	2.1 F		U
calcium	--	1100		116000	124000	132000	126000	125000		141000		119000	125000	128000	120000	126000		130000
chromium	50	10		U	U	1.7 F	U	U		U		1.9 F	3.6 F	U	1.4 F	2.2 F		U
cobalt	--	60		U	U	3.0 F	1.5 F	U		1.3 F		U	1.8 F	U	U	2 F		U
copper	200	10		U	U	U	3 F	4.2 F		2.4 F		2.9 F	8.8 F	U	3 F	2.9 F		U
iron	300	200		U	18200	20800	18100	20400		21000		18400	28000	19200	18300	19100		16800
lead	25	25	Data not available	U	U	U	U	U	Not Sampled Semi-Annual	U	Data not available	U	U	U	U	U	Not Sampled Semi-Annual	U
magnesium	35000	1000		18000	17900	19700	19300	18600		20600		18500	19300	20900	20000	20200		21500
manganese	300	10		1970	1940	2240	2560	2390		2300		2180	2220	2330	2180	2200		2330
molybdenum	--	15		U	U	U	U	U		U		U	U	U	U	U		U
nickel	100	20		U	U	2.9 F	2.8 F	U		1.5 F		U	U	U	U	2.9 F		U
potassium	--	1000		3460	3480	3860	3940	3690		3760		3180	3880	3490	3660	3650		3490
selenium	--	30		9.4 F	U	U	U	U		U		U	U	U	U	U		U
silver	50	10		U	U	U	U	U		U		U	1.8 F	U	U	U		U
sodium	20000	1000		29000	40200	48900	53300	56500		73900		59300	59100	61800	87800	68800		68400
thallium	0.5	80		U	U	U	U	U		U		U	U	U	U	U		U
vanadium	--	10		U	U	U	U	U		U		U	6.4 F	U	2.3 F	2.8 F		U
zinc	2000	20		4.8 F	U	U	8.1 F	12.4		U		7.9 F	U	U	106	13 F		U
mercury	0.7	1		U	U	U	U	U		U		U	U	U	U	U		U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	81.07	124	134	190	210	111		206	105.9	146	105	116	145	105		121
nitrate	10	--	0.15 F	U	U	U	U	U		U	U	U	U	U	U	U		U
sulfate	25	--	0.28 J	3.2	U	23.5	3.7	2.2 J	Not Sampled Semi-Annual	9.2	0.46 J	61.9 B	U	24.2	11	3.8	Not Sampled Semi-Annual	14.3
sulfide	--	--	U	U	U	U	U	U		U	U	U	U	U	U	U		U
Total alkalinity	--	--	340	243	293	278	352	296		239	333	253	347	336	416	350		285
Total Organic Carbon	--	--	NS	3.6	3.1	3.3	4	3.4		3.7	NS	8	7.4	6.9	7.1	5.4		6.3
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	2.9	4.2	7.2	3.4	3.6		5.2	NS	3.8	4.0	4.0	1.6	3.8		5.8
pH	--	--	6.74	9.36	6.80	6.72	6.00	6.78	Not Sampled Semi-Annual	7.13	6.69	9.42	6.83	6.90	5.95	6.81	Not Sampled Semi-Annual	7.28
Temperature (Celsius)	--	--	11.96	10.30	1.88	11.20	10.66	10.70		12.60	10.98	9.60	12.80	10.92	10.13	9.64		13.00
Redox (mV)	--	--	-132	-103	-123	-137	-105	-104		-124	-121	-99	-110	-128	-93	-83		-127
Dissolved Oxygen (mg/L)	--	--	0.82	0.84	2.20	3.60	0.00	0.50		0.64	0.62	1.10	2.75	3.00	0.00	1.30		0.51

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-87								782VMW-88							
Sample ID			NA	782VMW8735BA	782M8724CA	782M8735DA	782M8735EA	782M8735FA	782M8735GA	782M8735HA	NA	782VMW8837BA	782VM8834CA	782M8837DA	782M8837EA	782M8837FA	782M8837GA	782M8837HA
Date of Collection			2/27/2002	2/6/2003	6/27/2003	9/17/2003	12/12/2003	4/2/2004	7/2/2004	9/21/2004	2/27/2002	2/5/2003	6/26/2003	9/17/2003	12/10/2003	4/1/2004	7/2/2004	9/21/2004
Pump Intake Depth (ft TOIC)			35	35	35	35	35	35	35	35	35	37	37	37	37	37	37	37
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	27
benzene	1	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	0.19 R	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	0.23 F	U	U	0.21 F	U	U	U	0.2 F
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	31.68	33	34	35	30	30	29	24	2.22 F	2.2	2.8 F	3.5 F	2.5 F	2.2 F	3 F	2.5 F
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	U	U	0.25 F	U	U	U	U	U	0.06 F	0.86	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	0.14 F	U	U	0.20 F	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	24.03	26	30	33	35	34	23	25	42.94	35 M	34	40	31 J	30	24	27
Total Chlorinated Solvents:			24.0	26	30	33	35	34	23	25	43.17	35	34	40.41	31	30	24	27.2
Metals (µg/L)																		
aluminum	2000	200		58 F	250	51.8 R	U	U	7120	119 F		217 J	93.4 F	318 R	92 F	210	U	49.6 F
antimony	3	50		U	U	5.8 UR	U	U	U	4.9 F		U	U	5.8 UR	U	U	U	5 F
arsenic	25	30		U	U	U	U	U	U	U		U	5.4 F	U	U	U	U	5 F
barium	1000	50		U	40.4 F	517	471	477	502	473		336	372	398	381	430	422	412
beryllium	3	4		491	U	0.30 F	U	U	U	1.2 F		U	U	0.30 F	U	U	U	1.4 F
cadmium	5	5		U	U	U	U	U	0.9 F	U		U	U	U	U	U	U	U
calcium	--	1100		98300	85000	100000 R	99200	102000	120000	109000		97900	102000	107000 R	107000	109000	109000	111000
chromium	50	10		U	U	U	U	U	10.4	1.2 F		1.3 F	U	U	U	U	U	1 F
cobalt	--	60		U	U	U	U	U	5.9 F	U		U	U	U	U	U	U	U
copper	200	10		U	U	U	U	U	31.1	U		U	U	U	U	U	1.8 F	U
iron	300	200		23300	326	26000	23500	23100	39800	24000		13200 M	16600	17400	16900	16000	16500	19000
lead	25	25	Data not available	U	U	4.6 F	U	U	6.2 F	U	Data not available	U	U	5.2 F	U	U	U	U
magnesium	35000	1000		25500	13900	28000	26100	26300	31900	28700		17800	18600	21400	19700	20000	19600	19700
manganese	300	10		2930	40	3090	2870	2890	3450	3040		1510	1580	1760	1600	1860	1740	1840
molybdenum	--	15		U	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		U	U	U	U	U	10.8 F	U		U	U	U	U	U	U	3.6 F
potassium	--	1000		2690	2340	3040	2880	2780	4530	2820		3040	2950	3450	3300	3230	3200	3360
selenium	--	30		U	U	U	U	U	5.1 F	U		U	U	U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		15400	12400	20700	21500	21900	21100	22100		18400	20700 B	21800	21000	23200	22800	23100
thallium	0.5	80		U	U	U	U	U	U	U		U	11.5 F	U	U	U	U	U
vanadium	--	10		U	U	U	U	U	12.6	U		U	U	1.5 F	U	U	U	U
zinc	2000	20		4.3 F	U	6.8 F	U	U	38.7	U		6.1 F	U	U	3.6 F	U	7.7 F	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	28.17	21	26.8	30	39	37.9	38	38.5	32.68	50.6	48.2 B	49.6	66	59.3	56	49.8
nitrate	10	--	0.14 F	U	U	U	U	U	0.04 F	U	0.14 F	U	U	U	U	U	0.042 F	U
sulfate	25	--	0.16 J	3	U	2.0	14.2	6.2	U	U	0.15 J	2.7	U	39.9	11.2	U	U	U
sulfide	--	--	U	U	U	U	U	U	0.086 F	U	U	U	U	U	U	U	0.11 F	U
Total alkalinity	--	--	252	320	340	346	396	341	339	250	323	271	327	316	406	284	348	242
Total Organic Carbon	--	--	8.33	8.1	7.7	7.0	7.1	6.4	6.0	4.8	7.38	7.3	5.5	5.5	5.6	4.9	4.5	5.0
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	6.1	4.0	5.8	4.4	5.4	4.6	5.4	NS	6.9	5.8	3.6	5.2	4.1	4.8	5.0
pH	--	--	6.32	6.84	6.29	6.63	6.70	6.72	6.70	7.07	6.45	6.78	6.88	6.72	5.86	6.81	6.88	7.29
Temperature (Celsius)	--	--	9.31	10.34	13.66	12.40	10.21	10.89	13.70	12.30	10.39	8.38	13.58	12.81	11.71	11.20	13.90	14.50
Redox (mV)	--	--	-115	-91	-136	-141	-96	-100	-103	-135	-104	-36	-124	-134	-101	-79	-105	-142
Dissolved Oxygen (mg/L)	--	--	0.70	0.63	0.64	2.88	0.00	0.60	0.04	0.55	0.08	0.88	1.37	3.09	0.00	0.40	0.00	0.46

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-89								782VMW-90							
Sample ID			NA	782VMW8935BA	782M8935CA	782M8935DA	782M8935EA	782M8935FA	782M8935GA	782M8935HA	NA	782VMW9029BA	782M9029CA	782MV9031DA	782M9029EA	782M9029FA	782M9029GA	782M9029HA
Date of Collection			2/25/2002	2/4/2003	6/30/2003	9/18/2003	12/11/2003	4/2/2004	7/2/2004	9/21/2004	2/25/2002	2/4/2003	6/30/2003	9/23/2003	12/15/2003	4/2/2004	7/4/2004	9/22/2004
Pump Intake Depth (ft TOIC)			33	35	35	35	35	35	35	35	28	29	29	29	29	29	29	29
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	0.64 F	0.38 F	0.48 F	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	438.45 DL	670	640	330	420	400	440	560
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	180	250	170	160	140	170	200
acetone	50	10	U	U	U	U	U	U	U	U	145.03 DL	U	U	U	2.4 F	U	U	U
benzene	1	0.4	163.69 DL	100	85	110	67	110	120	95	32.76	36	16	27	16	18	9	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	3.8 UJ	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	0.41 F	U	0.59 F	U	U	U	0.46 F	U	17.81 DL	15	8.8	4.4	2.6	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	58.66 DL	64	49	39	44	44	48	57
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	20.13 DL	24	14	18	22	22	19	18 F
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	180	200	77	83	68	100	110
methylene chloride	5*	1	U	U	U	U	U	U	U	5.1	U	U	U	7	U	8.2 F	U	43
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	26	26	34	21	21
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	39.03 DL	48	26	32	38	42	36	35
MTBE	10	5	20.95	10	6.8 J	7.2	4 F	7.9 F	4.3 F	3.8 F	U	U	U	U	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	1.1	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	37	56	33	32	27	26	30
naphthalene	10	1	U	U	U	U	U	U	U	U	112.04 DL	170	160	100	98	78	120	91
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	21.4 DL	28	20	22	23	24	20	21
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	4.4	4.4	4.3	4.4 F	3.6 F	U
toluene	5*	1	0.30 F	U	0.34 F	U	U	U	U	U	0.65 F	U	U	U	0.25 F	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	1.16 F	U	U	U	0.47 F	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Chlorinated Solvents:			0.41	0.0	0.59	0.0	0.0	0.0	0.5	0.0	17.8	15	8.8	4.4	3.07	0.0	0.0	0.0
Metals (µg/L)																		
aluminum	2000	200	Data not available	317	405	81.1 F	286	45.7 F	265	54.3 F	Data not available	74	286	226	U	U	U	U
antimony	3	50		U	U	U	U	U	U	U		U	U	U	U	U	U	U
arsenic	25	30		U	5.3 F	U	U	U	4.5 F	4.6 F		U	U	4.9 F	5.1 F	U	U	6.8 F
barium	1000	50		692	653	743	768	723	538	531		178	150	136	156	132	130	129
beryllium	3	4		U	.6 F	U	U	U	U	1.1 F		U	.6 F	U	U	U	U	U
cadmium	5	5		U	U	U	U	0.5 F	U	U		U	.5 F	U	9.6	1.3 F	U	U
calcium	--	1100		102000	108000	111000	103000	109000	95000	94000		102000	69000	79000	73700	70800	68000	56600
chromium	50	10		1.8 F	U	U	U	U	1.2 F	1.3 F		2.4 F	U	U	U	U	1.5 F	U
cobalt	--	60		U	U	U	U	U	U	U		U	2.1 F	U	U	1.5 F	U	U
copper	200	10		2.1 F	U	U	1.8 F	U	1.8 F	U		U	1.7 F	3.0 F	2.4 F	U	U	U
iron	300	200		20000	22600	22700	21800	18000	19400	18300		34300	25800	20600	25100	21900	22400	20900
lead	25	25		U	U	U	U	U	U	U		U	U	5.9 F	U	U	U	U
magnesium	35000	1000		214000	18600	20900	20100	21400	16500	16300		17300	11400	13100	12800	11300	11200	9540
manganese	300	10		3100	4040	3620	3020	2970	3620	3620		7560	7100	5890	7260	5760	6270	6470
molybdenum	--	15		U	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		U	U	U	U	U	U	U		U	U	U	U	U	U	U
potassium	--	1000		3530	2890	3410	3870	3110	2650	2500		2030	1610	1910	1920	1690	1650	1500
selenium	--	30		U	U	U	U	U	U	U		U	U	U	U	U	5.8 F	6.7 F
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		24200	24000	36300	36600	34600	36000	36400		24600	16400	19300	23100	23900	19200	16100
thallium	0.5	80		U	U	U	U	U	U	U		U	U	U	U	U	U	U
vanadium	--	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
zinc	2000	20		5.6 F	U	U	5.2 F	U	U	U		5.5 F	U	2.6 F	3.8 F	U	U	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	58.83	65.6	76	96.1	119	88.4	75.6	78.5	50.38	112	27.6	72.4	79	48.1	47.6	36.3
nitrate	10	--	0.15 F	U	U	U	U	0.063	0.052	U	U	U	U	U	U	U	U	U
sulfate	25	--	0.14 J	56.6	U	30.2	16.4	12.8	35.5	23	0.25 J	21.2 B	9.7	68	7.4	U	3.9	U
sulfide	--	--	U	U	U	U	U	U	U	0.045 F	U	U	U	U	U	U	0.062	U
Total alkalinity	--	--	321	242	293	284	354	315	250	222	294	201	242	216	252	198	228	188
Total Organic Carbon	--	--	NS	5.7	4.0	4.8	5.4	4.9	3.6	2.5	NS	9.1	10.8	7.4	8	7.7	6.5	7.1
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	5.1	5.0	4.6	3.2	4.8	7.8	5.0	NS	5.1	5.0	NS	4.7	4.8	7.0	2.8
pH	--	--	6.77	9.42	6.83	6.90	6.06	6.81	6.95	7.24	6.42	9.12	6.70	6.81	6.84	6.84	6.26	6.22
Temperature (Celsius)	--	--	11.18	9.80	11.87	11.16	10.42	10.26	13.10	13.50	11.74	11.70	13.45	11.79	9.79	10.70	12.10	14.40
Redox (mV)	--	--	-126	-111	-129	-140	-126	-100	-108	-126	-116	-106	-138	-148	-120	-117	-73	-114
Dissolved Oxygen (mg/L)	--	--	1.04	0.95	2.03	2.41	0.00	0.60	0.06	1.20	0.82	0.60	1.16	2.11	0.00	0.30	0.00	0.70

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-91								782VMW-92							
Sample ID			NA	782VMW9127BA	782MW9127CA	782M9127DA	782M9127EA	782M9127FA	782M9127GA	782M9127HA	NA	782VMW9235BA	782VM9235CA	782M9235DA	782M9235EA	782M9235FA	782M9235GA	782M9235HA
Date of Collection			2/28/2002	2/7/2003	6/27/2003	9/18/2003	12/12/2003	4/5/2004	7/1/2004	9/21/2004	2/26/2002	2/6/2003	6/26/2003	9/18/2003	12/10/2003	4/1/2004	7/1/2004	9/21/2004
Pump Intake Depth (ft TOIC)			28	27	27	27	27	27	27	27	35	35	35	35	35	35	35	35
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	1.96	2.6	7.3	14	4.9	14	12	9.3	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	4.22	6.5	4.7	8.3	3.9	7.6	4.2	3.6	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
benzene	1	0.4	4.01	5.1	3.6	4.5	4.4	5.8	4.4	5.3	U	0.41 F	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	0.78 F	1.6	2.4	3.4	1.8	5.1	4.3	3.6	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	0.52 F	0.7	U	1.1	0.58 F	1.7	1.1	1.2	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	2.01	1.4	3.9	11	3.1	9.1	4.7	4.6	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	0.54	U	0.94 F	0.51 F	1.2	0.82 F	0.85 F	U	U	U	U	U	U	U	U
MTBE	10	5	U	U	U	U	U	U	U	U	16.06	16	16	17	14	14	13	10
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	0.47 F	0.85	U	0.64 F	0.4 F	0.82 F	0.58 F	0.7 F	U	U	U	U	U	U	U	U
naphthalene	10	1	1.02	3	4.2	5.6	2.8	4.8	5.5	3.3	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	0.23 F	U	U	U	0.52 F	0.36 F	0.44 F	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	0.3 F	U	0.38 F	0.32 F	0.52 F	0.35 F	0.41 F	U	U	U	U	U	U	U	U
toluene	5*	1	0.37 F	0.41 F	U	U	U	U	U	U	0.14 F	0.20 F	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	0.12 UJ	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	1.53	1.6	1.7	2.0	1.9	2.2	1.5	1.5
Total Chlorinated Solvents:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.6	1.7	2.0	1.9	2.2	1.5	1.5
Metals (µg/L)																		
aluminum	2000	200		U	35.3 F	31.7 F	U	U	50.2 F	U		1170	167 F	125 F	52.1 F	291	U	U
antimony	3	50		U	U	U	U	U	U	U		U	U	U	U	U	U	U
arsenic	25	30		61	66	68.9	69.4	56.2	55	66.3		U	U	U	U	U	U	U
barium	1000	50		172	213	236	231	204	192	209		392	397	464	427	483	481	506
beryllium	3	4		U	.3 F	0.30 F	U	0.3 F	U	1.4 F		.30 F	U	U	U	U	U	1.3 F
cadmium	5	5		U	U	U	U	1.3 F	0.6 F	U		U	U	U	U	U	U	U
calcium	--	1100		239000	286000	287000	275000	287000	256000	264000		100000	92700	107000	97600	107000	106000	112000
chromium	50	10		1.3 F	U	U	U	U	U	1 F		3 F	U	U	U	U	U	1.1 F
cobalt	--	60		4.3 F	5.2 F	5.1 F	4.6 F	4.4 F	4.3 F	4.2 F		U	U	U	U	U	U	U
copper	200	10		U	U	U	U	U	U	U		3.1 F	U	U	U	U	U	U
iron	300	200		41600	49600	50200	48200	45700	41000	41400		18700	16400	18600	16400	18300	17800	18700
lead	25	25	Data not available	U	U	U	U	U	U	U	Data not available	U	U	U	U	U	U	U
magnesium	35000	1000		32800	40000	39700	39000	35700	32600	34800		26300	24400	27400	25700	27700	27500	29300
manganese	300	10		1100	1680	1700	1610	1500	1460	1510		2150	2000	2200	2040	2220	2170	2280
molybdenum	--	15		2 F	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		6 F	6.1 F	5.6 F	6.3 F	5.9 F	5.2 F	5.1 F		U	U	U	U	U	U	U
potassium	--	1000		1510	1780	2130	2130	1730	1790	1990		3120	2640	2990	2810	2900	2840	2910
selenium	--	30		U	U	U	U	U	U	U		U	U	U	U	U	5.2 F	5.8 F
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		14800	45400	48400	48200	53100	59600	65600		18600	19000 B	20000	17200	17300	16000	15900
thallium	0.5	80		U	10 F	7.6 F	U	U	U	U		U	U	U	U	U	U	U
vanadium	--	10		U	U	U	U	U	U	U		1.6 F	U	U	U	U	U	U
zinc	2000	20		7.1 F	U	U	3.5 F	U	U	U		8.4 F	U	U	21.8	U	U	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	U	168	316	305	300	253	160	208	19.12	30.1	25.5 B	25.2	31.3	27.7	26.4	24.6
nitrate	10	--	U	U	U	U	U	U	U	U	0.15 F	U	U	U	U	U	0.063	U
sulfate	25	--	40.37	52.8	35.7	68.9	38.4	11.6	14.7	14.9	0.24 F	2.0	U	21.1	16	U	3.6	U
sulfide	--	--	U	U	U	U	U	U	0.067 F	U	U	U	U	U	U	U	0.11 F	U
Total alkalinity	--	--	514	484	548	491	720	367	510	454	372	284	364	345	439	281	344	283
Total Organic Carbon	--	--	12.72	10.1	8.4	8.1	8.8	8.2	8.0	8.9	5.1	6.4	4.4	4.6	4.7	4.8	3.9	5.2
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	4.0	8.3	4.2	5.6	3.2	2.8	4.4	NS	4.8	6.5	5.5	4.6	7.4	4.6	3.6
pH	--	--	6.48	6.73	6.67	6.65	6.89	6.64	6.60	7.10	6.59	6.85	6.91	6.88	5.93	6.90	6.48	7.14
Temperature (Celsius)	--	--	2.95	10.42	15.37	16.00	11.57	8.36	19.70	16.90	13.00	12.05	15.30	14.17	12.10	12.10	15.60	14.90
Redox (mV)	--	--	-89	-109	-131	-156	-115	-106	-129	-139	-135	-62	-138	-141	-101	-93	-100	-125
Dissolved Oxygen (mg/L)	--	--	2.37	0.80	1.15	0.00	0.00	0.80	1.90	0.43	0.91	0.63	1.50	0.00	0.00	0.80	4.80	0.75

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-93								782VMW-94							
Sample ID			NA	782VMW9335BA	782M9321CA	782M9335DA	782M9335EA	782M9335FA	782M9335GA	782M9335HA	NA	782VMW9440BA	782VM9440CA	782M9440DA	782M9440EA	782M9440FA	782M9440GA	782M9440HA
Date of Collection			2/26/2002	2/3/2003	6/27/2003	9/17/2003	12/10/2003	4/1/2004	7/1/2004	9/22/2004	2/26/2002	2/3/2003	6/26/2003	9/17/2003	12/10/2003	4/1/2004	7/1/2004	9/21/2004
Pump Intake Depth (ft TOIC)			35	35	35	35	35	35	35	35	40	40	40	40	40	40	40	40
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	UM	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	3 F	3.7 F	3.5 F	U	U	U	U	1.7 F	U	3.9 F	2.4 F
benzene	1	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	0.16 F	U	U	U	U	U	U	U	0.93 F	0.64	0.48 F	0.85 F	0.61 F	0.57 F	0.72 F	0.67 F
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	9.65	12	11	12	8.2 F	4.7 F	12	12	U	U	U	U	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	0.06 F	U	U	U	U	U	U	U	0.07 F	0.5	0.78 F	0.28 F	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	0.56 F	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	.12 UJ	U	U	U	U	U	U	U	0.12 UJ	U	U	U	U	U	U
vinyl chloride	2	1.1	76.02 DL	88	110	100	97	60	62	80	U	0.66	0.65 F	0.87 F	0.93 F	1.1	0.78 F	0.84 F
Total Chlorinated Solvents:			76.18	88	110	100	97	60	62	80	1.49	1.3	1.13	1.72	1.54	1.67	1.5	1.51
Metals (µg/L)																		
aluminum	2000	200		945	312	168 R	138 F	322	86 F	200		27.3 F	261	135 R	37.6 F	79.6 F	U	42.3 F
antimony	3	50		U	U	5.8 UR	U	U	U	U		U	U	5.8 UR	U	U	U	U
arsenic	25	30		U	U	U	U	U	U	U		U	U	U	U	U	U	U
barium	1000	50		129	121	120	95.6	71	79.5	105		650	728	733	721	712	648	706
beryllium	3	4		U	U	U	U	U	U	U		U	U	0.30 F	U	U	U	1.1 F
cadmium	5	5		.5 F	U	U	U	U	U	U		U	U	U	U	U	U	U
calcium	--	1100		93700	91900	101000 R	87000	64400	82200	93200		88200	92700	94500 R	91000	91500	83600	89200
chromium	50	10		2.1 F	U	U	U	U	U	U		U	U	U	U	U	U	1 F
cobalt	--	60		U	U	U	U	U	U	U		U	U	U	U	U	U	U
copper	200	10		4.7 F	2.7 F	2.3 F	3.7 F	5.8 F	5.4 F	2.1 F		U	U	U	U	U	2.5 F	1.6 F
iron	300	200		6040	4050	4580	3500	2020	2820	4340		1220	1820	1630	1650	1620	1370	1700
lead	25	25	Data not available	U	U	U	U	U	U	U	Data not available	U	U	U	U	U	U	U
magnesium	35000	1000		18100	17800	19600	15400	10500	13700	18600		1690	16700	16600	16400	16500	15400	17100
manganese	300	10		1910	1960	2060	1580	1060	1320	1920		889	861	837	813	822	730	753
molybdenum	--	15		U	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		U	2.4 F	U	U	U	U	U		U	U	U	U	U	U	2.2 F
potassium	--	1000		4110	3690	4040	4070	3310	4350	3510		U	5690	6100	5340	4620 F	7330	7160
selenium	--	30		U	U	U	U	U	U	5.2 F		U	U	U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		14800	15300	16300	13300	10000	12300	16000		U	94100	96100	110000	89100	99300	97800
thallium	0.5	80		U	9.4 F	U	U	U	U	U		U	U	U	U	U	U	U
vanadium	--	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
zinc	2000	20		22.7 F	U	12.2 F	14.3 F	24.4	12.3 F	11.4 F		5.9	23.8	4.5 F	4.5 F	5.9 F	6.3 F	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	26.57	27.7	25.8	24.8	28.1	18.7	19.1	27.9	174.8	228	226	183	242	123	192	185
nitrate	10	--	0.14 F	U	U	U	0.12	0.26	0.52	U	U	U	U	U	U	U	U	U
sulfate	25	--	0.46 F	10.5	U	32	5.7	U	1.9	U	0.14 F	2.8	U	4.3	4.8	U	U	U
sulfide	--	--	U	U	U	U	U	U	0.13 F	U	U	U	U	U	U	U	0.085 F	U
Total alkalinity	--	--	309	241	307	317	388	174	261	321	243	185 B	234	241	305	277	260	241
Total Organic Carbon	--	--	4.62	4.4	3.3	4.0	3.0	2.3	1.6	3.5	3.78	2.5	1.4	U	1.3	1.1	U	1.4
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	4.5	3.0	3.5	1.4	0.0	2.0	3.8	NS	1.0	NS	3.5	0.4	1.5	1.6	1.3
pH	--	--	7.02	7.16	6.54	6.84	7.12	7.33	6.54	6.60	7.90	7.72	7.32	7.32	7.39	7.32	7.49	7.42
Temperature (Celsius)	--	--	12.46	10.39	14.17	15.10	12.36	11.09	15.40	14.50	12.23	9.88	15.80	15.15	11.52	10.50	15.30	15.20
Redox (mV)	--	--	-134	-63	-126	-131	-115	-32	-83	-106	-257	-71	-141	-161	-123	-87	-150	-149
Dissolved Oxygen (mg/L)	--	--	2.14	0.92	1.08	0.00	1.20	5.20	1.90	1.32	0.56	0.95	1.28	0.00	1.75	0.80	0.60	0.76

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-95						782VMW-96							
Sample ID			NA	782VMW9528BA	782MW9528CA	782M9528DA	782M9528EA	782M9528FA	NA	782VMW9637BA	782VMW9638CA	782M9637DA	782M9637EA	782M9637FA	782M9637GA	782M9637HA
Date of Collection			2/25/2002	1/31/2003	6/27/2003	9/18/2003	12/12/2003	4/2/2004	2/21/2002	2/6/2003	6/26/2003	9/18/2003	12/10/2003	4/1/2004	7/1/2004	9/21/2004
Pump Intake Depth (ft TOIC)			28	28	28	28	28	28	39	37	37	37	37	37	37	37
VOCs (µg/L)																
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	1.66	U	U	U	U	0.66 F	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	0.62 F	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	U	U	U	U	U	U	U	U	1.4 F
benzene	1	0.4	0.33 F	.25 F	.37 F	0.43 F	0.49 F	U	U	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	0.17 F	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	0.20 F	.49 F	.7 F	0.83 F	0.78 F	0.33 F	U	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	0.55 F	U	U	U	U	0.27 F	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	8.78	.39 F	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	0.12 F	U	U	U	U	U	U	1.7	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	1.12 F	.57 F	U	U	U	1.6 F	2.60 F	4.0	4.2 F	6.0	4.6 F	3.7 F	8.7 F	6.7
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	.85 UJ	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	0.23 F	U	.32 F	U	U	U	0.10 F	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	.12 UJ	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	77.8 DL	96	130 J	120	72	130	95	96
Total Chlorinated Solvents:			0.2	0.49	0.7	0.83	0.78	0.33	77.8	96	130	120	72	130	95	96
Metals (µg/L)																
aluminum	2000	200	Data not available	131 F	71 F	489	86.1 F	905	125 F	192 F	165 F	97.6 F	U	117 F	105 F	160 F
antimony	3	50		U	U	U	U	U	U	U	U	U	U	U	U	U
arsenic	25	30		U	U	U	U	U	U	U	U	U	U	U	U	U
barium	1000	50		390	375	532	355	422	582	573	621	657	595	612	587	642
beryllium	3	4		U	U	0.30 F	U	U	U	U	.3 F	U	U	U	U	1.4 F
cadmium	5	5		U	U	U	U	0.5 F	U	U	U	U	U	U	U	U
calcium	--	1100		85800	92100	141000	97100	128000	93700 M	91200	96100	102000	92400	94800	93100	101000
chromium	50	10		1.5 F	U	U	U	1.8 F	U	1.4 F	U	U	U	U	U	1.2 F
cobalt	--	60		U	U	U	U	1.6 F	U	U	U	U	U	U	U	U
copper	200	10		U	U	6.3 F	U	U	U	2.3 F	U	U	U	U	4 F	3.3 F
iron	300	200		14500 M	18700	26000	22300	21800	3920 M	3840	4190	4180	3480	3050	3490	3760
lead	25	25		U	U	U	U	U	U	U	U	U	U	U	U	U
magnesium	35000	1000		13100	13400	19100	12600	17000	18500	17800	18800	19600	18200	18400	17900	19800
manganese	300	10		1870	2110	2650	2740	2180	1380	1330	1410	1450	1310	1400	1330	1420
molybdenum	--	15		4.1 F	U	U	U	U	U	U	U	U	U	U	U	U
nickel	100	20		U	U	U	U	3.8 F	U	U	U	2.4 F	U	2.9 F	U	2.2 F
potassium	--	1000		5010	4610	6090	5390	4830	4750	4630	4510	4840	5190	4850	5690	5850
selenium	--	30		U	U	U	U	U	U	U	U	U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U	U	U	U	U	U	U
sodium	20000	1000		38600	32600	69900	37100	50000	16600	14800	15700 B	16600	16000	16200	16500	19900
thallium	0.5	80		U	U	5.9 F	U	U	U	U	U	U	U	U	U	U
vanadium	--	10		U	U	U	U	2.1 F	U	U	U	U	U	U	U	1.5 F
zinc	2000	20		3.2 F	U	U	4.5 F	U	U	6.6	U	U	3.0 F	6.6 F	U	8.5 F
mercury	0.7	1		U	U	U	U	U	U	U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																
chloride	250	--	55.34	50.2	31	136	12.3	93.2	29.83	26.5	28.5 B	31.9	36.2	36	37.8	38.1
nitrate	10	--	0.14 F	2.2	U	U	U	U	0.15 F	0.062	U	U	U	0.1	0.15	0.12
sulfate	25	--	4.84 J	10.8	U	16.8	5.9	0.56 F	0.24 F	2.9	U	12.4	5.7	U	U	U
sulfide	--	--	U	U	U	U	U	U	U	U	U	U	U	U	0.062	U
Total alkalinity	--	--	329	232	325	299	422	331	310	247	312	300	386	329	321	283
Total Organic Carbon	--	--	NS	1.2	4.5	3.8	4.7	2.8	4.07	4.5	3.2	3.1	3.1	3.2	1.8	3.1
Field Parameters																
Ferrous Iron (Field Kit)	--	--	NS	2.4	4.7	4.5	3.4	3.4	NS	3.8	3.2	2.5	3.0	1.2	0.8	4.0
pH	--	--	6.59	9.52	7.13	6.85	6.94	6.88	7.20	7.05	6.99	6.88	5.91	6.95	6.65	7.33
Temperature (Celsius)	--	--	11.64	12.00	12.81	14.06	12.04	11.06	11.31	8.75	14.65	14.58	12.49	11.75	15.80	15.50
Redox (mV)	--	--	-131	-127	-160	-169	-132	-120	-103	25	-113	-123	-79	-61	-59	-104
Dissolved Oxygen (mg/L)	--	--	0.56	0.58	0.91	0.00	0.00	1.00	1.12	2.05	1.70	0.00	0.00	1.50	1.46	0.94

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-97								782VMW-98						782VMW-99					
Sample ID			NA	782VMW9733BA	782M9719CA	782M9731DA	782M9731EA	782M9731FA	782M9733GA	782M9731HA	NA	782VMW9832BA	782M9817CA	782M9829DA	782M9829EA	782M9829FA	NA	782VM9928BA	782M9919CA	782M9928DA	782M9928EA	782M9928FA
Date of Collection			2/22/2002	1/31/2003	6/26/2003	9/16/2003	12/11/2003	3/31/2004	7/1/2004	9/21/2004	2/20/2002	1/30/2003	6/25/2003	9/16/2003	12/11/2003	3/31/2004	2/22/2002	1/31/2003	6/27/2003	9/17/2003	12/12/2003	4/2/2004
Pump Intake Depth (ft TOIC)			33	33	33	33	33	33	33	33	32	33	33	33	33	33	28	28	28	28	28	28
VOCs (µg/L)																						
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	0.25 F	0.2 F	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.26 F	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	3 F	U	2 F	1.8 F	U	U	U	U	U	1.9 F	42.2	U	U	U	1.7 F	U
benzene	1	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	0.15 F	U	U	U	U	U	U	U	0.07 F	U	U	U	U	U	0.6	0.28 F	0.24 F	0.48 F	0.51	0.26 F
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	0.87 F	0.71	.44 F	0.45 F	0.73 F	0.6 F	0.49 F	0.66 F	U	U	U	U	U	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	U	.24 F	U	U	U	U	U	U	U	0.39 F	U	U	U	U	U	U	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.21 F	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	30.54	38	32	18	42	32	21	22	U	U	U	U	U	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	.25 F	U	U	0.25 F	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.14 F	U	0.48 F	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.12 UJ	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Chlorinated Solvents:			31.41	38.96	32.44	18.45	42.73	32.6	21.49	22.66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metals (µg/L)																						
aluminum	2000	200		U	51 F	55 F	U	208	U	U		128 F	44.4 F	51.1 F	U	104 F		392	65.8 F	154 R	U	162 F
antimony	3	50		U	U	5.8 UR	U	U	U	U		U	U	5.8 UR	U	U		U	U	5.8 UR	U	U
arsenic	25	30		U	U	U	U	U	U	U		U	U	U	U	U		U	U	U	U	U
barium	1000	50		29	38 F	44 F	31.8 F	26.6	31 F	38.3 F		12.6	11.7 F	12.6 F	12.2 F	10.1 F		40.3	445	44.1 F	45.7 F	36.1 F
beryllium	3	4		U	U	0.30 F	U	U	U	1.1 F		.4 F	U	0.40 F	U	U		U	U	0.30 F	U	U
cadmium	5	5		.5 F	U	U	U	U	U	U		U	U	U	U	U		U	U	U	U	U
calcium	--	1100		79700	75400	86900	86000	89600	86200	88600		55300	61600 B	67000	63900	56200		97500	94300	99900 R	90400	83800
chromium	50	10		2 F	U	U	U	U	3.5 F	2.9 F		1.4 F	1.7 F	U	1.3	U		2 F	1.7 F	U	U	1.4 F
cobalt	--	60		U	U	2.8 F	1.7 F	1.9 F	1.8 F	1.7 F		U	U	U	U	U		U	U	U	U	U
copper	200	10		2.4 F	U	U	2.3 F	2.6 F	4.4 F	3.4 F		U	U	U	U	5.2 F		2.2 F	U	U	2.3 F	U
iron	300	200		U	55.2	54 F	U	88.7 F	U	18.4 F		62.9 F	34.7 F	46.4 F	U	68.1 F		566	23300	181 F	65.5 F	81.3 F
lead	25	25	Data not available	U	U	4.9	U	U	U	U	Data not available	U	U	U	U	U	Data not available	U	U	U	U	U
magnesium	35000	1000		13700	12600 B	11800	16000	16900	12900	13800		18500	18900 B	20600	19300	18400		19500	25100	16000	13400	16800
manganese	300	10		5040	7640	9980	5230	5540	8220	8160		33.9	11.5	7.8 F	24.9	11.7		66.8	2890	28.3	8.8 F	13.3
molybdenum	--	15		2.4 F	U	U	U	U	U	U		U	U	U	U	U		2.2 F	U	U	U	U
nickel	100	20		U	U	2.6 F	2.7 F	3.4 F	2.1 F	1.8 F		U	5.7 F	5.4 F	U	U		U	U	U	U	U
potassium	--	1000		1940	1460	1600	1780	1690	1510	1450		9630	3220 B	2790	3950	7510		2560	2690	2660	7510	2220
selenium	--	30		12.4 F	U	6.5 F	U	U	U	U		U	U	U	U	U		U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U		U	U	U	U	U
sodium	20000	1000		11000	11300 B	12400	9850	10500	11000	10800		11300	9090 B	12600	15100	17900		10500	16700	11100	11100	14600
thallium	0.5	80		U	U	U	U	U	U	U		U	U	U	U	U		U	6.7 F	U	U	U
vanadium	--	10		U	U	U	U	U	U	U		U	U	U	U	U		U	U	U	U	U
zinc	2000	20		U	U	U	U	U	U	U		5.6 F	U	U	2.4 F	9.6 F		6.4 F	U	3.6 F	4.2 F	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U		U	U	U	U	U
Natural Attenuation Parameters (mg/L)																						
chloride	250	--	14.19 R	21	16.1 B	15.2	21.3	19.8	15.3	13.9	17.69	25.9	34.1 B	32.6	35.2	16.4	43.18 R	50.2	16.4	17.4	8.7	23.6
nitrate	10	--	0.82 F	2.4	2.3	1.7	1.4	1.0 B	1.2	1	1.48	1.2	0.8	0.8	0.81	0.63 B	0.69 F	2.2	1.5	0.27	0.91	1.4
sulfate	25	--	12.45 R	9.1	9.3 B	11.4	11.8	13.3	13.5	13.9	10.83	5.1	6.6 B	7.1	11.4	7.7	9.83	10.8	9.6	6.1	12.4	8.4
sulfide	--	--	U	U	U	U	U	0.045 F	0.12	U	1.8	U	U	U	U	U	U	U	U	U	U	U
Total alkalinity	--	--	257	211	246	249	345	307	287	268	209	166	210 B	213	268	255	147	232	272	270	344	317
Total Organic Carbon	--	--	2.17	2.5	1.4	U	2.0	1.6	U	1.9	0.90 F	U	U	U	U	U	7.08	1.2	U	1.1	1.6	0.93 F
Field Parameters																						
Ferrous Iron (Field Kit)	--	--	NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NS	0.0	0.4	0.0	0.0	0.0	NS	0.0	0.0	0.0	0.0	0.0
pH	--	--	7.19	6.63	6.41	6.57	7.45	6.94	6.52	6.84	7.24	8.15	6.89	6.94	7.28	7.78	12.25	6.97	6.77	7.21	7.85	7.34
Temperature (Celsius)	--	--	11.25	12.60	12.79	12.75	12.29	11.01	11.40	12.20	13.56	11.50	13.27	12.37	12.69	10.91	9.11	10.10	11.62	13.47	10.70	10.20
Redox (mV)	--	--	19	141	91	30	156	137	40	48	79	206	24	178	219	216	-108	100	63	53	157	242
Dissolved Oxygen (mg/L)	--	--	0.72	3.68	0.44	0.00	0.70	0.70	1.60	0.72	3.12	4.46	6.95	6.65	3.49	9.98	3.64	4.86	4.83	5.23	8.20	5.90

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location			782VMW-100								782VMW-101							
Sample ID	NYSDEC Class GA Groundwater Standards	Reporting Limit	NA	782VMW10025BA	782VM10023CA	782M10025DA	782M10025EA	782M10025FA		782M10025HA	NA	782VM10118BA	782VM10118CA	782M10118DA	782M10118EA	782M10118 FA	782M10118GA	782M10118HA
Date of Collection			2/28/2002	2/7/2003	6/25/2003	9/19/2003	12/9/2003	3/31/2004	Jul-04	9/21/2004	2/20/2002	1/30/2003	6/26/2003	9/19/2003	12/9/2003	3/31/2004	7/2/2004	9/21/2004
Pump Intake Depth (ft TOIC)			18	25	25	25	25	25		25	18	18	18	18	18	18	18	18
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	2.3 F	2.8 F		4.3 F	U	U	U	U	1.3 F	2.2 F	U	3.2 F
benzene	1	0.4	U	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
bromomethane	5*	0.5	U	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
chloroform	7	0.3	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	U	U	U	U	U	U		U	0.14 F	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	Not Sampled Semi-Annual	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
MTBE	10	5	U	U	U	U	U	U		U	9.59	2.2	1 F	3 F	3.1 F	2.6 M	1.3 F	2.6 F
o-xylene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
toluene	5*	1	0.10 F	U	U	U	U	U		U	U	U	U	U	U	UM	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	.12 UJ	U	U	U	U		U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U		U	2.11	0.8	.74 F	1.5	1.0	0.95 F	0.76 F	0.85 F
Total Chlorinated Solvents:			0.0	0.0	0.0	0.0	0.0	0.0		0.0	2.3	0.8	0.74	1.5	1.0	0.95	0.76	0.85
Metals (µg/L)																		
aluminum	2000	200		547	46.5 F	177 F	304	284		262		108 F	48.5 F	42.9 F	U	U	U	U
antimony	3	50		U	U	5.8 UR	272	U		6.2 F		U	U	5.8 UR	U	U	U	U
arsenic	25	30		12.9 F	U	128	272	168		199		U	U	U	U	U	U	U
barium	1000	50		348	49.9 F	327	929	553		681		170	156	178	207	247	163	190
beryllium	3	4		U	U	0.4 F	U	U		1.6 F		U	U	U	U	U	U	1.1 F
cadmium	5	5		U	U	U	U	1.3 F		U		U	U	U	U	U	U	U
calcium	--	1100		55200	72900 B	103000	71600	76100		106000		74900	72800	76800	82300	108000	77900	86100
chromium	50	10		2.5 F	U	U	U	U		13.5		U	U	U	U	U	U	0.9 F
cobalt	--	60		U	U	16.7 F	50.6 F	33.8 F		37.3		U	U	U	U	U	U	U
copper	200	10		U	1.7 F	U	4.1 F	4.9 F		U		U	U	U	U	U	2.2 F	U
iron	300	200		5260	424	56000	104000	70000		88500		6590	6600	7160	8520	12100	8290	8920
lead	25	25	Data not available	U	U	11.1 F	U	6.1 F	Not Sampled Semi-Annual	8 F	Data not available	U	U	4.0 F	U	U	U	U
magnesium	35000	1000		10100	8960 B	12400	9630	8850		12400		9900	9240 B	10400	12100	14400	9600	11200
manganese	300	10		2600	627	18700	83700	67600		53900		1590	1770	1920	2190	2720	2500	2380
molybdenum	--	15		2.3 F	U	U	U	U		U		U	U	U	U	U	U	U
nickel	100	20		U	U	2.9 F	7.6 F	7.3 F		6.2 F		U	U	U	U	U	U	U
potassium	--	1000		3700	2690 B	4510	3780	1720		3590		1470	1300	1480	1680	1560	1290	1450
selenium	--	30		U	U	14.8 F	47.4	29.6 F		14.3 F		U	U	U	U	U	U	U
silver	50	10		U	U	U	4 F	2.3 F		1.6 F		2.4 F	U	U	U	U	U	U
sodium	20000	1000		41100	2670 B	14500	35000	2830		3120		3130	1150 B	2620	4780	3460	1050	3700
thallium	0.5	80		U	U	12.9 F	U	U		U		U	9.6 F	U	U	U	U	U
vanadium	--	10		1.4 F	U	3.4 F	7.5 F	4.9 F		6 F		U	U	U	U	U	U	U
zinc	2000	20		6.7 F	U	U	14 F	10.9 F		10.8 F		U	U	U	5.8 F	U	U	U
mercury	0.7	1		U	U	U	U	U		U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	2.19	27.8	U	8.0	26.2	1.8		4.8	7.85	3.8	2.3 B	3.7	8.9	5.9	0.43 F	5.4
nitrate	10	--	U	U	U	U	U	U		U	0.13 F	U	U	U	U	U	U	U
sulfate	25	--	25.37 R	11.7	5.7 B	11	52.5	24.6	Not Sampled Semi-Annual	2.6 F	0.74 F	1.2	U	21.4	10.3	U	U	U
sulfide	--	--	U	U	U	U	U	U		U	U	U	U	U	U	0.044	U	U
Total alkalinity	--	--	174	166	238 B	263	272	173		177	311	190	230	224	330	308 M	260	218
Total Organic Carbon	--	--	2.61	2.7	3.4	9.6	5.2	5.3		6	5.03	2.8	2.9	2.9	3.9	3.9	1.6	3.3
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	0.0	0.0	0.0	0.0	0.0		0.0	NS	3.0	2.5	3.4	2.6	4.0	3.8	4.4
pH	--	--	6.97	7.19	7.29	7.20	6.62	7.48	Not Sampled Semi-Annual	7.08	6.83	7.85	6.96	6.66	6.91	6.54	6.82	6.79
Temperature (Celsius)	--	--	2.29	4.09	18.52	17.09	7.10	6.00		17.00	9.49	8.10	12.78	13.54	10.72	8.30	12.80	12.90
Redox (mV)	--	--	26	385	-20	4	61	125		20	-131	-70	-131	-137	-109	-45	-97	-125
Dissolved Oxygen (mg/L)	--	--	3.42	5.26	5.40	2.76	2.42	1.40		0.75	0.42	2.70	2.57	0.00	1.90	2.20	0.10	0.63

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location			782VMW-102								782VMW-104							
Sample ID	NYSDEC Class GA Groundwater Standards	Reporting Limit	NA	782VM10219BA	782VM10219CA	782M10219DA	782M10219EA	782M10219FA	782M10219GA	782M10219HA	NA	782VMW10426BA	782M10418CA	782M10728DA	782M10428EA	782M10428FA	782M10426GA	782M10428HA
Date of Collection			2/20/2002	1/30/2003	6/25/2003	9/19/2003	12/9/2003	3/31/2004	7/2/2004	9/21/2004	2/22/2002	1/30/2003	6/26/2003	9/16/2003	12/11/2003	3/31/2004	7/1/2004	9/21/2004
Pump Intake Depth (ft TOIC)			19	19	19	19	19	19	19	19	26	26	26	26	26	26	26	28
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	5.2 UM	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	0.70 F	9.6	13	7.4	30 J	36	6.8	18
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	0.24 F	1.3	1.7	0.94 F	5.1 J	6.8	1.1	2.8
acetone	50	10	U	U	U	U	U	U	U	U	U	U	U	U	1.5 F	U	U	U
benzene	1	0.4	U	U	U	U	U	2000	3200	2900	0.15 F	.43 F	U	0.35 F	0.45 F	0.58	0.26 F	0.28 F
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	2.8 UM	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	5.8 F	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	0.08 F	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	5.6 UM	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	0.51 F	5.6	14	5.8	2.6 J	21	5.7	9.9
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	0.30 F	1.9	4.8	2.2	0.61 F	6.6	2.6	3.7
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	0.70 F	14	16	8.4	49 J	43	8.3	19
methylene chloride	5*	1	U	U	.45 M	U	U	U	U	120	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	0.42 F	0.25 F	0.29 F
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	1.2	4.2	1.8	U	6.6	2.7	4
MTBE	10	5	86 DL	120	480	630	200	310	340	230 F	U	U	U	U	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	0.09 F	U	U	1.2	1.1 J	4.3	1.2	1.3
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	.30 F	U	U	0.25 F	0.51 F	U	0.4 F
naphthalene	10	1	U	U	U	2.8 UM	U	U	U	25 J	U	2.6	3.0	2.4	4.6 J	20	1.5	3.2
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	0.41 F	0.77	1.4	0.97 F	U	2.3	1.2	1.7
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	0.85 F	.39 F	U	0.27 F	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	0.22 F	U	0.22 F
toluene	5*	1	U	U	U	U	U	U	U	U	0.16 F	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Chlorinated Solvents:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.69	0.39	0.0	0.27	0.0	0.0	0.0	0.0
Metals (µg/L)																		
aluminum	2000	200		2130	3150	160 F	U	6280	1060	U		204	250	138 F	U	36.9	U	U
antimony	3	50		U	U	5.8 UR	U	U	U	U		6.9 F	U	5.8 UR	U	U	U	5.1 F
arsenic	25	30		U	U	U	U	U	U	U		20.8	16.6 F	18.1 F	14.3 F	12.9 F	11.9 F	14.9 F
barium	1000	50		724	599	591	581	734	489	548		26	24.7 F	25.9 F	20.7 F	18.9	13.9 F	14.5 F
beryllium	3	4		.60 F	.3 F	0.30 F	U	0.5 F	U	1.2 F		U	U	0.30 F	U	U	U	U
cadmium	5	5		U	U	U	U	0.5 F	U	U		U	U	U	U	U	U	U
calcium	--	1100		107000	95800	102000	105000	109000	101000	109000		85400	99300	105000	91400	88600	71800	75100
chromium	50	10		4.0 F	4.7 F	U	U	8.1 F	1.6 F	U		1.8 F	U	U	U	U	U	1.1 F
cobalt	--	60		1.9 F	2.2 F	U	U	4.7 F	U	U		2.7 F	3.6 F	3.0 F	2.9 F	2.9 F	1.8 F	2
copper	200	10		4.8 F	9.1 F	U	U	19.6	5.4 F	U		U	U	U	U	U	U	U
iron	300	200		11300	15900	11700	11900	40300	13900	12200		21700	25000	21900	18500	21100	14100	13300
lead	25	25	Data not available	U	U	U	U	4.1 F	U	U	Data not available	U	U	U	U	U	U	U
magnesium	35000	1000		20300	19700 B	18800	20200	22600	18700	20300		10400	11900 B	12500	10600	10300	8590	9470
manganese	300	10		1820	2010	2080	2270	2050	2140	2370		1900	2090	1900	1750	2020	1460	1490
molybdenum	--	15		U	U	U	U	U	U	U		4.0 F	U	U	U	U	U	U
nickel	100	20		3.1 F	5.4 F	U	U	10.9 F	1.6 F	U		U	U	U	U	U	U	U
potassium	--	1000		3210	3030 B	2420	2280	4050	2370	2190		1520	1690	1920	1920	1710	1500	1540
selenium	--	30		U	U	U	U	U	U	U		U	U	U	U	7.3 F	U	U
silver	50	10		1.8 F	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		12200	10800 B	9920	8580	15600	5510	14400		15100	19600	19700	20300	20100	13200	11400
thallium	0.5	80		U	9.2 F	U	U	U	U	U		U	U	U	U	U	U	U
vanadium	--	10		4.9 F	6.6 F	U	U	17.1	2.4	U		U	U	U	U	U	U	U
zinc	2000	20		14.2 F	U	U	U	53.6	13.9	U		5.4 F	U	U	U	6 F	U	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	24.77	15.5	14.9 B	10.7	25.8	27.2	17.5	23.6	4.36 R	24.6	29 B	80.3	48.4	10.9	6.6	6.9
nitrate	10	--	U	U	U	U	U	U	0.065	U	0.16 F	U	U	U	U	U	0.039 F	U
sulfate	25	--	0.09 F	U	U	24.7	15	U	U	U	6.67	4.6	9.9 B	4.4	12.1	3.2	2.7	1.9 F
sulfide	--	--	U	U	U	U	U	U	0.056 F	U	U	U	U	U	U	U	0.11 F	U
Total alkalinity	--	--	377	271	333 B	304 M	418	337	333	296	255	194	323	218	317	245	234	206
Total Organic Carbon	--	--	5.61	4.5	5.2	5.9	6.2	7.0	5.5	6.5	3.73	3.6	5.2	U	3.9	5.3	2.4	3
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	5.0	2.5	3.6	4.0	4.0	4.4	4.2	NS	3.4	6.5	6.0	5.0	4.5	5.0	5.0
pH	--	--	6.93	7.91	6.95	6.41	6.80	6.56	6.50	6.57	7.00	6.89	6.22	6.53	7.42	6.97	6.52	7.43
Temperature (Celsius)	--	--	9.94	10.20	11.55	13.54	11.04	9.60	11.80	12.30	11.58	9.90	13.89	15.43	12.51	9.04	11.70	17.80
Redox (mV)	--	--	-124	-76	-129	-124	-114	-55	-71	-124	-126	-42	-139	-145	-108	-95	-102	-135
Dissolved Oxygen (mg/L)	--	--	0.35	2.40	3.22	0.00	1.60	0.70	0.00	0.47	0.79	2.34	1.90	0.00	0.24	1.00	1.70	0.96

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782VMW-105B								782MW-6D							
Sample ID			NA	782VMW105B36BA	782M105B19CA	782M105B33DA	782M105B33EA	782M105B33FA	782M105B33GA	782M105B33HA	NA	782M6D43BA	782M6D25CA	782M6D43DA	782M6D43EA	782M6D43FA	782M6D43GA	782M6D43HA
Date of Collection			2/21/2002	1/30/2003	6/26/2003	9/16/2003	12/11/2003	3/31/2004	7/1/2004	9/22/2004	2/27/2002	1/30/2003	6/30/2003	9/18/2003	12/10/2003	4/1/2004	7/2/2004	9/22/2004
Pump Intake Depth (ft TOIC)			36	36	36	36	36	36	36	36	43	43	43	43	43	43	43	43
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	4.8 F	1.7 F	U	U	U	U	U	U	U	U	U	1.4 F
benzene	1	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	0.11 F	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	4.63	2.6	1.6	3.7	3.2	6	3.2	2.9	0.18 F	U	.21 F	0.35 F	U	U	U	0.2 F
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.22 UM	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	U	U	U	0.28 F	U	U	U	U	U	U	U	U	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	49.95	39	29	26	21	28	25	29	U	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	0.64 F	0.7	.26 F	0.36 F	0.21 F	0.36 F	0.38 F	0.38 F	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	0.13 F	.40 F	U	U	U	U	U	U	0.05 F	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.14 UM	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	2.05	2.4	2.8	2.9	3.5	3.7	2.4 M	3.1
Total Chlorinated Solvents:			55.2	42.3	30.86	29.7	24.2	34	28.2	31.9	2.23	2.4	3.01	3.25	3.5	3.7	2.4	3.3
Metals (µg/L)																		
aluminum	2000	200		11400	3330	3320	902	5900	1490	268		574	505	250	81.9 F	44.8 F	230	U
antimony	3	50		U	U	5.8 UR	U	U	U	U		U	U	U	U	U	U	U
arsenic	25	30		11.9 F	5.1 F	U	U	11.2 F	9.1 F	U		U	U	U	U	U	U	U
barium	1000	50		81.2	51	49.3 F	34.3 F	75.2	48.5 F	35.6 F		169	168	193	167	148	157	140
beryllium	3	4		.50 F	.3 F	0.40 F	U	U	U	U		.70 F	U	U	U	U	U	U
cadmium	5	5		U	U	U	U	U	U	U		U	.5 F	U	U	U	U	U
calcium	--	1100		99000	78100	78600	70200	84700	74600	73900 B		124000	108000	118000	102000	98600	101000	96300
chromium	50	10		15.3	5.7 F	4.0 F	2.2 F	9.2 F	3.6 F	U		2.2 F	U	U	U	U	U	U
cobalt	--	60		6.2	3.2 F	3.2 F	U	5.9 F	1.8 F	U		U	U	U	U	U	U	U
copper	200	10		38.4	9.3 F	8.0 F	3.4 F	16.7	7 F	3.1 F		U	2.6 F	U	U	U	1.7 F	U
iron	300	200		23500	7740	6690	2510	22200	13600	4010		11400	10600	11300	9110	8700	12900	8320
lead	25	25	Data not available	7.2	4 F	U	U	U	U	U	Data not available	U	U	U	U	U	U	U
magnesium	35000	1000		20300	13000 B	14300	12300	18000	13400	12800		18500	16400	17500	15300	14600	15000	14100
manganese	300	10		2470	2550	2350	1910	4460	2860	1890		2060	1720	1880	1680	1620	1750	1670
molybdenum	--	15		U	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		15.9	6.6 F	5.9 F	3.1 F	9.8 F	3.7 F	U		U	U	U	U	U	U	U
potassium	--	1000		5520	3350	3490	2710	3750	2670	2220		3570	3420	3810	3490	3270	3390	3060
selenium	--	30		U	U	U	U	U	U	U		U	U	U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		42500	42400	40400	34200	22600	23600	23300		67800	67300	74400	68900	66300	62400	56800
thallium	0.5	80		U	U	U	U	U	U	U		U	U	U	U	U	U	U
vanadium	--	10		19.2	6.4 F	6.1 F	1.8 F	11	2.6 F	U		U	U	U	U	U	U	U
zinc	2000	20		56.3	U	U	10.7 F	26.1	9.3	U		2.7 F	U	U	U	U	U	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	56.78	48.2	30.6 B	29.1	26.5	25.9	25.3	24.2	124.98	216	164	199 M	171	72.9 J	132	131
nitrate	10	--	0.68 F	0.9	0.7	0.54	0.44	0.52 B	0.56	0.66	0.16 F	U	U	U	U	0.086 J	0.078	U
sulfate	25	--	12.98	7.8	14.5 B	24.5	17.9	13.5	13.7	14.5	0.09 J	U	U	18.9	14	U	U	U
sulfide	--	--	U	U	U	U	U	0.094 F	0.13 F	U	U	U	U	U	U	U	0.069 M	U
Total alkalinity	--	--	243	183	259	258	625	273	246	240	250	202	243	265	327	342 M	282	245
Total Organic Carbon	--	--	1.71	1.5	1.4	U	1.6	1.5	U	1.9	3.07	3.1	2.6	3.3	3.1	2.8	1.5	2.7
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	0.0	0.0	0.0	0.0	0.0	0.8	0.0	NS	4.2	4.8	3.5	5.2	3.4	3.0	4.2
pH	--	--	7.45	7.31	6.62	6.88	7.76	7.28	6.83	7.78	6.77	8.08	6.42	6.61	6.01	6.82	6.46	7.23
Temperature (Celsius)	--	--	12.66	12.63	13.89	14.69	12.52	11.48	13.30	14.60	10.71	12.30	13.28	12.84	12.00	12.10	12.70	13.70
Redox (mV)	--	--	3	95	50	7	5	175	18	-74	-125	-100	-145	-129	-110	-86	-10	-132
Dissolved Oxygen (mg/L)	--	--	0.69	0.93	1.15	0.00	1.95	1.00	0.12	0.63	0.63	2.12	0.89	0.00	0.00	0.50	0.20	0.56

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	782MW-6R2								782MW-10							
Sample ID			NA	782MW6R2BA	782M6R224CA	782M6R230DA	782M6R230EA	782M6R230FA	782M6R230GA	782M6R230HA	NA	782MW1027BA	782M1027CA	782M1027DA	782M1027EA	782M1027FA	782M1027GA	782M1027HA
Date of Collection			2/27/2002	2/4/2003	6/30/2003	9/18/2003	12/11/2003	4/5/2004	7/1/2004	9/22/2004	2/21/2002	2/6/2003	6/27/2003	9/18/2003	12/12/2003	4/1/2004	7/1/2004	9/21/2004
Pump Intake Depth (ft TOIC)			30	30	30	30	30	30	30	30	27	27	27	27	27	27	27	27
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	0.21 F	U	U	0.26 F	U	U	U	U
1,1-dichloroethane	5*	0.4	0.23 F	.26 F	.27 F	0.31 F	U	U	0.22 F	0.25 F	0.61 F	.48 F	.58 F	0.68 F	0.46 F	0.56 F	0.46 F	0.49 F
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	4 F	U	2.6 F	11	U	U	U	U	U	U	4.7 F	4.1 F
benzene	1	0.4	U	0.77	0.63	0.8	0.54	0.62	U	0.21 F	0.58	.49 F	.44 F	0.52	0.44 F	1	0.42 F	0.46 F
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	13.75	.48 F	1.3	0.42 F	1.6	1.1	11	9.9	66.09	55	68	68	53	75	48	56
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	U	.31 F	U	U	U	U	U	U	0.36 F	U	U	0.32 F	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	U	.34 UJ	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	0.10 F	U	.29 F	U	U	U	U	U	0.06 F	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	0.63 F	.28 F	.29 F	0.33 F	0.21 F	0.23 F	0.74 F	0.82 F	3.38	2.4	3.1	3.8	2.2	3.2	2.6	3.2
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	14.34	4.3	5.4	5.6	5.2	2.8	16	21	25.38	19	26	30	21	26	18	21
Total Chlorinated Solvents:			28.72	5.06	6.99	6.35	7.01	3.03	27.74	31.72	94.85	76.74	97.1	101.8	76.2	104.2	68.6	80.2
Metals (µg/L)																		
aluminum	2000	200		828	94.5 F	1740	2080	909	752	971		460	250	435	U	127 F	40.4 F	U
antimony	3	50		U	U	U	U	U	U	U		U	U	U	U	U	U	U
arsenic	25	30		5.8 F	U	5.8 F	U	U	6.3 F	47.5		15 F	12.6 F	19.9 F	U	U	6.1 F	U
barium	1000	50		124	137	153	124	111	74.1	200		71.8	67.4	73.5	55.4	55.2	56.1	53.5
beryllium	3	4		U	.6 F	0.50 F	0.3 F	U	U	U		U	U	U	U	U	U	1.3 F
cadmium	5	5		U	U	U	U	U	0.6 F	U		.40 F	U	U	U	U	U	U
calcium	--	1100		110000	113000	119000	115000	105000	107000	101000 B		90100	89300	95800	89600	90600	91200	91200
chromium	50	10		2.7 F	U	2.1 F	4.3 F	1.7 F	1.3 F	2.2 F		1.9 F	U	U	U	U	0.9 F	1.7 F
cobalt	--	60		1.7 F	U	3.2 F	2.9 F	2 F	U	2.5 F		U	U	U	U	U	U	U
copper	200	10		6.9	U	11.1	16.8	5.8 F	5 F	11.3 F		U	U	U	U	U	U	U
iron	300	200		21900	20400	24200	12600	9970	30100	196000		41800	32300	37200	13100	14900	16600	11300
lead	25	25	Data not available	4.1 F	U	U	U	U	U	U	Data not available	U	U	U	U	U	U	U
magnesium	35000	1000		15500	14700	16600	15300	13800	12700	13400		17500	17000	18200	17200	17600	17300	17500
manganese	300	10		2160	2110	2270	2030	1680	1450	2460		3930	2720	2820	2490	2550	2520	2450
molybdenum	--	15		U	U	U	U	U	U	U		U	U	U	U	U	U	U
nickel	100	20		U	U	4.3 F	5.6 F	2.5 F	U	2.5 F		U	U	2.4 F	U	U	U	2.6 F
potassium	--	1000		2820	2620	3440	3310	2640	2310	2460		1620	1710	2070	1960	1810	1800	1820
selenium	--	30		U	U	U	U	U	U	6.7 F		U	U	U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U		U	U	U	U	U	U	U
sodium	20000	1000		40800	50800	59200	51400	52800	22500	28900		21000	26100	28400	26500	25800	26500	27500
thallium	0.5	80		U	U	U	U	U	U	U		U	7.3 F	U	U	U	U	U
vanadium	--	10		U	U	3.7 F	4.5 F	2 F	1.4 F	4.5 F		U	U	2.0 F	U	U	U	U
zinc	2000	20		11.5 F	U	U	18.8 F	7.3 F	9.1 F	12.4 F		8.2 F	U	U	U	34.3	U	U
mercury	0.7	1		U	U	U	U	U	U	U		U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																		
chloride	250	--	51.37	144	134	173	170	134	53.9	64	34.38 R	40.4	61.6	49.4	48.3	59.9	58	53.2
nitrate	10	--	U	U	U	U	U	0.064	0.11	0.4	0.35 F	U	U	U	U	U	0.044 F	U
sulfate	25	--	2.74 J	8.8 B	U	39.1	12.6	U	9.8	1.9 F	8.57	15.6	8.6	34.8	12.8	2	8.4	4.9 F
sulfide	--	--	U	U	U	U	U	U	0.12	U	U	U	U	U	U	U	0.14 F	U
Total alkalinity	--	--	289	208	258	256	328	278	295	271	289	233	260	263	361	273	294	226
Total Organic Carbon	--	--	6.21	8.3	4.4	4.3	4.4	3.8	U	10.2	5.17	10 J	5.8	8.4	5.1	4.4	3.2	4.2
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	6.1	5.2	2.0	5	5.4	0.0	2.5	NS	4.0	3.7	4.5	5.4	5.2	5.4	5.4
pH	--	--	6.71	6.66	6.21	6.79	7.41	6.98	6.29	6.40	6.62	6.83	6.95	6.81	6.82	6.48	6.60	6.99
Temperature (Celsius)	--	--	11.50	10.45	12.51	12.75	12.10	10.38	14.20	13.30	11.59	13.41	13.20	14.47	12.16	11.90	13.60	14.40
Redox (mV)	--	--	-135	-72	-139	-149	-58	-85	32	-44	-122	-94	-148	-138	-110	-63	-97	-126
Dissolved Oxygen (mg/L)	--	--	0.43	0.40	0.64	0.00	0.00	2.60	0.23	0.80	0.74	5.98	1.03	0.00	0.00	0.30	0.00	0.30

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location	NYSDEC Class GA Groundwater Standards	Reporting Limit	AP2MW-3								786MW-30						
Sample ID			NA	AP2MW0327BA	AP2M0327CA	AP2M0327DA	AP2M0327EA	AP2M0327FA	AP2M0327GA	AP2M0327HA	786MW3022BA	786M3015CA	786M3022DA	786M3022EA	786M3022FA	786M3022GA	786M3022HA
Date of Collection			2/27/2002	2/7/2003	6/27/2003	9/19/2003	12/9/2003	3/31/2004	7/2/2004	9/21/2004	1/22/2003	7/1/2003	9/17/2003	12/12/2003	4/2/2004	7/1/2004	9/22/2004
Pump Intake Depth (ft TOIC)			27	27	27	27	27	27	27	27	22	22	22	22	22	22	22
VOCs (µg/L)																	
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	.19 M	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	U	U	U	U	U	U	1.3 F	U	U	1.8 F
benzene	1	0.4	U	1100	2200 J	2400	2200	2100	1900	1200	U	U	U	U	U	U	U
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	18 F	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	50 F	60	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	0.73	U	U	U	0.7 F	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	76 F	130	U	U	U	U	U	U	U
methylene chloride	5*	1	U	21	U	U	U	U	U	63	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	250.8	270	310	370	210	190 F	270 F	190 F	U	U	U	U	U	U	U
o-xylene	5*	1	U	U	U	U	U	U	75 F	42 F	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	.26 F	U	U	U	0.31 F	U	U
trichloroethylene (TCE)	5	1	U	U	U	U	U	U	U	U	0.88	3.3	3.6	4.4	1.8	2.3	4
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	U	U	U	U	U	U	18 F	14 F	.38 F	.37 F	U	0.66 F	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Chlorinated Solvents:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.88	3.3	3.6	4.4	1.8	2.3	4
Metals (µg/L)																	
aluminum	2000	200		U	27.2 F	38.1 R	U	34 F	U	U	117 F	265	76.5 R	U	208	46.7 F	90.9 F
antimony	3	50		U	U	5.8 UR	U	U	U	U	U	U	5.8 UR	U	U	U	U
arsenic	25	30		U	U	U	U	U	U	U	7.8 F	U	U	U	U	U	6.7 F
barium	1000	50		813	747	799	761	794	765	842	36.1	41.1 F	23 F	20.3 F	19.9 F	16.9 F	23.6 F
beryllium	3	4		U	U	U	U	U	U	1.5 F	U	.5 F	0.30 F	U	U	U	U
cadmium	5	5		U	U	U	U	U	U	U	.40 F	U	U	U	U	U	U
calcium	--	1100		102000	98900	104000	107000	112000	111000	125000	72400 M	53900	66600 R	57600	59000	54900	56600
chromium	50	10		U	U	U	U	U	U	U	U	1.4 F	U	2.2 F	U	1.3 F	1.4 F
cobalt	--	60		U	U	U	U	U	U	U	U	U	U	U	U	U	U
copper	200	10		U	U	U	U	U	2.3 F	U	U	U	U	U	U	2.4 F	U
iron	300	200		13800	13400	15000	14300	15200	15300	17000	2010 M	450	672	1600	730	1350	2650
lead	25	25	Data not available	U	U	U	U	U	U	U	U	U	U	U	U	U	U
magnesium	35000	1000		19700	18800	21400	21000	21400	20900	24400	8680	8520	9180	8050	7400	7530	7610
manganese	300	10		1570	1530	1650	1650	1710	1750	1910	1270 M	146	340	897	501	745	1920
molybdenum	--	15		U	U	U	U	U	U	U	U	2 F	U	U	U	U	U
nickel	100	20		U	U	U	U	U	U	U	U	U	U	U	U	U	U
potassium	--	1000		2180	2260	2460	2340	2390	2450	2530	1800	U	1230	1020	1090	854 F	894 F
selenium	--	30		U	U	U	U	U	U	U	U	U	U	U	U	U	U
silver	50	10		U	U	U	U	U	U	U	U	U	U	U	U	U	U
sodium	20000	1000		15800	12500	14700	14100	12900	12000	15200	2290	30000	1510	1280	2000	1130	1220
thallium	0.5	80		U	U	U	U	U	U	U	U	6.2 F	U	U	U	U	U
vanadium	--	10		U	U	U	U	U	U	U	U	U	U	U	U	U	U
zinc	2000	20		2.5 F	U	U	U	U	28.7	U	10.2 F	10600	2.7 F	2.6 F	U	U	U
mercury	0.7	1		U	U	U	U	U	U	U	U	U	U	U	U	U	U
Natural Attenuation Parameters (mg/L)																	
chloride	250	--	22.14	27.5	25.2	26.9	36.6	39	39.7	42.6	3.8	U	U	U	U	U	1.3
nitrate	10	--	U	U	U	U	U	U	0.038 F	U	U	1.1	0.56	1.6	0.63	0.88	1.1
sulfate	25	--	0.08 J	2.6	U	7.7	21	U	2.6	U	11.3	11.1	9.8	18.1	6.6	9.2	11.1
sulfide	--	--	U	U	U	U	U	0.044 F	0.1 F	U	U	U	U	U	U	0.098 F	U
Total alkalinity	--	--	360	288	331	290	418	274	328	293	149	174	180	213	198	165	132
Total Organic Carbon	--	--	6.76	5.8	5.6	5.7	5.6	6.0	5.5	6.4	1.3	U	U	U	U	U	U
Field Parameters																	
Ferrous Iron (Field Kit)	--	--	NS	6.0	8.0	4.4	2.2	3.8	5	2.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0
pH	--	--	6.53	9.68	6.91	6.82	6.89	6.66	6.51	6.33	7.35	6.78	7.49	7.45	7.07	7.48	7.55
Temperature (Celsius)	--	--	10.11	10.20	11.62	11.39	11.38	10.70	12.10	11.40	10.45	11.52	13.07	10.53	8.50	12.80	32.20
Redox (mV)	--	--	-106	-111	-139	-135	-121	-35	-78	-92	31	7	-52	150	83	-96	144
Dissolved Oxygen (mg/L)	--	--	0.75	0.70	1.25	2.81	1.17	0.30	0.00	0.41	0.65	6.93	4.11	6.80	3.40	6.30	7.10

Notes:

B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location			782SW-115								782SW-118							
Sample ID	NYSDEC Class GA Groundwater Standards	Reporting Limit	782SW11401AA	782SW11501BA	782S11501CA	782S11501DA	782S11501EA	782S11501FA	782S11501GA	782S11501HA	782SW11801AA	782SW11801BA	782S11801CA	782S11801DA	782S11801EA	782S11801FA	782S11801GA	782S11801HA
Date of Collection			5/7/2002	2/10/2003	2/27/2003	9/19/2003	12/9/2003	4/1/2004	7/2/2004	9/21/2004	5/7/2002	2/10/2003	2/27/2003	9/19/2003	12/9/2003	3/31/2004	7/2/2004	9/21/2004
Pump Intake Depth (ft TOIC)			Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	0.11 F	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	U	U	U	U	U	U	U	U	0.09 F	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	0.5 F	U	U
1,2,4-trimethylbenzene	5*	1	0.08 F	U	U	U	U	U	U	U	0.07 F	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	U	U	2.8 F	3.4 F	U	U	U	U	1.4 F	2.1 F	U	2.8 F
benzene	1	0.4	U	U	U	U	U	U	U	U	U	U	U	3.8	3.8	1.5	13	6.2
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	0.15 F	.49 F	U	U	0.53	0.24 F	U	0.29 F	0.12 F	.48 F	U	U	0.5	0.22 F	U	0.24 F
cis-1,2-dichloroethene	5*	1	0.16 F	U	U	U	U	U	U	U	0.13 F	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	0.20 F	U	U	0.21 F	U	U	U	U	1.59 F	1.1	.86 F	4.2 F	0.71 F	0.24 F	2.5	1 F
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	0.16 F	U	U	U	0.22 F	U	U	U	0.14 F	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	.12 UJ	U	U	U	U	U	U	U	.12 UJ	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Chlorinated Solvents:			0.32	0.0	0.0	0.0	0.22	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metals (µg/L)																		
aluminum	2000	200		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
antimony	3	50		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
arsenic	25	30		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
barium	1000	50		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
beryllium	3	4		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
cadmium	5	5		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
calcium	--	1100		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
chromium	50	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
cobalt	--	60		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
copper	200	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
iron	300	200		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
lead	25	25	Data not available	NS	NS	NS	NS	NS	NS	NS	Data not available	NS	NS	NS	NS	NS	NS	NS
magnesium	35000	1000		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
manganese	300	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
molybdenum	--	15		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
nickel	100	20		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
potassium	--	1000		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
selenium	--	30		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
silver	50	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
sodium	20000	1000		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
thallium	0.5	80		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
vanadium	--	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
zinc	2000	20		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
mercury	0.7	1		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Natural Attenuation Parameters (mg/L)																		
chloride	250	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
nitrate	10	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
sulfate	25	--	Data not available	NS	NS	NS	NS	NS	NS	NS	Data not available	NS	NS	NS	NS	NS	NS	NS
sulfide	--	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Total alkalinity	--	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Total Organic Carbon	--	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
pH	--	--	7.40	5.78	6.95	7.70	5.95	6.16	7.58	7.76	7.92	6.07	7.32	7.62	5.84	7.20	7.49	7.57
Temperature (Celsius)	--	--	14.06	4.58	15.85	17.16	5.92	7.30	15.80	15.20	14.83	2.65	16.76	17.19	5.81	8.30	16.00	15.30
Redox (mV)	--	--	-7	435	3	25	-8	208	-15	91	-35	441	-22	-40	64	48	-15	88
Dissolved Oxygen (mg/L)	--	--	9.46	12.47	8.28	7.95	9.37	11.70	2.20	9.38	11.64	12.98	7.91	8.09	9.55	11.00	2.60	9.61

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.

R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

Appendix A (continued)
Nosedocks / Apron 2 Chlorinated Plume
Sampling Results February 2003 - September 2004

Sample Location			782SW-119								782SW-120							
Sample ID	NYSDEC Class GA Groundwater Standards	Reporting Limit	782SW11901AA	782SW11901BA	782S11901CA	782S11901DA	782S11901EA	782S11901FA	782S11901GA	782S11901HA	782SW12001AA	782SW12001BA	782S12001CA	782S12001DA	782S12001EA	782S12001FA	782S12001GA	782S12001HA
Date of Collection			5/7/2002	2/10/2003	2/27/2003	9/19/2003	12/9/2003	3/31/2004	7/2/2004	9/21/2004	5/7/2002	2/10/2003	6/27/2003	9/19/2003	12/9/2003	3/31/2004	7/2/2004	9/21/2004
Pump Intake Depth (ft TOIC)			Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
VOCs (µg/L)																		
1,1,1-trichloroethane	5*	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1- dichloroethene	5*	1.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-dichloroethane	5*	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichloroethane	0.6	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-dichlorobenzene	3	0.3	0.08 F	U	U	U	U	U	U	U	0.08 F	U	U	U	U	U	U	U
1,2,3-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	0.7 F	U	U
1,2,3-trichloropropane	0.04	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-trichlorobenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	0.6 F	U	U
1,2,4-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	0.19 F	U	U	U	U	U	U	U
1,3,5-trimethylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
acetone	50	10	U	U	U	U	1.8 F	2.5 F	2.3 F	3.5 F	U	U	U	U	1.9 F	3.4 F	U	4.3 F
benzene	1	0.4	U	U	U	3.1	3.6	1.8	6.6	5.1	2.86	1	.24 F	2.8	3.7	1.8	6.7	5
bromomethane	5*	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
bromodichloromethane	--	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chloroform	7	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
chlorbenzene	5*	0.5	U	.46F	U	U	0.45 F	0.2 F	U	0.23 F	U	.42 F	U	U	0.43 F	0.2 F	U	0.23 F
cis-1,2-dichloroethene	5*	1	0.13 F	U	U	U	U	U	U	U	0.11 F	U	U	U	U	U	U	U
dichlorodifluoromethane	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ethylbenzene	5*	1	U	U	U	U	U	U	U	U	0.37 F	.23 F	U	.31 F	U	U	0.22 F	0.22 F
isopropylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
xylene (m+p)	5*	2	U	U	U	U	U	U	U	U	0.87 F	0.58	U	0.64 F	U	U	0.58 F	0.5 F
methylene chloride	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
n-propylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
MTBE	10	5	1.59 F	1	2.5 F	5.2	1.3 F	0.52 F	1.8 F	1 F	1.74 F	1.1	1.7 F	4.6 F	1.3 F	0.68 F	1.8 F	1.3 F
o-xylene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
p-isopropyltoluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
naphthalene	10	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
sec-butylbenzene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichloroethylene (TCE)	5	1	0.14 F	U	U	U	U	U	U	U	0.12 F	U	U	U	U	U	U	U
tetrachloroethene (PCE)	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
tert-butylbenzene	5*	1.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
toluene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trans-1,2-dichloroethene	5*	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trichlorofluoromethane	5*	1	U	.12 UJ	U	U	U	U	U	U	U	.12 UJ	U	U	U	U	U	U
vinyl chloride	2	1.1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Chlorinated Solvents:			0.27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.23	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metals (µg/L)																		
aluminum	2000	200		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
antimony	3	50		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
arsenic	25	30		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
barium	1000	50		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
beryllium	3	4		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
cadmium	5	5		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
calcium	--	1100		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
chromium	50	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
cobalt	--	60		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
copper	200	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
iron	300	200		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
lead	25	25	Data not available	NS	NS	NS	NS	NS	NS	NS	Data not available	NS	NS	NS	NS	NS	NS	NS
magnesium	35000	1000		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
manganese	300	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
molybdenum	--	15		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
nickel	100	20		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
potassium	--	1000		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
selenium	--	30		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
silver	50	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
sodium	20000	1000		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
thallium	0.5	80		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
vanadium	--	10		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
zinc	2000	20		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
mercury	0.7	1		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Natural Attenuation Parameters (mg/L)																		
chloride	250	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
nitrate	10	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
sulfate	25	--	Data not available	NS	NS	NS	NS	NS	NS	NS	Data not available	NS	NS	NS	NS	NS	NS	NS
sulfide	--	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Total alkalinity	--	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Total Organic Carbon	--	--		NS	NS	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS
Field Parameters																		
Ferrous Iron (Field Kit)	--	--	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
pH	--	--	7.98	6.41	7.55	7.51	5.73	7.28	7.50	7.54	7.92	6.61	7.62	7.30	5.72	7.68	7.26	7.41
Temperature (Celsius)	--	--	14.07	2.33	16.88	17.09	5.16	8.30	16.00	15.30	13.99	2.22	17.44	17.38	5.71	8.50	16.40	15.70
Redox (mV)	--	--	-47	434	-49	-19	64	47	-15	84	-35	430	-8	26	105	37	-23	64
Dissolved Oxygen (mg/L)	--	--	10.04	12.48	9.03	7.57	11.79	11.10	4.60	9.66	9.24	12.64	9.26	10.25	9.85	11.20	3.10	9.61

Notes:
B - The analyte was found in an associated blank, as well as in the sample.
DL - indicates that a dilution was required to obtain the sample result.
M - A matrix effect was present.
U -The analyte was analyzed for, but not detected. The associated numerical value is at or below the method detection limit.
F -The analyte was detected above the MDL, but below the RL.
J -The analyte was positively identified, the quantitation is approximate.
NA - Sample ID not available.
NS - Not sampled.
R - The result was rejected due to an inability to meet QA/AC criteria.
UJ - The result is estimated at the method detection limit.
UM - The analyte was not detected, but there was a matrix effect for the analyte.
UR - The analyte was not detected, however the result was rejected due to deficiencies in the lab's ability to meet QC criteria.
-- Groundwater Standard not available.
* - The principal organic contaminant standard for groundwater of 5 µg/L applies to this substance.
**A duplicate sample was collected at this location; highest results among the two samples are reported.
-Shading indicates substance exceeds NYS Groundwater Standards or Guidance Values.

APPENDIX B

FIELD SAMPLING FORMS

(Field sampling forms are included electronically on CD with this report.)

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MC / RW

Location and Site Code (**SITENAME, SITEID**): 787 RI

Well No. (**LOCID**): 787VMW-76 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/26/02 Weather: Sun / 90°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

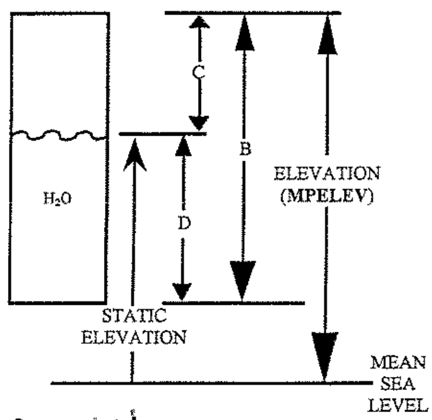
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 21.52 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 38'

Depth during Sampling / Purge: 22.10' - 22.46'

Purge Date and Method: Bladder Pump 2/26/02

Physical Appearance/Comments: Slow recharge. Pump rate: 18 s off 12 s on 25 psi

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	FLOW RATE mL/min
0950	22.46	6.88	689	13.07	62.5	1.19	-93	120
1000	22.16	6.93	688	12.80	31.6	0.95	-119	110
1010	22.10	6.95	686	12.82	36.8	0.97	-127	70
1020	22.07	7.00	670	~~13.15~~	28.8	0.82	-135	65
				13.01				

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 783NMW-77 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/25/02 Weather: sun / 43°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

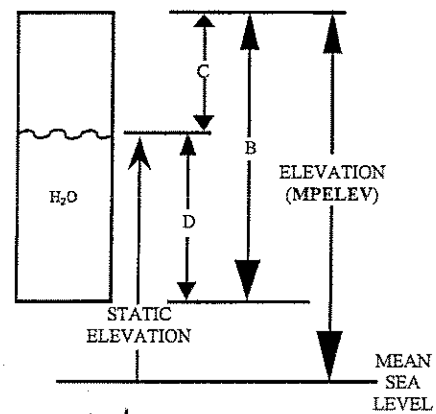
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 18.79 ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ______ (gal)



Intake Depth: 30'
Depth during purge/sample: 21.28'-21.47'

Purge Date and Method: Bladder pump 2/25/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow RATE mL/min
1100	20.32	6.69	788	11.99	223.0	1.40	-86	100
1110	20.40	6.71	794	11.66	225.0	0.94	-89	110
1120	20.32	6.74	796	11.48	334.0	0.81	-91	90
1130	20.12	6.76	797	11.11	423.0	0.83	-94	100

WELL PURGING & SAMPLING FORM

Project: 654-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 752 RI

Well No. (**LOCID**): 752VMW-78 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/26/02 Weather: Sun / 38°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

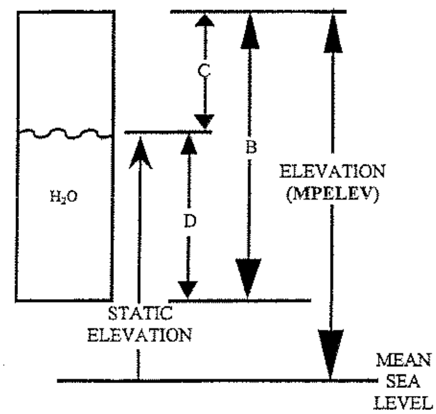
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 25.02 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 40'

Depth During Purge/Sampling: 25.05' - 25.25

Purge Date and Method: Bladder Pump 2/26/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	FLOW RATE mL/min
0845	25.11	6.30	626	11.87	136.0	2.26	-108	230
0850	25.21	6.54	625	11.68	57.1	1.44	-142	240
0855	25.05	6.70	625	11.57	59.4	1.10	-156	250
0900	25.10	6.78	626	11.97	139.0	0.89	-166	160
0905	25.20	6.84	624	12.00	155.0	0.87	-173	240
0910	25.10	6.89	620	12.35	167.0	0.79	-170	280

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 664-01-02   Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RT

Well No. (**LOCID**): 782VMW-8B   Well Diameter (**CASDIAM**): 2''

Date (**LOGDATE**): 2/22/02   Weather: Snow / 29°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

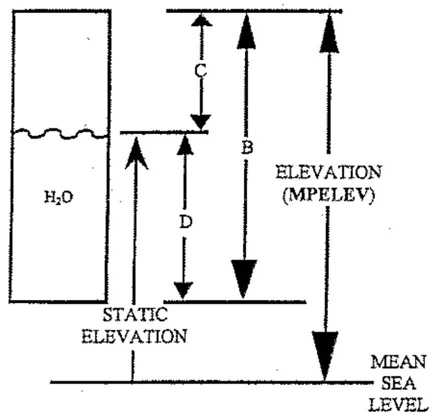
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) 20.43 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



Intake Depth ~~28~~ MG 33'

Depth during purge/sampling:

Purge Date and Method: Bladder Pump 2/22/02

Physical Appearance/Comments: some suspended fines in last sample (331 NTU'S).

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1412	20.42	7.01	660	9.52	430	1.80	-94	240
1417	20.45	7.06	665	9.62	373	1.07	-104	240
~~1422~~								~~240~~
1427	20.46	7.13	665	9.43	264	0.78	-108	240
1432	20.42	7.17	662	9.64	250	0.70	-110	240
1437	20.45	7.20	697	8.04*	254	0.68	-110	240
1447	20.42	7.19	658	9.83	390	0.69	-114	270
1452	20.42	7.21	663	9.99	331	0.56	-115	240

* Battery change, water sat for 10 minutes without flow.

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-91 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/21/02 Weather: clouds / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

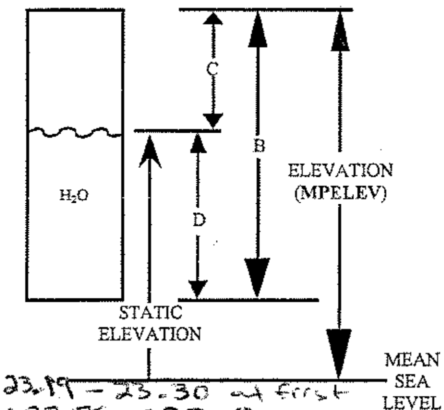
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 22.12 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



water level during purge/sample: 23.19 – 23.30 at first
Intake Depth: 46' (bgs) then: 22.75 – 23.03

Purge Date and Method: Bladder pump 2/21/02

Physical Appearance/Comments: clear. Pump slow for least drawdown.

FIELD MEASUREMENTS: * Readings collected once ~~every~~ 1.5 L.

Time	~~Volume Removed (gal)~~ DEPTH	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1022	23.21	6.62	563	11.61	67.5	2.61	-158
1048	22.95	7.40	552	10.27	161.0	4.04	-165
1053	22.82	7.44	549	10.41	148.0	2.42	-172
1104	22.95	7.49	560	11.64	144.0	1.19	-191
1113	22.93	7.60	562	11.98	128.0	.98	-191
1119	23.04	7.62	550	12.04	138.0	.89	-190

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-82 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/22/02 Weather: Snow / 32°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

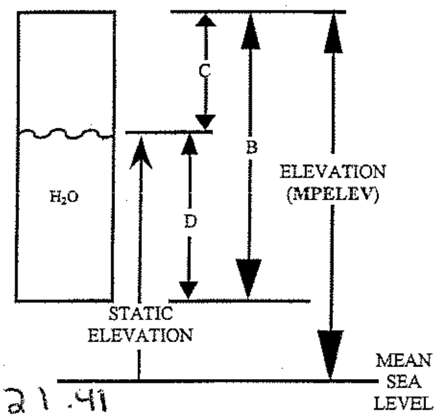
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 20.98 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



Depth during purge/sampling: 21.20-21.41

Intake Depth: 46'

Purge Date and Method: Bladder 2/22/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS: Purge rate in mL/min

Time	~~Volume Removed (gal)~~ DEPTH	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Purge Rate mL/min
1015	21.25	6.40	633	9.47	106.0	2.34	-124	140
1020	21.32	6.67	652	9.57	163.0	1.28	-154	140
1025	21.21	6.87	668	9.56	156.0	0.90	-165	140
1030	21.37	7.06	679	9.47	127.0	0.77	-170	140
1035	21.33	7.20	687	9.32	119.0	0.71	-173	140
1040	21.32	7.22	691	9.33	117.0	0.60	-174	140
1045	21.25	7.27	691	9.47	115.0	0.63	-176	140

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 DI

Well No. (**LOCID**): 782VMW-83 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/28/02 Weather: sun/clouds 97°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

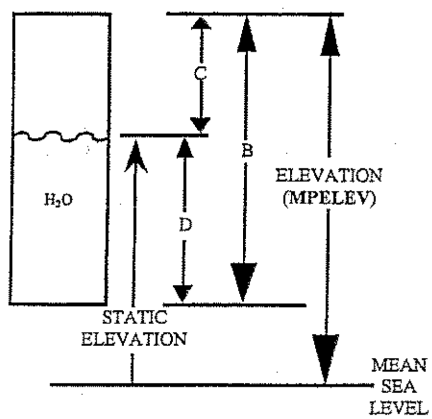
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 20.41 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 33'

Depth During Sampling/Purge:

Purge Date and Method: Peristaltic pump 2/28/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ Depth ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1632	20.45	6.83	782	8.97	520.0	7.47	101	240
1637	20.46	6.91	803	7.16	454.0	8.58	98	230
1642	20.46	6.96	842	6.75	385.0	8.86	96	230
1647	20.45	6.99	876	6.21	360.0	5.95	94	200
1652	20.47	7.01	859	7.23	327.0	8.41	87	240

WELL PURGING & SAMPLING FORM

Project: 684-01-02　　Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-84　　Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/21/02　　Weather: cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

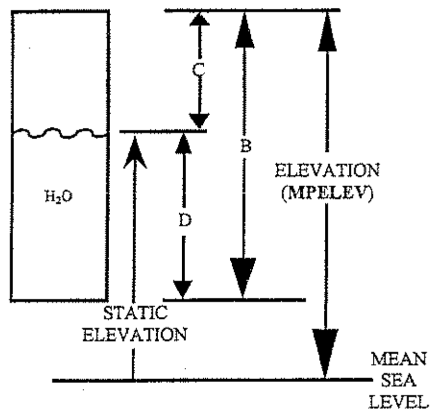
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 24.58 ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ________ (gal)



Intake Depth: 36

Depth During purge/sampling:

Purge Date and Method: Bladder pump 2/21/02

Physical Appearance/Comments:

FIELD MEASUREMENTS: *Readings collected once every 1.5L.

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1647	24.35	7.01	691	12.36	73.9	1.19	-112
1652	24.27	7.05	690	12.37	74.8	0.64	-123
1657	24.42	7.03	690	12.36	74.9	0.64	-123
1702	24.35	7.07	691	12.33	63.6	0.53	-127
1708	24.44	7.09	692	12.44	56.0	0.48	-131
1716	24.25	7.09	693	12.42	50.9	0.46	-133

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-85 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/25/02 Weather: Sun / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

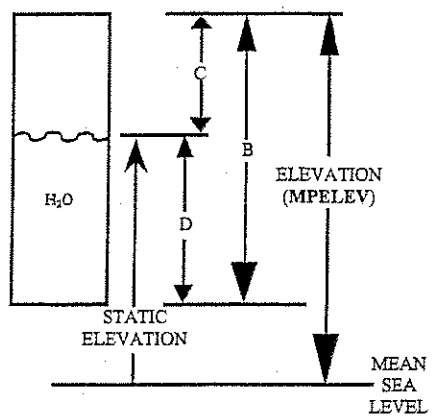
Measured Well Depth (B) (TOTDEPTH) ________ ft.

Measured Water Level Depth (C) (STATDEP) 24.64 ft.

Length of Static Water Column (D) ____ (B) - ____ (C) = ____ (D) ft.

Casing Water Volume (E) ____ (A) x ____ (D) = ____ gal

Total Purge Volume = ________ (gal)



INTAKE DEPTH: 37'

DEPTH DURING PURGE/SAMPLE: 24.82 - 24.98

Purge Date and Method: Bladder Pump 2/25/02

Physical Appearance/Comments: dissolved iron 3.6 mg/l

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	FLOW RATE mL/MIN
1205	24.98	6.49	759	13.01	219.0	5.67	-49	240
1210	24.84	6.56	801	12.35	121.0	2.33	-109	240
1215	24.91	6.69	807	12.02	113.0	1.17	-126	240
1220	24.95	6.71	807	12.01	115.0	0.93	-131	240
1225	24.91	6.74	809	11.96	116.0	0.82	-132	240
~~[illegible]~~ MIN								

WELL PURGING & SAMPLING FORM

Project: 584-01-02 Sampled by: ME / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782MW-86 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/25/02 Weather: Sun / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

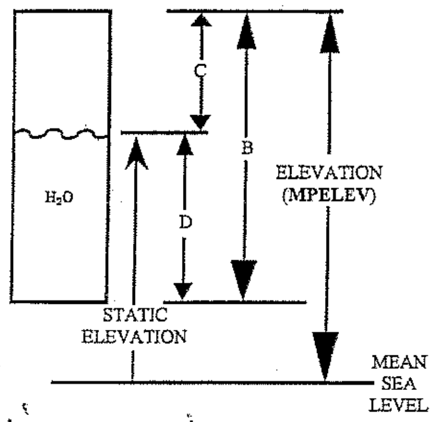
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 23.49 ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ________ (gal)



Intake Depth: 35'

Depth during Purge/sampling: 23.64' - 23.90'

Purge Date and Method: Bladder Pump 2/25/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1345	23.82	6.56	999	11.70	180.0	1.92	-109	240
1350	23.65	6.61	1,170	11.28	215.0	1.11	-115	250
1355	23.64	6.66	1,180	11.06	216.0	0.75	-119	240
1400	23.82	6.68	1,180	11.05	307.0	0.68	-121	250
1405	23.65	6.67	1,150	11.02	7999.0	0.63	-122	240
1410	23.72	6.69	987	11.00	7999.0	0.97	-119	200
1415	23.64	6.69	990	10.98	7999.0	0.62	-121	230

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: AG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-87 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/27/02 Weather: cold 30°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

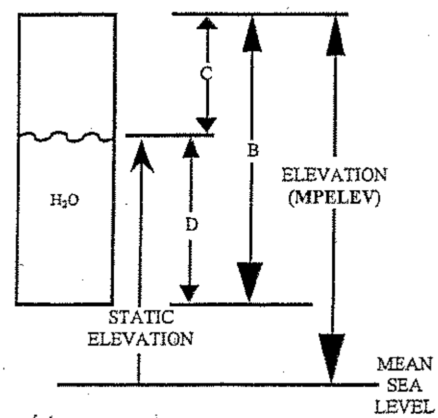
Measured Well Depth (B) (**TOTDEPTH**) ______ ft.

Measured Water Level Depth (C) (**STATDEP**) 24.42 ft.

Length of Static Water Column (D) ____ (B) - ____ (C) = ____ (D) ft.

Casing Water Volume (E) ____ (A) x ____ (D) = ____ gal

Total Purge Volume = ______ (gal)



Intake Depth: 35'
Depth During Purge/Sampling: 24.44 - 24.62

Purge Date and Method: Bladder Pump 2/27/02

Physical Appearance/Comments: ______

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	FLOW RATE mL/min
1115	24.44	6.13	767	8.62	100.0	1.17	-83	220
1120	24.44	6.27	770	8.17	137.0	0.83	-1	200
1125	24.43	6.25	761	8.35	166.0	0.81	-105	160
1130	24.60	6.30	765	9.35	136.0	0.78	-109	280
1135	24.42	6.32	765	9.31	136.0	0.70	-115	240

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: CBH-C1-02 Sampled by: MG /KM

Location and Site Code (**SITENAME, SITEID**): TSS 27

Well No. (**LOCID**): TSNMW-S8 Well Diameter (**CASDIAM**): ________

Date (**LOGDATE**): 2/27/02 Weather: cold 30°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

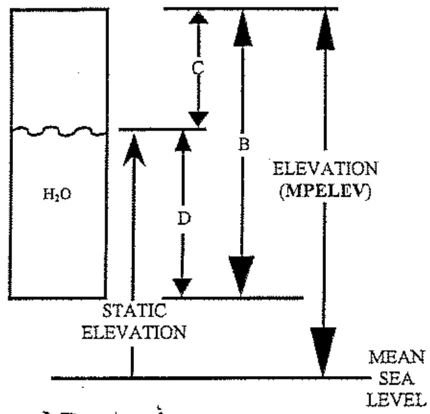
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) 27.49 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake depth: 35

Depth During Sampling/Purge: 27.45 - 27.60'

Purge Date and Method: Bladder Pump 2/27/02

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1315	27.45	6.33	457	8.86	475	5.60	-74	220
1320	27.57	6.31	637	10.24	304	1.50	-101	240
1325	27.47	6.40	665	10.46	205	1.02	-104	240
1330	27.47	6.42	670	10.47	182	0.91	-107	260
1335	27.49	6.45	675	10.39	173	0.78	-109	250

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-03 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-89 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/25/02 Weather: Sun / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

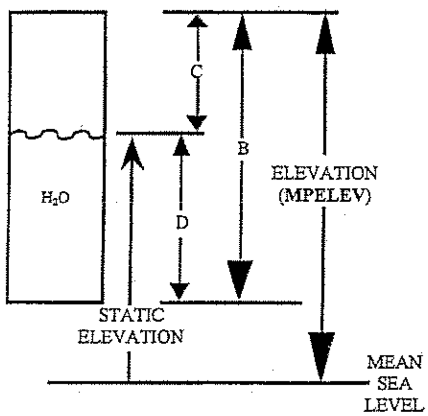
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) 25.15 ft.

Length of Static Water Column (D) ____ (B) - ____ (C) = ____ (D) ft.

Casing Water Volume (E) ____ (A) x ____ (D) = ____ gal

Total Purge Volume = ____ (gal)



Intake Depth: 33'

Depth during purge / sample: 25.00 - 25.30

Purge Date and Method: Bladder Pump / 2/25/02

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	FLOW RATE mL/min
1440	25.22	6.77	767	~~[illegible]~~ 11.86	217.0	5.33	-110	280
1445	25.23	6.75	774	11.37	150.0	1.72	-119	260
1450	25.21	6.77	780	11.29	128.0	1.23	-123	250
1455	25.27	6.77	785	11.18	109.0	1.04	-126	240
~~1500~~ MG								

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MC/RM

Location and Site Code (**SITENAME, SITEID**): 782 PI

Well No. (**LOCID**): 782VMW-90 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/25/02 Weather: Sun /37°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

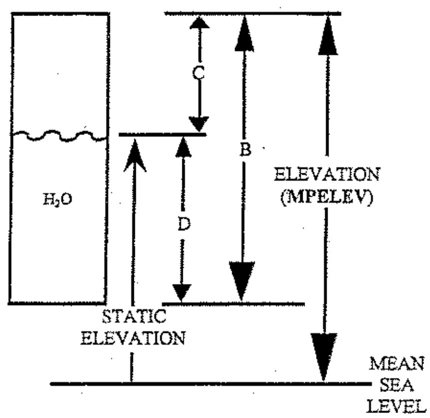
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 23.75 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



Intake Depth: 28'

Depth During Purge/Sampling: 25.71 - 25.92

Purge Date and Method: Bladder Pump 2/25/02

Physical Appearance/Comments: Brownish water, sheen (apparent), strong petroleum odor

FIELD MEASUREMENTS: Free Product from 25.39' - 25.75'

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1105	25.79	6.30	634	11.73	>999.0	2.17	-111	400
1110	25.71	6.32	662	11.68	>999.0	1.09	-115	240
1115	25.79	6.35	678	11.64	>999.0	1.02	-115	240
1120	25.75	6.36	690	11.75	>999.0	0.98	-116	240
1125	25.74	6.39	695	11.73	>999.0	0.91	-116	240
1130	25.74	6.42	706	11.74	>999.0	0.82	-116	240

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: CY-WP Sampled by: AC/RIN

Location and Site Code (**SITENAME, SITEID**): 782 EI

Well No. (**LOCID**): 782Vmwell Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/28/02 Weather: sun/23°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

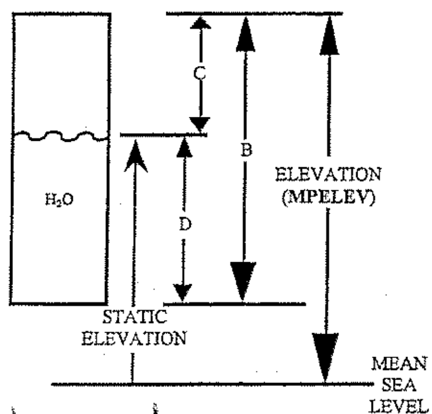
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) 22.31 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 28'

Depth During sampling/purge 22.90'-23.02'

Purge Date and Method: Bladder Pump 2/28/02

Physical Appearance/Comments: Slow recovery flow rate: 7 sec per 60 sec at 18 psi

FIELD MEASUREMENTS:

Time	~~Volume~~ Depth ft ~~Removed~~ (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1200	22.99	6.39	1,270	3.79	464.0	4.69	-57	30
1215	22.96	6.44	1,280	3.53	332.0	3.69	-59	35
1230	22.90	6.48	1,270	2.95	385.0	2.31	-59	35

WELL PURGING & SAMPLING FORM

Project: 684-01-02　　Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-92　　Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/26/02　　Weather: Clouds / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

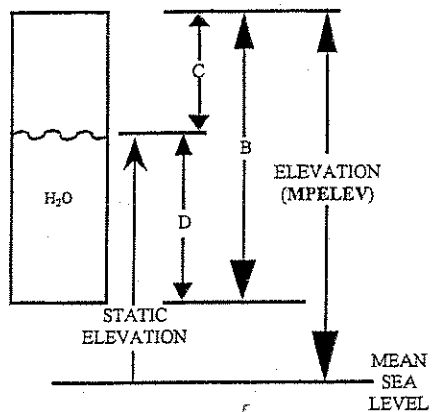
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) 22.75 ft.

Length of Static Water Column (D) ____ (B) - ____ (C) = ____ (D) ft

Casing Water Volume (E) ____ (A) x ____ (D) = ____ gal

Total Purge Volume = ________ (gal)



Intake Depth: 35'

Depth during purge/sampling: 22.71 - 22.90'

Purge Date and Method: Bladder Pump 2/26/02

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	~~Volume Removed (gal)~~ DEPTH	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1525	22.81	7.04	647	12.97	747.0	3.63	-142	240
1530	22.76	6.79	721	12.82	>999.0	2.28	-136	250
1535	22.84	6.63	753	12.86	876.0	1.16	-137	240
1540	22.82	6.61	764	12.97	564.0	2.26	-131	240
1545	22.75	6.58	776	13.22	368.0	1.17	-136	200
1550	22.78	6.60	777	12.94	302.0	1.03	-137	240
1555	22.77	6.59	777	13.00	234.0	0.91	-135	240

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG/RM

Location and Site Code (**SITENAME, SITEID**): 782 ET

Well No. (**LOCID**): 783VMW-93 Well Diameter (**CASDIAM**): ________

Date (**LOGDATE**): 2/26/02 Weather: sun/clouds 35°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

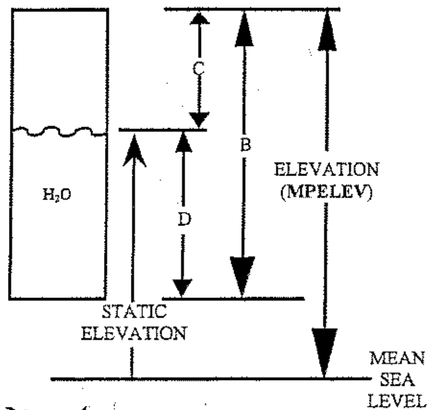
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) 22.09 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 35'
Depth during purge/sampling: 22.35'-22.60

Purge Date and Method: Bladder Pump 2/26/02

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1210	22.50	8.11	580	12.84	547.0	4.39	-179	400
1215	22.35	7.30	598	12.67	366.0	1.85	-145	220
1220	22.36	7.13	599	12.52	321.0	1.59	-137	240
1225	22.30	7.04	600	12.45	298.0	1.10	-136	250
1230	22.32	7.02	605	12.41	270	1.07	-136	240
1235	22.32	7.02	614	12.46	262.0	2.14	-134	240

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RT

Well No. (**LOCID**): 782VMW-94 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/26/02 Weather: Sun/Cloudy 36°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

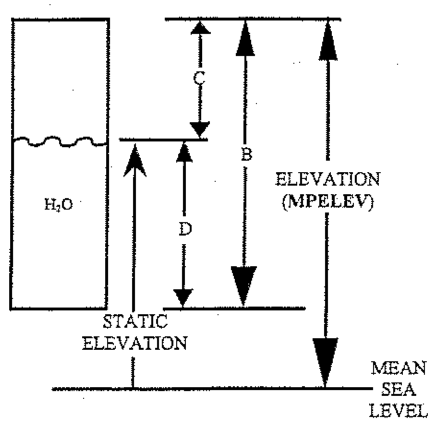
Measured Well Depth (B) (**TOTDEPTH**) ______________ ft.

Measured Water Level Depth (C) (**STATDEP**) 22.73 ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ________ (gal)



Intake Depth: 40'

Depth during purge/sampling:

Purge Date and Method: Bladder Pump 2/26/02

Physical Appearance/Comments: ______________________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1405	23.10	9.29	1,220	12.43	419.0	1.82	70	270
1410	23.07	8.96	1,180	12.26	546	0.99	20	235
1415	22.96	8.65	1,190	12.26	472.0	0.79	-4	240
1420	22.94	8.39	1,210	12.28	324.0	0.71	-55	240
1425	22.92	8.06	1,220	12.23	195.0	0.85	-243	235
1430	23.03	7.90	1,220	12.23	178.0	0.56	-258	240
1435	23.02	7.90	1,220	12.23	137.0	0.56	-257	

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG/RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-95 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/25/02 Weather: sun /35°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

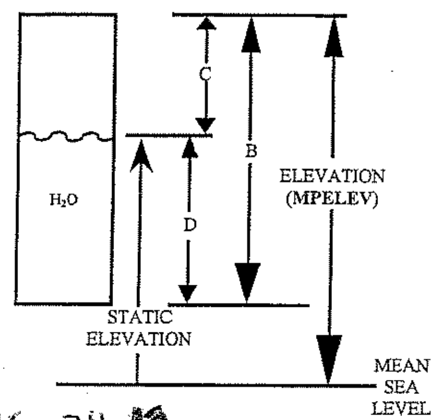
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 23.79 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



Intake Depth: 28'
Depth during purge/sampling: 23.96 - 24.10

Purge Date and Method: Bladder Pump 2/25/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume Removed (gal)~~ DEPTH	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
0950	24.05	6.31	810	11.92	74.4	1.13	-91	240
0955	23.98	6.36	827	11.89	50.9	0.83	-110	280
1000	23.99	6.48	828	11.75	84.4	0.71	-121	240
1005	23.98	6.49	826	11.63	78.4	0.63	-127	240
1010	24.00	6.59	826	11.66	79.7	0.59	-130	240
1015	24.05	6.59	818	11.64	88.6	0.56	-131	240

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG/RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782 MW-96 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/21/02 Weather: overcast 38°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

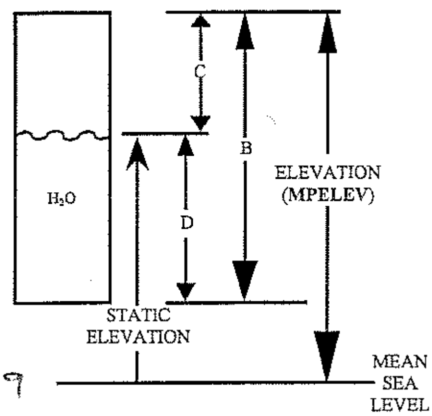
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 22.43' ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ______ (gal)



depth during purge/sampling: 22.50 - 22.69

Intake Depth: 39'

Purge Date and Method: bladder pump

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS: Readings collected once every 1.5 L.

Time	~~Volume~~ Depth Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1514	22.60	7.29	626	12.65	204	1.44	-109
1525	22.51	7.23	570	11.15	450	1.50	-100
1530	22.60	7.24	525	11.22	311	2.75	-94
1536	22.65	7.22	531	11.28	275	2.54	-95
1543	22.58	7.21	578	11.23	208	1.71	-99
1549	22.54	7.21	595	10.91	189	1.42	-100
1556	22.57	7.20	606	10.98	183	4.23	-101
1602	22.64	7.20	613	11.31	188	1.12	-103
~~[illegible]~~							

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): B782 RI

Well No. (**LOCID**): 782vmw-97 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/22/02 Weather: Snow / 30°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

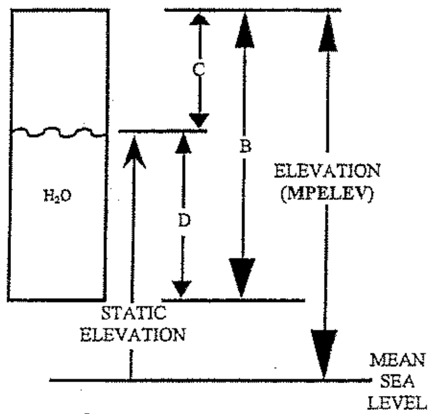
Measured Well Depth (B) (TOTDEPTH) ________ ft.

Measured Water Level Depth (C) (STATDEP) 21.11 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 33'

Depth During purge/Analysis: 21.11' - 21.31'

Purge Date and Method: Bladder pump 2/22/02

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1136	21.11	7.05	540	9.57	55.3	2.87	47	240
1141	21.12	7.08	534	11.09	102.0	1.25	32	240
1146	21.15	7.15	524	11.17	78.3	0.97	25	240
1151	21.120	7.17	520	11.16	74.0	0.77	22	240
1156	21.30	7.19	519	11.25	67.9	0.72	19	240
1201								
1206								

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: ML/RM

Location and Site Code (**SITENAME, SITEID**): B 752

Well No. (**LOCID**): 752VMW-98 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/20/02 Weather: Mixed sun/clouds 35°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

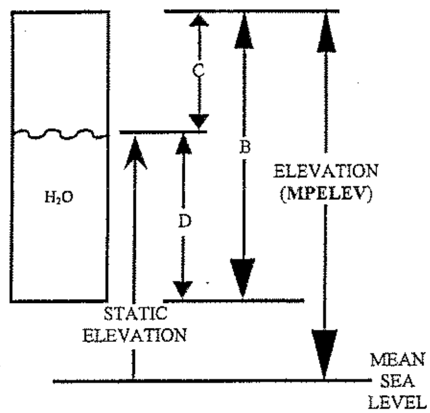
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 19.51 ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ______ (gal)



WATER LEVEL DURING PURGING/SAMPLING
19.51 to 19.72
PUMP INTAKE DEPTH: 32'

Purge Date and Method: Bladder pump 2/20/02

Physical Appearance/Comments: clear water 5 cycles to fill flow-thru

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	DEPTH
1315		6.74	.491	13.69	-10.0	4.03	104	19.60
1327		6.97	.490	13.75	-10.0	3.31	81	19.69
1339		7.15	.492	13.75	-10.0	3.14	78	19.59
1346		7.19	.488	13.79	-10.0	3.12	76	19.70
1402		7.26	.492	13.50	-10.0	3.26	83	19.55
1409		7.24	.490	13.56	-10.0	3.12	79	19.60

sample: 1415

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 783 RI

Well No. (**LOCID**): 783VMW-99 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/22/02 Weather: Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

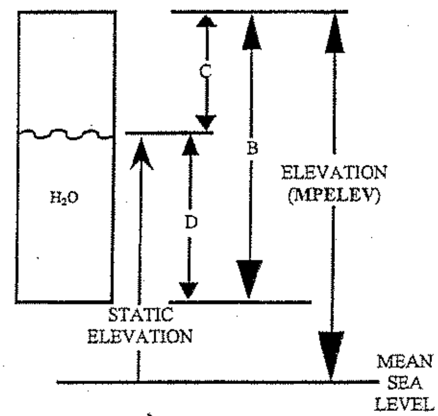
Measured Well Depth (B) (**TOTDEPTH**) 30 ft.

Measured Water Level Depth (C) (**STATDEP**) 20.81 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 28'

Depth During Purge/Sampling: 20.80 – 20.95'

Purge Date and Method: Bladder Pump 2/22/02

Physical Appearance/Comments: ______

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1640	20.81	11.33	553	7.86	192.0	6.01	-78	240
1645	20.86	11.49	593	8.60	144.0	4.89	-83	240
1650	20.82	11.71	718	8.96	149.0	4.50	-88	240
1655	20.81	12.02	1,280	9.30	102	4.15	-101	280
1700	20.83	12.20	1,530	9.52	132.0	3.83	-109	280
1705	20.93	12.25	1,540	9.46	248.0	3.37	-110	280
1710	20.91	12.25	1,420	9.11	324.0	3.04	-108	240

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 783 RI

Well No. (**LOCID**): 783VMW-10C Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 6/25/02 Weather: Sun / cloudy 26°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

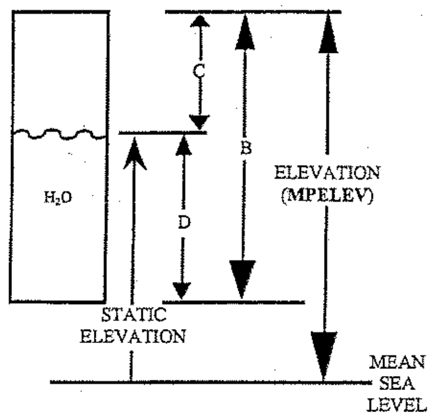
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 16.30 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake depth = 18'

Depth during sampling / Purge: 16.50 – 16.62

Purge Date and Method: Bladder Pump

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ Depth ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1507	16.51	6.97	384	3.68	333.0	6.32	23	50
1521	16.57	6.95	384	2.65	563.0	3.54	22	50
1531	16.61	6.97	386	20.29	659.0	3.42	26	40
1541								

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-101 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/20/02 Weather: Sun/clouds 35°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

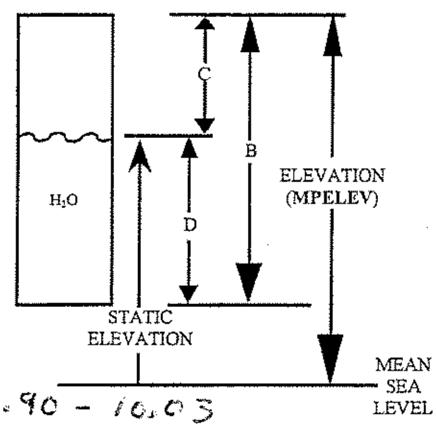
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 9.90 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Water level during Purge/Sampling: 9.90 - 10.03

Pump Intake Depth: 15'

Purge Date and Method: Bladder Pump

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1521	10.02	6.73	.613	9.67	291.0	.96	-119
1526	9.95	6.77	.614	9.74	218.0	.65	-125
1532	10.01	6.78	.620	9.79	177.0	.49	-130
1538	9.97	6.79	.622	9.80	136.0	.44	-132
1546	9.94	6.83	.615	9.49	123.0	.42	-131

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 752 EI

Well No. (**LOCID**): 782Vmw-102 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/20/02 Weather: cloudy (28°)

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

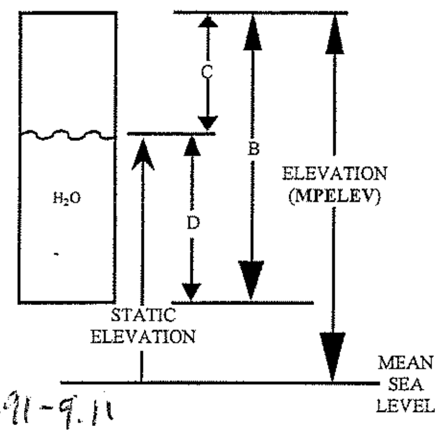
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 8.81 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Water level during purge/samp.: 8.91-9.11
Pump Intake Depth: 19'

Purge Date and Method: Bladder pump

Physical Appearance/Comments: cloudy water

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	DTW
16:50	—	6.91	797	9.93	410	0.39	-121	8.91
16:55	—	6.90	797	9.93	277	0.38	-123	8.85
17:00	—	6.91	795	9.93	173	1.07	-113	8.85
17:05	—	6.92	796	9.94	157	0.43	-118	8.91
17:15	—	6.93	796	9.95	75	0.37	-122	8.81
17:25		6.93	794	9.94	48.3	0.35	-124	8.99

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG/FM

Location and Site Code (**SITENAME, SITEID**): B782 RI

Well No. (**LOCID**): 782VMW-104 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/22/02 Weather: Clouds/30°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

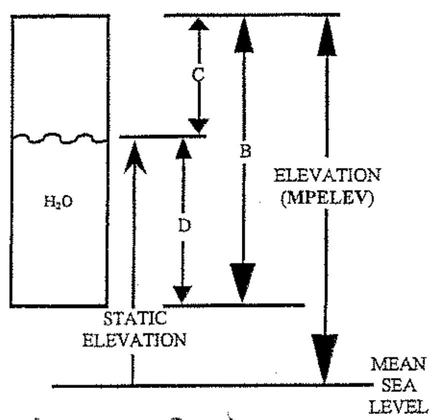
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) 20.00 ft.

Length of Static Water Column (D) ____ (B) - ____ (C) = ____ (D) ft.

Casing Water Volume (E) ____ (A) x ____ (D) = ____ gal

Total Purge Volume = ________ (gal)



Intake Depth: 26'
Depth during purge/sample: 20.10 - 20.30'

Purge Date and Method: Bladder Pump 2/22/02

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1355	20.10	6.87	455	11.49	~~455~~ 110	1.84	-116	240
1400	20.10	6.98	472	11.65	206	1.19	-121	240
1405	20.12	6.98	483	11.70	174.0	0.74	-124	240
1410	20.20	6.96	483	11.63	116.0	0.86	-124	240
1415	20.08	7.00	486	11.58	101.0	0.79	-126	240

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782VMW-105b Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/21/02 Weather: overcast / 45°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

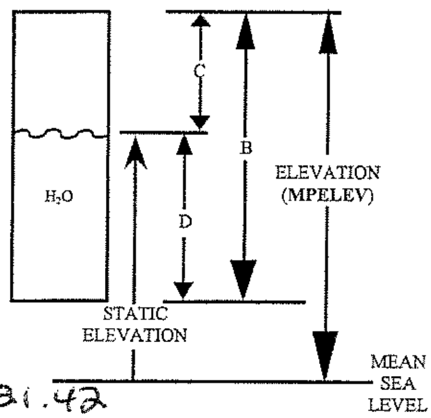
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 21.26 ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ________ (gal)



Depth during purge/sampling: 21.28-21.42

Intake Depth: 36'

Purge Date and Method: Bladder Pump.

Physical Appearance/Comments: clear at first became turbid after 15 minutes. Sampled w/ 462 NTU turbidity.

FIELD MEASUREMENTS: Readings collected once every 1.5 L.

Time	Volume DEPTH Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1321	21.28	7.40	563	12.39	75.5	3.87	42
1334	21.28	7.30	771	12.01	>999.0	1.20	25
1346	21.29	7.39	724	12.12	912	4.27	31
1359	21.31	7.44	692	12.09	546	2.75	28
1407	21.27	7.43	672	13.01	358	1.05	15
1415	21.36	7.46	680	12.60	564	.76	7
1423	21.27	7.45	665	12.66	462	.69	3

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): 782MW-6D Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/27/02 Weather: sun/clouds/28°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

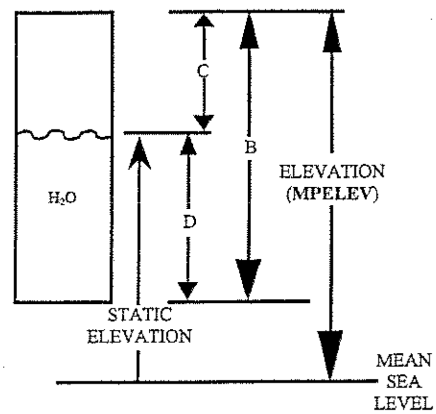
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 24.71 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



Intake depth: 43'

Depth during purge/sampling:

Purge Date and Method: Bladder pump 2/27/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH/ ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	FLOW RATE mL/min
1500	24.85	6.63	853	10.15	288.0	1.72	-102	240
1505	24.73	6.70	868	10.47	234.0	0.94	-115	240
1510	24.72	6.73	867	10.61	298.0	0.80	-121	240
1515	24.72	6.75	869	10.91	282.0	0.69	-124	260
1520	24.72	6.77	865	10.71	224.6	0.63	-125	240

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 783 RI

Well No. (**LOCID**): ~~783~~ 783MW-6R2 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/27/02 Weather: Sun / 27°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

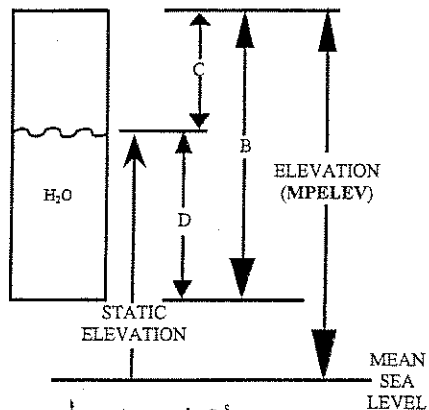
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 24.61 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake Depth: 30'

Depth During Sample/Purge: 24.65' - 24.80'

Purge Date and Method: Bladder Pump 2/27/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed (gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	FLOW RATE mL/min
1610	24.65	6.61	702	11.97	525.0	0.70	-124	1,040
1613	24.70	6.63	709	11.99	425.0	0.58	-128	880
1616	24.69	6.65	713	12.09	351.0	0.52	-130	940
1619	24.71	6.66	717	12.03	285.0	0.47	-132	990
1622	24.67	6.68	720	11.97	238.0	0.43	-134	880
1625	24.65	6.71	722	11.50	242.0	0.43	-135	940

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WELL PURGING & SAMPLING FORM

Project: 684-11-02 Sampled by: MC/RM

Location and Site Code (**SITENAME, SITEID**): 732 RJ

Well No. (**LOCID**): 732 MW-1C Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/28/02 Weather: Sun/clouds 27°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

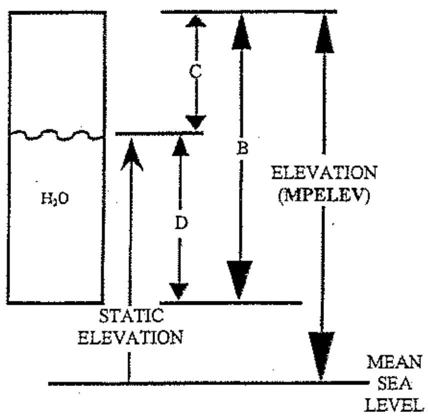
Measured Well Depth (B) (TOTDEPTH) __________ ft.

Measured Water Level Depth (C) (STATDEP) 22.82 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Intake depth: 27'
Depth during sampling/Purge:

Purge Date and Method: Bladder Pump 2/28/02

Physical Appearance/Comments: ______

FIELD MEASUREMENTS:

Time	~~Volume~~ Depth Removed ~~(gal)~~	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1415	22.95	6.92	647	12.36	286.0	1.63	-105	260
1420	22.87	6.56	660	12.22	320.0	1.05	-113	260
1425	22.90	6.57	650	11.98	337.5	0.86	-117	240
1430	22.90	6.62	650	11.59	38.0	0.74	-132	240

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: MG / RM

Location and Site Code (**SITENAME, SITEID**): 782 RI

Well No. (**LOCID**): ~~782W~~ AP2 MW-3 Well Diameter (**CASDIAM**): 2"

Date (**LOGDATE**): 2/27/02 Weather: clouds / 28°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

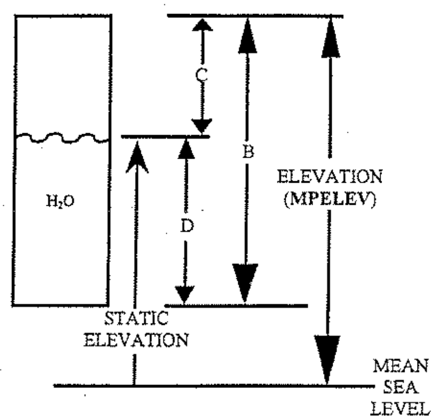
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 20.02 ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



Intake Depth: 27'

Depth during purge/sampling: 20.02 – 20.12

Purge Date and Method: Bladder Pump 2/27/02

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Time	~~Volume~~ DEPTH ~~Removed~~ (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate mL/min
1405	20.04	6.41	716	8.53	53.5	4.24	-87	260
1410	20.04	6.45	714	9.61	80.1	1.68	-94	240
1415	20.04	6.51	715	10.23	109.0	0.91	-102	230
1420	20.04	6.53	715	10.11	120	0.75	-106	240
1425								

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: CH/NVH

Location and Site Code (SITENAME, SITEID): Six Mile Creek

Well No. (LOCID): 782SW-114/115 Well Diameter (CASDIAM): ________

Date (LOGDATE): 5/7/02 Weather: Overcast, 70°, dry

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

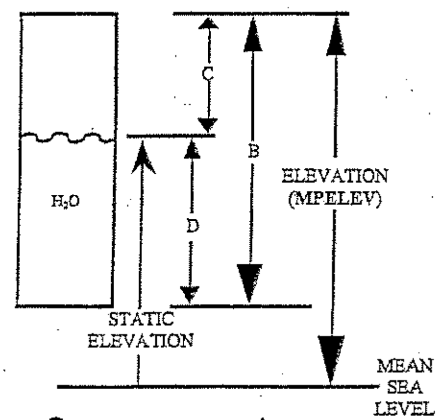
Measured Well Depth (B) (TOTDEPTH) ________ ft.

Measured Water Level Depth (C) (STATDEP) ________ ft.

Length of Static Water Column (D) ____ (B) - ____ (C) = ____ (D) ft.

Casing Water Volume (E) ____ (A) x ____ (D) = ____ gal

Total Purge Volume = ________ (gal)



coordinates for 782VMW-114

Purge Date and Method: (1138970, 1174626) 4' north is where

Physical Appearance/Comments: Orange - clear w/ Fe floc particles / sample was collected.

782SW-115 was collected from creek shore ~10' DG from seepage flow. (1138976, 1174612)

FIELD MEASUREMENTS:

collected sample

	Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
-115	1400	Stream 10' DG	6.86	417	12.82	23.8	8.97	26
-114	1410	~~Lat~~ Pure seepage from wall of culvert	7.01	611	13.92	68.1	8.37	-77
	TOOK Fe^{2+} reading → 3.6 mg/L							
	for sample 782SW-115, I collected 1 more cup for Horiba.							
	1420	Stream ~10' DG		~~400~~		~~4~~		
			7.40	424	14.06	55.1	9.46	0 ↓ decreasing -3, -7

- Obvious sheen, reeks of H_2S

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 084-01-08 Sampled by: CUH/NVH

Location and Site Code (**SITENAME, SITEID**): Six Mile Creek

Well No. (**LOCID**): 782SW-118 Well Diameter (**CASDIAM**): ________

Date (**LOGDATE**): 5/7/08 Weather: Windy, overcast, 70° (prestorm)

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

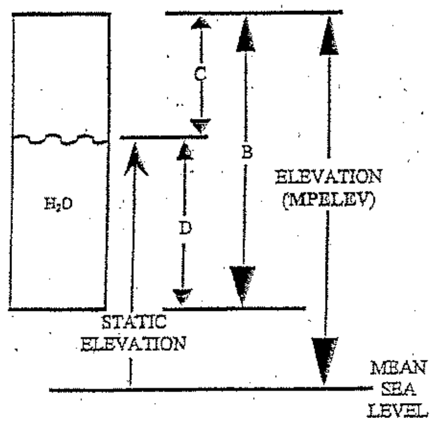
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) ________ ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Purge Date and Method: (1139099, 1174409 N)

Physical Appearance/Comments: Clear, no color

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
~ ~~10~~ 20'	DG of SW-116	7.92	447	14.83	62.3	11.64	-35

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 6B4-01-02 Sampled by: CVH/NVH

Location and Site Code (SITENAME, SITEID): Six Mile Creek

Well No. (LOCID): 7B2SW-119 Well Diameter (CASDIAM): ________

Date (LOGDATE): 5/7/02 Weather: Overcast, windy, pre-storm, 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

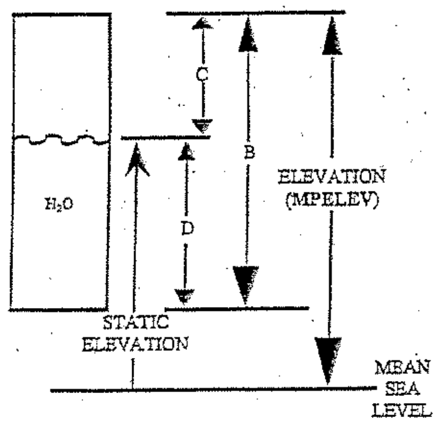
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ________ (gal)



Purge Date and Method: <1139180, 1174286>

Physical Appearance/Comments: clear, colorless

FIELD MEASUREMENTS:

	Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1735	25' DG from 7B2SW-117		7.98	412	14.07	36.9	10.04	-47

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 684-01-02 Sampled by: CWH/NVH

Location and Site Code (SITENAME, SITEID): Six Mile Creek

Well No. (LOCID): 7828W-120 Well Diameter (CASDIAM): ________

Date (LOGDATE): 5/7/02 Weather: Overcast, windy, pre-storm, 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

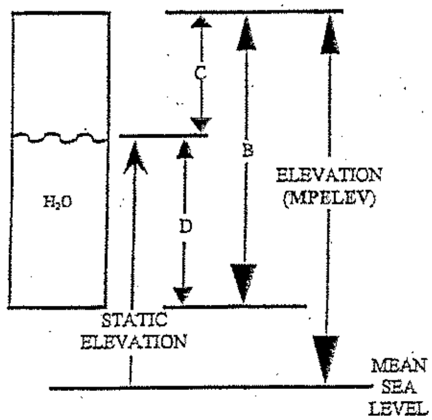
Measured Well Depth (B) (TOTDEPTH) ________________ ft.

Measured Water Level Depth (C) (STATDEP) ________________ ft.

Length of Static Water Column (D) ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ________ (gal)



Purge Date and Method: <1139393, 1173924>

Physical Appearance/Comments: Clear, colorless

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
~350' ft	DG from 7825W-117	7.92	425	13.99	28.6	9.24	-35

WELL PURGING & SAMPLING FORM

Project: 782 Chlorinated Solvents Sampled by: RM/KAP

Location and Site Code (**SITEID**):

Well No. (**LOCID**): WL-782VMW-76 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/4/03 Weather: cloudy, windy, cold - temps in 30's

Start Time: 15:15 → 1710

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

150 300
150 300
300
995
1 gal

PURGING INFORMATION:

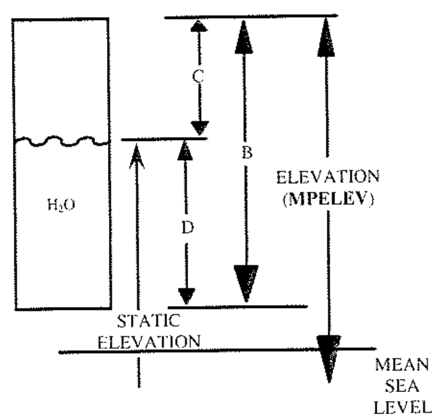
Measured Well Depth (B) (**TOTDEPTH**) — ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 21.30 ft.

Length of Static Water Column (D) = — (B) - — (C) = — (D) ft. (optional)

Depth during Purging/Sampling: — ft (provide range)

Comments (re: Depth during purging/sampling): —



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear no odor

Dissolved Ferrous Iron (mg/L): 3.1 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
15:40	21.42	7.14	0.447	~~6.50~~ 6.50	66.5	2.69	-63	50
16:00	21.44	7.11	0.446	~~6.52~~ 6.52	92.9	2.98	-75	~~75~~ 75
~~16:20~~ 16:14	21.42	7.13	0.455	6.70	133	4.73	-59	75
~~16:40~~ 16:28	21.35	7.15	0.442	6.30	123	5.08	-53	75
~~16:42~~								
	Sample @	16:35						

RAM
RAM
RAM

SAMPLE TIME: 16:35

SAMPLE ID: 782VMW7639BA

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 782 Chlorinated Solvents Sampled by: RM/KAP

Location and Site Code (**SITEID**): ____________

Well No. (**LOCID**): WL-782VMW77 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/5/03 Weather: Overcast, Windy.

START TIME: 15:00

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

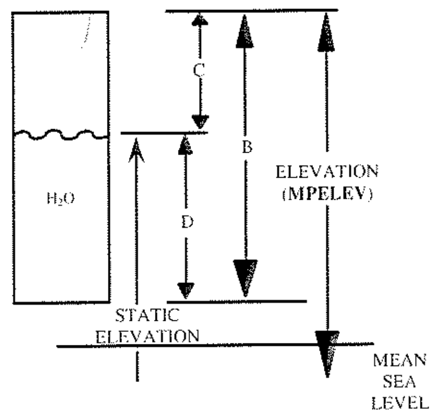
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) ~~18.23~~ ~~19.7~~ ft. 19.70

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: cloudy orange color no odor

Dissolved Ferrous Iron (mg/L): unable to read. > orange water

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1625	19.73	6.85	0.675	0.17	OL	3.38	262	50 ml
1645	19.74	6.82	0.671	0.33	>999	3.04	210	50
1710	19.78	6.82	0.634	3.60	779	2.47	115	50

SAMPLE TIME: 1715

SAMPLE ID: 782VMW773OBA

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: JP/MG

Location and Site Code (**SITEID**): 782

Well No. (**LOCID**): 782VMW-78 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1-31-03 Weather: 15°/overcast/windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

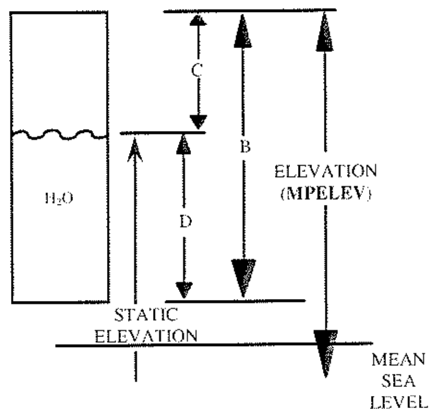
Measured Water Level Depth (C) (**STATDEP**) 24.44 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Depth during Purging/Sampling: 24.44 - 24.65 ft (provide range)

Comments (re: Depth during purging/sampling): ________

Intake Depth - 40.0'



Purge Date and Method: BLADDER PUMP 1-31-03

Physical Appearance/Comments: ________

Dissolved Ferrous Iron (mg/L): 0.0 mg/l

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1227	25	9.46	505	11.2	110	6.38	-120	320
1231	25	9.78	511	12.0	82.2	4.22	-127	320
1234	25.10	9.79	507	11.9	84.0	4.38	-125	325
1239	25.0	9.70	501	12.0	85.6	4.68	-121	320
~~1243~~ 1244	25.1	9.71	497	11.8	87.6	4.83	-119	320
1300	collect Sample							

WELL PURGING & SAMPLING FORM

Project: 782 Petro Spills

Sampled by: RM KAP

Location and Site Code (SITEID): '

Well No. (LOCID): WL-782YMW-80

Well Diameter (SDIAM): 2"

Date (LOGDATE): 2/3/03

Weather:

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

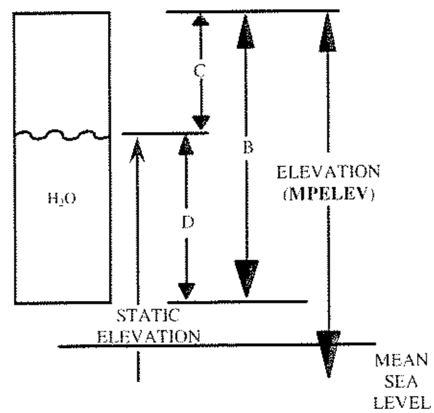
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 19.81 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear no odor

Dissolved Ferrous Iron (mg/L): 3.8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
14:20	19.81	6.05	6.325	~~38~~ 10.5	~~5.33~~ 38.1	5.33	260	150
14:23	19.86	6.39	0.444	10.41	108	2.53	213	200
14:27	19.86	6.60	0.471	10.89	82	1.32	119	200
14:30	19.86	6.72	0.492	10.97	58.2	1.05	68	200
14:34	19.86	6.80	0.482	10.68	58.3	0.83	22	200
14:39	19.86	6.85	0.481	10.93	48.2	0.67	-9	200

SAMPLE TIME: 1440

SAMPLE ID: 782VMW8033BA

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: JB/RM

Location and Site Code (**SITEID**): NOsedocks/Apron 2

Well No. (**LOCID**): 782 , VMW81 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1/30/03 Weather: Cold clear temp in 30's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

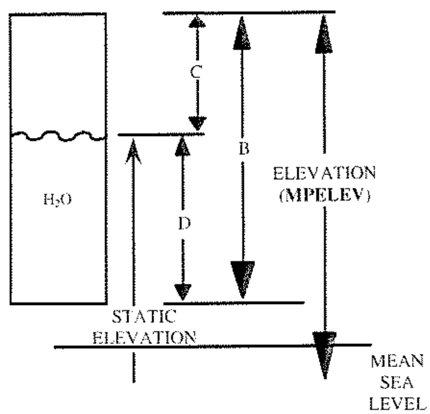
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 22.05 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): 1.4 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1530	22.53	7.86	0.456	9.54	227	5.61	241	200
1535	22.70	7.73	0.461	10.45	96.3	2.73	156	180
1540	22.70	7.68	0.462	10.95	95.7	1.87	62	160
1545	22.68	7.66	0.473	10.64	90.8	1.43	-35	170

WELL PURGING & SAMPLING FORM

444-97-10

Project: ~~782VMW - 82~~ DB Sampled by: DB, JP, MG

Location and Site Code (SITEID): 782VMW-82

Well No. (LOCID): WL-782VMW-82 Well Diameter (SDIAM): 2"

Date (LOGDATE): 1-30-03 Weather: 20 °F

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

1530

Measured Well Depth (B) (TOTDEPTH) 46 ft. (optional)

Measured Water Level Depth (C) (STATDEP) DB ~~20.53~~ 20.72 ft.

Length of Static Water Column (D) = ____ (B) - ~~72~~ (C) = ____ (D) ft. (optional)

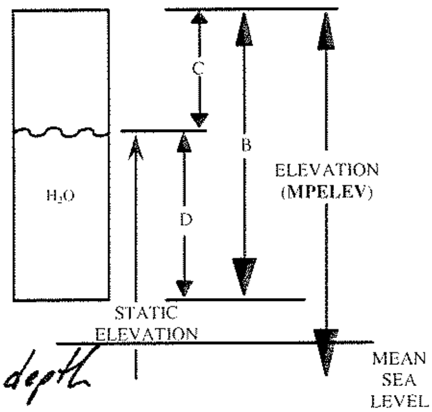
Depth during Purging/Sampling: DB ~~20.72~~ ft

(provide range)

20.72 - 20.85

Comments (re: Depth during purging/sampling):

46 ft intake depth



Purge Date and Method: BLADDER PUMP 1-30-03

Physical Appearance/Comments: Clear

Dissolved Ferrous Iron (mg/L): 2.0 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1554	46	8.29	0.458	10.5	179.0	6.33	-102	210ml
1600 ~~1600~~ DB	46	8.72	0.463	10.8	271.0	4.62	-120	210
1606	46	8.73	0.480	11.0	180.0	3.60	-123	~~200~~ DB 300
1612	46	8.73	0.487	10.8	135.0	3.44	-125	300
1618	46	8.73	0.491	10.8	143.0	3.69	-126	300
1630	sampled							

WELL PURGING & SAMPLING FORM

Project: 4414-97-16 Sampled by: MG / BC

Location and Site Code (**SITEID**): 787 RI

Well No. (**LOCID**): 22NMW-S3 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/4/03 Weather: Wind / 27°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

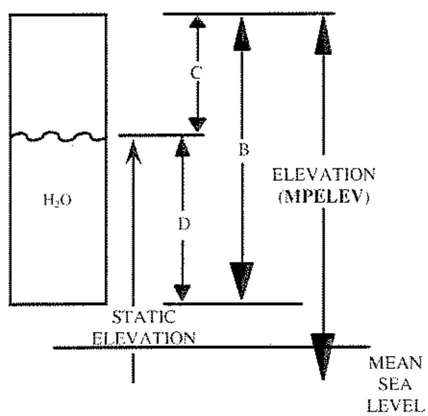
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 20.02 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ~~20.~~ 19.97 ft - 20.02 (provide range)

Comments (re: Depth during purging/sampling): ____________



Intake: 33'

Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): ~~N93~~ ~0.0 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1703	20.00	7.24	463	9.8	31.2	1.12	62	360
1707	19.99	7.28	478	10.3	22.4	.87	61	360
1711	19.98	7.28	482	10.1	19.6	.83	62	360
1725	collect	sample						

WELL PURGING & SAMPLING FORM

Project: 782 CHLORINATED SOLVENTS Sampled by: RM/KAP

Location and Site Code (**SITEID**): ____________

Well No. (**LOCID**): WL-782VMW-84 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): ____________ Weather: SUNNY, 20°F, CALM

START TIME: 1600

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

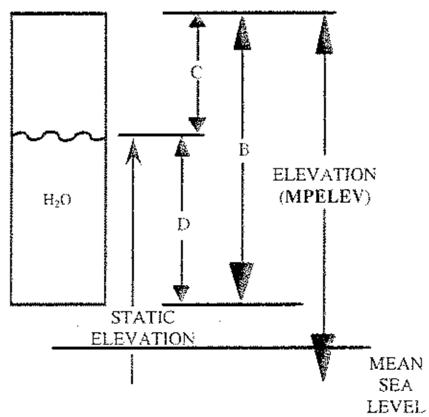
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 23.62 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: THIS WELL WILL NOW BECOME A TEMPORARY WELL BECAUSE CAP WAS TOO CLOSE TO EDGE. CLEAR, NO ODOR.

Dissolved Ferrous Iron (mg/L): 7.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1617	23.62	6.98	0.579	11.13	186	4.44	12	150
1624	23.62	6.89	0.593	11.36	51.6	2.16	-37	200
1629	23.62	6.87	0.594	11.28	14.2	1.52	-46	200

SAMPLE ID: 782VMW8440BA TIME: 1630

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: JP/MG

Location and Site Code (**SITEID**): 782

Well No. (**LOCID**): 782VMW-85 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1.31.03 Weather: 20°/partly Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

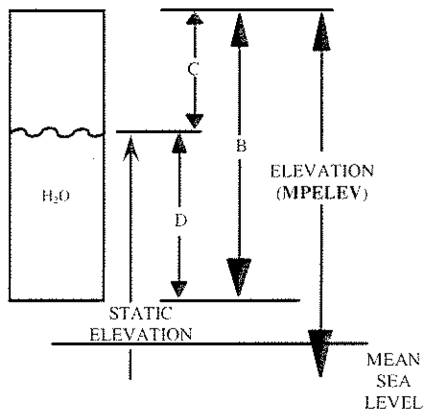
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 24.69 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 24.69 - 24.78 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Intake Depth – 36'

Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): 2.9 mg/l

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1610	24.69	9.18	6.46	9.5	50.0	2.44	-95	450
1613	24.71	9.31	645	10.2	52.2	1.08	-100	450
1617	24.70	9.34	645	10.3	47.4	0.88	-102	450
1620	24.70	9.36	645	10.3	46.1	0.84	-103	450
~~Collect Samp~~								
1630	Collect Sample							

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: MG / BC

Location and Site Code (**SITEID**): 8782 Chl Plume

Well No. (**LOCID**): 782UMW-86 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/4/03 Weather: Rain, 35°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

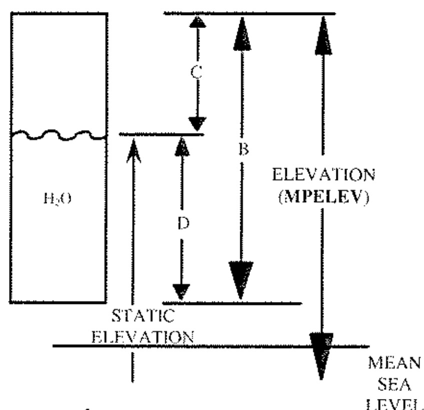
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 23.15 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 23.33' - 23.44' ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 2/4/03

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): 3.8 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1051	23.40	9.49	751	9.5	302	3.10	-94	360
1055	23.38	9.51	7.33	9.6	265	1.86	-98	340
1059	23.40	9.48	711	9.4	218	1.53	-98	36
1103	23.46	9.43	699	9.5	187	1.30	-97	360
1107	23.38	9.42	692	9.6	167	1.10	-99	340

782VM8633BA
BC

WELL PURGING & SAMPLING FORM

Project: 782 Chlorinated Solvents Sampled by: RM/KAP

Location and Site Code (SITEID):

Well No. (LOCID): WL-782VMW-87 Well Diameter (SDIAM): 2"

Date (LOGDATE): 2/6/03 Weather: CLEAR, 20°C, CALM

START TIME: 1645

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

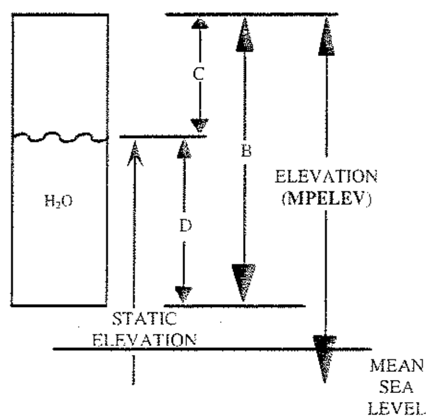
Measured Well Depth (B) (TOTDEPTH) ~~24~~ ft. (optional)

Measured Water Level Depth (C) (STATDEP) 24.18 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling):



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: VERY CLEAR, NO ODOR

Dissolved Ferrous Iron (mg/L): 6.1

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1715	24.18	6.78	0.608	10.39	3.7	1.34	-72	400
1718	24.18	6.83	0.599	10.29	-10	0.74	-86	400
1721	24.19	6.84	0.609	10.34	-10	0.63	-91	400

SAMPLE ID: 782VMW8735BA TIME: 1730

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 782 Chlorinated Solvents Sampled by: RM/KAD

Location and Site Code (SITEID): ______

Well No. (LOCID): WL-782VMW-88 Well Diameter (SDIAM): 2"

Date (LOGDATE): 2/5/03 Weather: BLIZZARD CONDITIONS

START TIME ~~0845~~ 10:00

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) — ft. (optional)

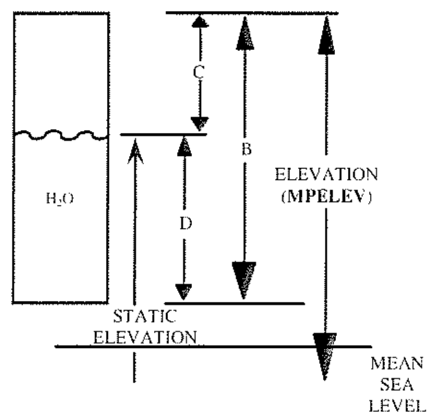
Measured Water Level Depth (C) (STATDEP) ~~[illegible]~~ 27.38 ft.

Length of Static Water Column (D) = — (B) - — (C) = — (D) ft. (optional)

Depth during Purging/Sampling: — ft (provide range)

Comments (re: Depth during purging/sampling): WELL UNDER PRESSURE WHEN PLUG REMOVED.

TOTAL VOLUME PURGED = 4L



Purge Date and Method: BLADDER PUMP ______

Physical Appearance/Comments: ______

Dissolved Ferrous Iron (mg/L): 6.9

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
10:50	27.40	6.60	0.566	7.46	110	1.29	86	150
10:57	27.40	6.72	0.561	7.52	114	0.97	2	150
11:04	27.40	6.78	0.565	8.38	95.1	0.88	-30	150

SAMPLE TIME: 1110

SAMPLE ID: 782VMW8837BA
BC
BS
BD

END TIME: 12:15

WELL PURGING & SAMPLING FORM

Project: U44-97-10 Sampled by: MG / BC

Location and Site Code (**SITEID**): B 782 chl. plume

Well No. (**LOCID**): 782VMW-89 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/4/03 Weather: Rain / 35°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

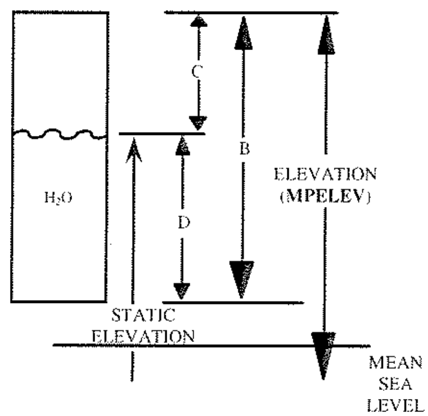
Measured Well Depth (B) (**TOTDEPTH**) ____ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 24.85 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Depth during Purging/Sampling: 24.99 - 25.08 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Intake Depth: 35'

Purge Date and Method: BLADDER PUMP ____

Physical Appearance/Comments: ____

Dissolved Ferrous Iron (mg/L): ~~4.52~~ 5.1 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1217	24.99	9.42	514	9.9	63.2	1.17	-109	400
1221	25.02	9.44	515	9.9	76.2	1.04	-110	400
1226	25.00	9.44	520	9.7	59.0	1.00	-110	400
1231	25.03	9.42	522	9.8	57.6	.95	-111	400
1240	collect	Sample.						

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: MG/BC

Location and Site Code (**SITEID**): B782

Well No. (**LOCID**): 782UMW-90 Well Diameter (**SDIAM**): 2'

Date (**LOGDATE**): 2/4/03 Weather: Cloudy/30°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

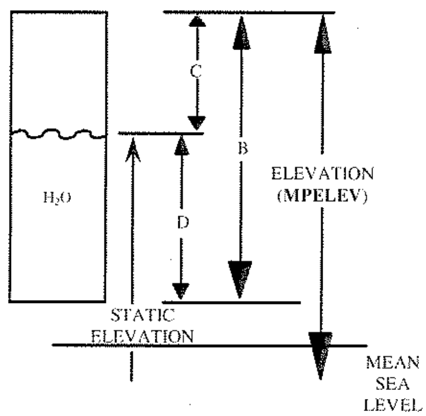
Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 25.3 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Depth during Purging/Sampling: 25.39-25.45 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Intake ~29'

Purge Date and Method: BLADDER PUMP ______

Physical Appearance/Comments: ______

Dissolved Ferrous Iron (mg/L): 5.1 mg/l

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
3:17	25.39	9.03	546	11.3	52.6	0.83	-99	300
3:21	24.41	9.09	566	11.4	48.8	0.69	-103	300
3:25	24.43	9.11	566	11.5	47.0	0.64	-105	300
3:29	24.40	9.12	568	11.7	51.8	0.60	-106	300

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: MG, DB

Location and Site Code (**SITEID**): 782VMW-91

Well No. (**LOCID**): WL-782VMW-91 Well Diameter (**SDIAM**): 2

Date (**LOGDATE**): 2-7-03 Weather: 25°F sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

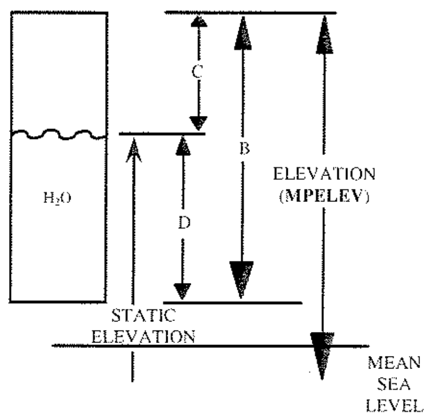
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 20.09 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 20-26-20.37 (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 2-7-03

Physical Appearance/Comments: clear, no odor

Dissolved Ferrous Iron (mg/L): 4.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1605	20.26	6.68	1.71	9.39	9.1	1.20	-53	250
1610	20.26	6.69	1.72	10.25	-10.0	0.75	-82	290
1615	20.30	6.70	1.72	10.57	-10.0	0.69	-98	300
1620	20.39	6.72	1.73	10.70	-9.5	0.77	-107	300
~~1623~~								
1625	20.40	6.73	1.73	10.42	-2.3	0.80	-109	300
1640	Sampled							

WELL PURGING & SAMPLING FORM

Project: 782 Chlorinated Solvents Sampled by: RM/KW

Location and Site Code (**SITEID**):

Well No. (**LOCID**): WL-782VMW-72 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/6/03 Weather: Sunny, 15°F

Start Time 1100

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

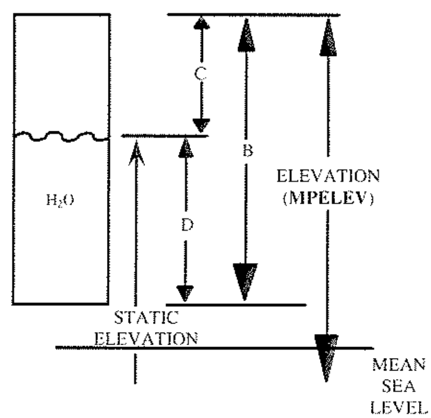
Measured Well Depth (B) (**TOTDEPTH**) ____ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 22.64 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Depth during Purging/Sampling: ____ ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments:

Dissolved Ferrous Iron (mg/L): 4.8 mG/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1117	22.~~73~~64	6.51	0.522	11.45	175	2.03	176	225
1122	22.64	6.66	0.590	12.28	281	1.13	32	250
1126	22.64	6.76	0.594	12.24	260	0.78	-39	250
1130	22.65	6.85	0.596	12.06	198	0.63	-62	250

SAMPLE ID: 782VMW9235BA

TIME COLLECTED: 1135

WL782VMW9335BA

WELL PURGING & SAMPLING FORM

Project: 782 PETRO SPILLS Sampled by: RM/KAP

Location and Site Code (SITEID):

Well No. (LOCID): WL-782VMW-93 Well Diameter (SDIAM): 2"

Date (LOGDATE): 2/3/03 Weather:

15:26 start time

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

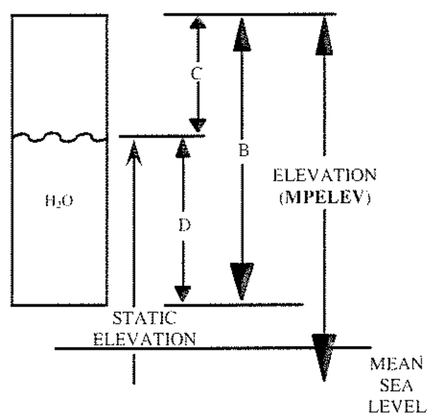
Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

Measured Water Level Depth (C) (STATDEP) 21.80 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling):



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear no odor

Dissolved Ferrous Iron (mg/L): 4.5

FIELD MEASUREMENTS: 5 10 10

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
15:48	21.95	9.7	0.213	7.37	62.4	6.7	196	200
15:51	21.95	8.75	0.315	10.16	61.8	4.23	181	200
15:54	21.95	7.86	0.593	10.34	82.0	2.25	-54	200
15:57	22.05	7.48	0.420	10.41	99.3	1.54	-67	200
15:59	22.05	7.35	0.429	10.56	111.0	1.33	-66	200
16:04	22.05	7.16	0.437	10.59	82.0	0.92	-63	200

SAMPLE TIME: 16:10

SAMPLE ID: 782VMW9335BA

WELL PURGING & SAMPLING FORM

Project: 782 PETRO SPILLS Sampled by: RM/KAP

Location and Site Code (**SITEID**): ____________

Well No. (**LOCID**): WL-782VMW-94 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/3/03 Weather: ____________

16:49 START TIME

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

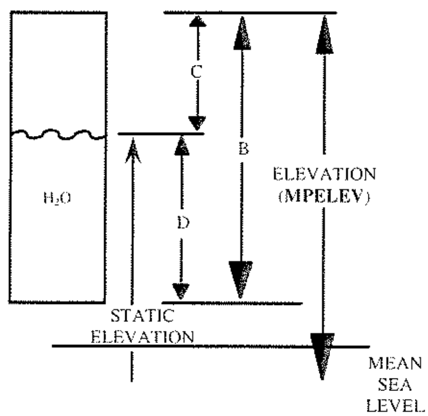
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 22.50 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: clear no odor

Dissolved Ferrous Iron (mg/L): 1.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1700	22.62	10.32	0.711	8.77	83.6	4.25	107	200
1705	22.62	9.44	0.685	9.31	57.8	2.42	120	190
1710	22.55	8.94	0.705	9.53	38.1	1.78	127	190
1715	22.55	8.47	0.723	9.89	24.9	1.41	122	190
1720	22.55	8.12	0.735	9.97	21.2	1.20	21	190
1728	22.55	7.81	0.746	9.75	17.4	1.03	-65	190
1730	22.55	7.72	0.747	9.88	15.5	0.95	-71	190

SAMPLE TIME: 1735

SAMPLE ID: 782VMW94420B4

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 447-97.10

Location and Site Code (**SITEID**): 782 Sampled by: JP / MG

Well No. (**LOCID**): 782VMW-95

Date (**LOGDATE**): 1.31.03 Well Diameter (**SDIAM**): 2"

Weather: 15°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

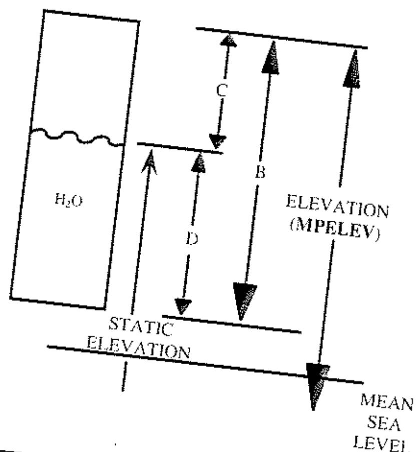
Measured Water Level Depth (C) (**STATDEP**) 23.72 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 23.72 - 23.85 ft (provide range)

Comments (re: Depth during purging/sampling): ________

Intake Depth 28'



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: ________

Dissolved Ferrous Iron (mg/L): 2.4 mg/l

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
~~1645~~	~~23.75~~							~~480~~
1648	23.75	9.34	465	11.4	183	1.5	-111	480
1651	23.76	9.41	469	12.0	91.2	.81	-119	480
1654	23.75	9.45	471	12.0	84.4	.71	-123	480
1657	23.77	9.52	480	12.0	82.2	.58	-127	480
1720	collect sample							

WELL PURGING & SAMPLING FORM

Project: 782 CHLORINATED SOLVENTS Sampled by: [illegible]

Location and Site Code (**SITEID**): 782

Well No. (**LOCID**): WL-~~[illegible]~~ 782VMW-96 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/6/03 Weather: Sunny, 15°F

Start time: ~~1200~~ 1230

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

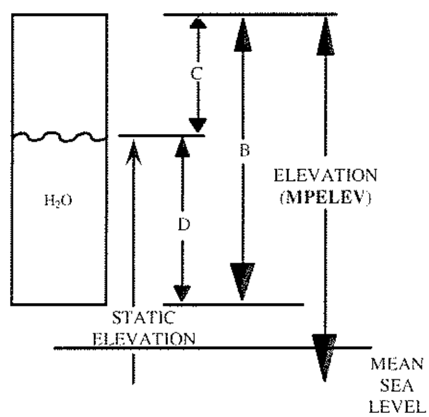
Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 22.18 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear no odor.

Dissolved Ferrous Iron (mg/L): 3.8 MG/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1240	22.18	7.57	494	6.74	129	5.82	136	100
1245	22.19	7.18	500	7.14	61	3.04	56	100
1250	22.18	7.07	491	8.64	53.3	1.89	34	100
1255	22.18	7.06	487	8.77	50.1	1.92	35	100
1300	22.18	7.06	485	8.82	22.7	2.05	38	100
1305	22.18	7.05	495	8.73	22.7	2.05	35	100

Sample ID: 782VMW9637BA. time 1310

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: JP / MG

Location and Site Code (**SITEID**): 782

Well No. (**LOCID**): 782 MW-47 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1-31-03 Weather: 15° / overcast / windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

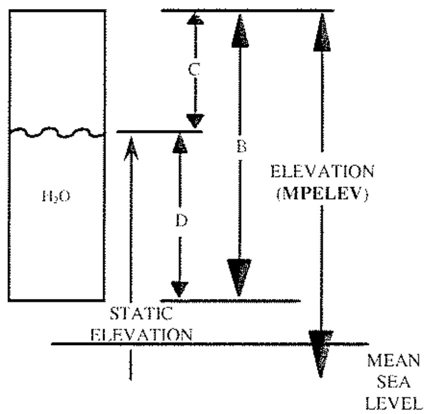
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 20.50 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling 20.52 - 20.66 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Intake Depth - 33'

Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear

Dissolved Ferrous Iron (mg/L): 0.0 mg/l

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1040	20.55	6.09	371	11.8	62.5	4.17	169	460
1045	20.57	6.31	381	12.0	44.9	5.75	156	450
1048	20.55	6.41	383	12.0	42.0	6.20	151	450
1051	20.57	6.46	384	12.0	39.7	3.56	149	440
1054	20.57	6.53	386	12.4	40.4	4.17	145	450
1057	20.57	6.58	387	12.4	39.4	2.03	144	456
1100	20.58	6.63	389	12.6	40.3	3.68	141	
1105	collect sample			~240 ml/min				

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: RM/JB

Location and Site Code (**SITEID**): Nosedocks/Apron 2

Well No. (**LOCID**): 783 VMW98 Well Diameter (**SDIAM**): 2 inch

Date (**LOGDATE**): 1/30/03 Weather: Sunny 30°F

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

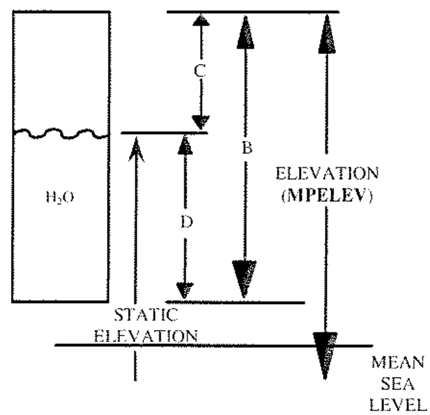
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 18.92 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: clear no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
10:55	18.92	9.43	0.504	12.63	91.9	6.01	197	350
1700	18.95	8.88	0.324	12.46	97.4	4.82	190	300
1705	18.85	8.58	0.335	12.21	92.7	4.31	196	280
1710	18.75	8.36	0.357	12.26	97.7	4.69	201	240
1715	18.92	8.15	0.343	11.50	114	4.46	206	210

SAMPLER DEPTH: 33'

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: JP/MG

Location and Site Code (**SITEID**): ____________

Well No. (**LOCID**): 782VMW-99 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1-31-03 Weather: 20° / OVERCAST

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

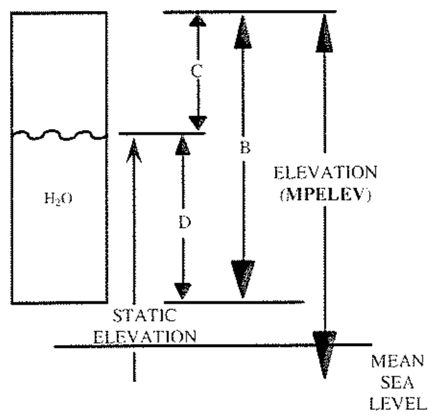
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 20.10 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 20.12 - 20.24 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Intake Depth : 28'

Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: "

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1519	20.14	7.14	389	9.8	97.6	6.53	88	400
1522	20.15	7.07	402	10.1	91.8	5.64	91	400
1525	20.16	7.03	419	10.1	96.4	5.18	94	400
1529	20.15	6.99	437	10.1	91.7	4.95	98	400
1531	20.16	6.97	443	10.1	88.8	4.86	100	400
1540	Collect Sample							

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: RM / DB

Location and Site Code (**SITEID**): 782 Chlorinated Plume Study

Well No. (**LOCID**): WL-782VMW-100 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/7/2003 Weather: Cold, cloudy, snow.

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

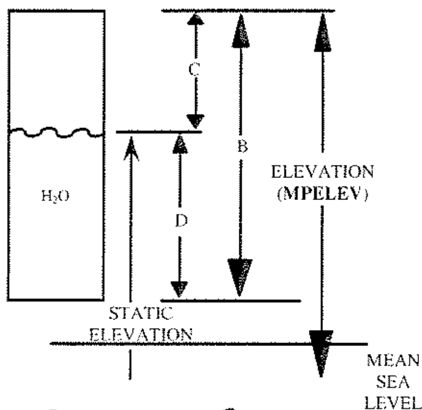
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 15.98 ft. ~~16.98~~ DB 16.28

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: DB 15.98-16.30 ft. (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 2-7-03

Physical Appearance/Comments: silty (lite brown)

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1002	16.30	6.43	0.324	4.71	342.0	6.06	361	50
1012	16.18	6.82	0.324	3.99	399.0	5.80	376	50
1022	16.21	7.03	0.327	3.98	349.0	5.36	321	50
1032	16.21	7.19	0.329	4.09	303.0	5.26	385	50
1035	Sample							

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: JP, DB, MG

Location and Site Code (**SITEID**): 782VMW-101

Well No. (**LOCID**): WL-782VMW-101 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1-30-02 Weather: 20°F Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

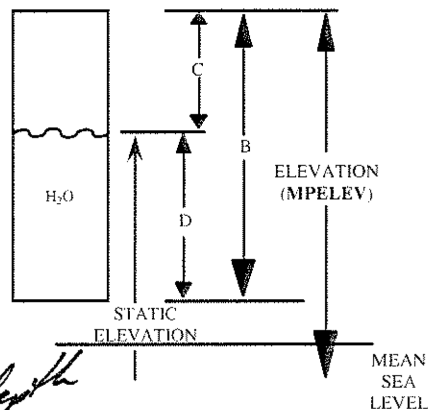
Measured Well Depth (B) (**TOTDEPTH**) 78.00 DB ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 10.06 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 10.06 - 10.13 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



18.00 - intake depth

Purge Date and Method: BLADDER PUMP 1-30-03

Physical Appearance/Comments: clear (slight silt)

Dissolved Ferrous Iron (mg/L): 3.0

400

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1255	18	7.88	0.326	8.1	127.0	4.80	-72	~~400~~ DB 240
1301	18	7.86	0.327	7.9	119.0	4.78	-66	240
1307	18	7.85	.328	8.1	115.0	3.98	-68	240
1313	18	7.85	.331	8.3	118.0	3.00	-69	240
1319	18	7.85	.333	8.1	109.0	2.70	-70	240
1330	Sampled							

Page ____ of ____

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: DB, MG, JP

Location and Site Code (**SITEID**): 782VMW-102

Well No. (**LOCID**): WL-782VMW-102 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1-30-03 Weather: 15°F, sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

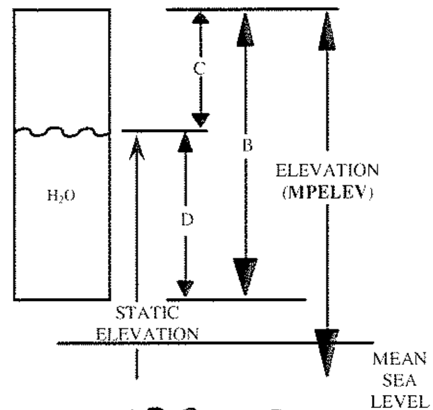
Measured Well Depth (B) (**TOTDEPTH**) ~~78.00~~ DB ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 8.97 ft.

Length of Static Water Column (D) = ________ (B) - ________ (C) = ________ (D) ft. (optional)

Depth during Purging/Sampling: 8.97 to 9.11 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Arrive at ~~1115~~ 11:00AM

19.00 ft - intake depth

Purge Date and Method: BLADDER PUMP 1-30-03

Physical Appearance/Comments: ~~red~~ DB brown - silty

Dissolved Ferrous Iron (mg/L): 5.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1126	19.00	7.94	0.519	10.0	999.0	2.36	-67	240ml
1132	19.00	7.94	0.518	9.6	999.0	5.15	-67	240mL
1138	19	7.94	0.515	9.9	999.0	3.30	-70	240ml
1144	19	7.55	0.516	9.7	999.0	2.27	-72	240ml
~~1150~~ DB								
1215	19	7.91	0.510	10.2	712.0	2.40	-76	240ml
1230	Sample							

QED - control box froze, took 20 minute

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: RM/JB

Location and Site Code (**SITENAME, SITEID**): Nosedocks/Apron 2

Well No. (**LOCID**): 782VMW104 Well Diameter (**CASDIAM**): 2 inch

Date (**LOGDATE**): 1/30/03 Weather: Sunny 32°F

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0
Unit Casing Volume (A) (gal/ft.)	0.04	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0

PURGING INFORMATION:

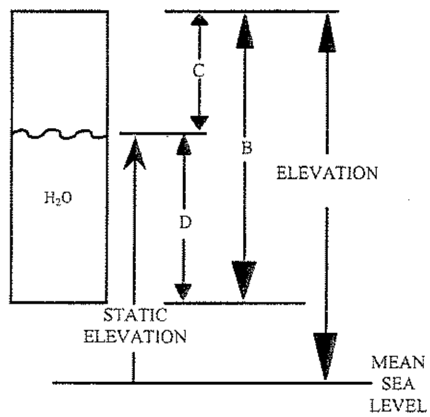
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) 19.46 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear

FIELD MEASUREMENTS: 3.4 mg/l Fe

Time	~~Volume~~ DTW ~~Removed~~ (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate ml/min
1245	19.56	6.50	0.418	11.31	315	3.50	75	300
1250	19.53	6.69	0.428	11.37	164	2.41	37	250
1255	19.75	6.84	0.436	10.69	140	2.49	-13	230
1300	19.59	6.86	0.438	10.73	127	2.24	-15	240
1305	19.50	6.90	0.442	10.23	138	2.06	-34	200
1310	19.53	6.89	0.440	9.90	142	2.34	-42	200

IRON 3.4 mg/L

WELL PURGING & SAMPLING FORM

Project: 444-97-10　　Sampled by: RM/JB

Location and Site Code (**SITEID**): Nosedocks/Apron 2

Well No. (**LOCID**): 782VMW-105B　　Well Diameter (**SDIAM**): 2 inch

Date (**LOGDATE**): 1/30/03　　Weather: Sunny 32° F

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

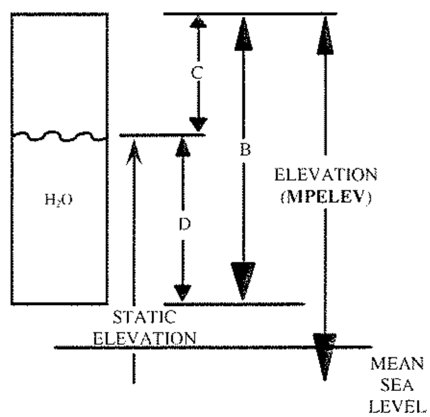
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 20.75 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: light brown no odor

Dissolved Ferrous Iron (mg/L): 0.0 mg/l

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1425	20.76	7.45	0.494	11.80	>1000	2.75	98	200
1430	20.79	7.27	0.485	11.99	>1000	1.75	92	200
1435	20.76	7.27	0.473	12.10	>1000	1.33	90	200
1440	20.76	7.31	0.471	12.36	>1000	0.97	93	200
1445	20.80	7.31	0.463	12.63	>1000	0.93	95	220

WELL PURGING & SAMPLING FORM

Project: -97-10 Sampled by: ____________

Location and Site Code (**SITEID**): AP2MW327BA

Well No. (**LOCID**): ____________ Well Diameter (**SDIAM**): ____________

Date (**LOGDATE**): 3-7-03 Weather: Cold, Windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

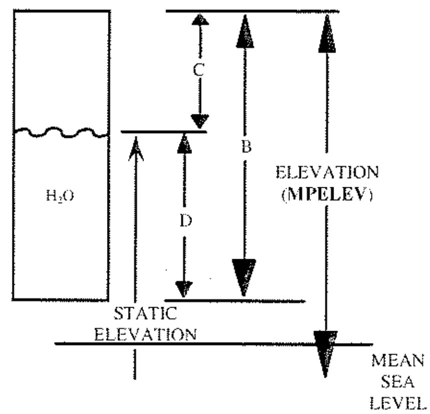
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 20.00 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 20.00 - 20.15 (provide range)

Comments on Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): 6.0 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
4:19	20.10	9.71	525	10.2	-7.1	0.93	-109	480
4:22	20.05	9.73	528	10.1	-4.3	0.82	-109	480
4:25	20.10	9.72	529	10.1	-2.7	0.72	-110	480
4:28	20.05	9.70	529	10.2	-3.8	0.72	-110	480
4:31	20.10	9.68	531	10.2	-5.2	0.70	-111	480

Sample collected @ 16:45

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: DB, MG, JP

Location and Site Code (**SITEID**): 782 MW-6D

Well No. (**LOCID**): WL-782MW-6D Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 1-30-03 Weather: 20°F sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ft. (optional)

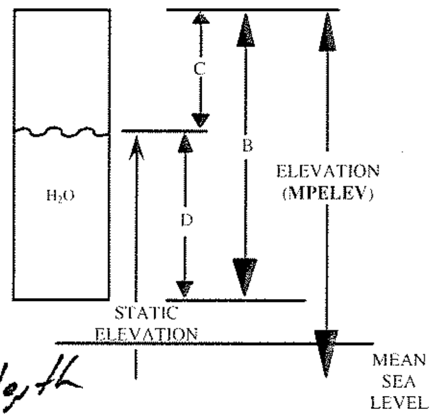
24.55

Measured Water Level Depth (C) (**STATDEP**) 24.30 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: 24.30 - 24.50 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



43 ft intake depth

1645-

Purge Date and Method: BLADDER PUMP 1-30-03

Physical Appearance/Comments: Clear (slight silt)

Dissolved Ferrous Iron (mg/L): 4.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1720 ~~1730~~ DB	43	7.81	0.805	11.8	125.0	2.87	-93	480
1732	43	7.94	0.803	12.3	154.0	2.67	-95	480
1734	43	7.98	0.809	12.3	95.8	3.04	-97	480
1736	43	8.03	0.811	12.2	90.7	3.64	-98	480
1738	43	8.08	0.805	12.3	81.0	2.12	-100	480
1745	Sample							

QED - froze, battery died

WELL PURGING & SAMPLING FORM

Project: 782 Chlorinated Solvents Sampled by: RM/KAP

782MW6R2 Location and Site Code (**SITEID**): ______

Well No. (**LOCID**): ______ Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/4/03 Weather: ______

START TIME: 1115

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

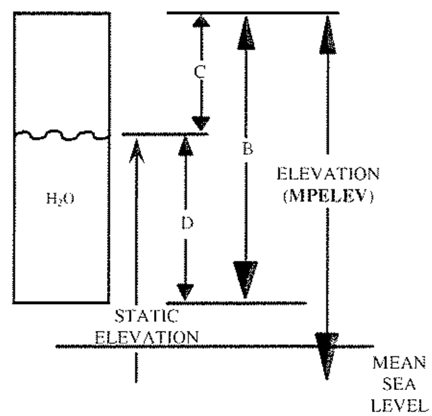
Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 24.40 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP ______

Physical Appearance/Comments: ______

Dissolved Ferrous Iron (mg/L): 6.1 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
12:09	24.35	6.52	0.603	10.51	10.0	0.54	-17	400
12:12	24.35	6.61	0.616	10.61	10.0	0.44	-55	400
12:15	24.35	6.66	0.613	10.45	9.9	0.40	-72	400

SAMPLE TIME: 1220

SAMPLE ID: 782MW6R230BA

WELL PURGING & SAMPLING FORM

Project: 782 CHLORINATED SOLVENTS Sampled by: RM/KAS

Location and Site Code (**SITEID**): ____________________

Well No. (**LOCID**): WL-782MW-10 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 2/6/03 Weather: SUNNY, 20°F, CALM

START TIME: 13:40

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

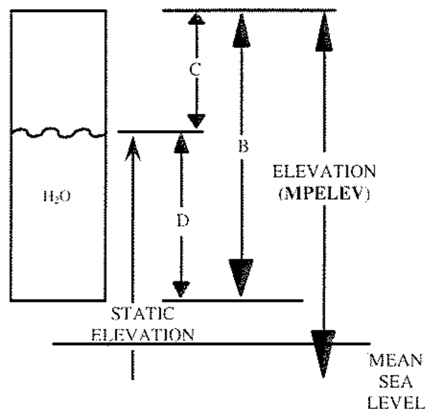
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) 22.47 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: SLIGHT ORANGE IN COLOR, SLIGHT IRON ODOR

Dissolved Ferrous Iron (mg/L): 4.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1350	22.47	6.76	0.574	13.16	349	7.17	-69	400
1353	22.47	6.79	0.574	13.25	241	6.60	-78	400
1356	22.47	6.83	0.572	13.41	186	5.98	-94	400

SAMPLE ID: 782MW1027BA TIME: 1400
782MW1027BC

WELL PURGING & SAMPLING FORM

Project: 444-97-16 Sampled by: MG, DB

Location and Site Code (SITENAME, SITEID): 786 MW-30

Well No. (LOCID): ____________ Well Diameter (CASDIAM): 2"

Date (LOGDATE): 1-22-03 Weather: 15 0F sunny

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0
Unit Casing Volume (A) (gal/ft.)	0.04	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0

PURGING INFORMATION:

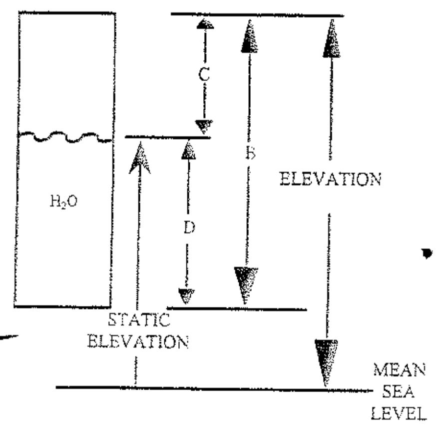
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



depth range - ~~17.45 to~~ 17.34 to 17.45

Purge Date and Method: low flow bladder pump / 1-22-03

Physical Appearance/Comments: (light) silty, no odor
FE 0.0

FIELD MEASUREMENTS:

Time	~~Volume Removed (gal)~~ Depth to water	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	flow rate mL/m
1620	17.34	7.59	271	10.36	230.0	1.82	216	270
1625	17.39	7.46	272	10.45	52.5	.95	127	270
1630	17.34	7.40	276	10.46	38.9	.81	80	270
1635	17.38	7.37	277	10.39	17.2	.70	48	270
1640	17.40	7.35	281	10.45	8.1	.65	31	270
1645	Sample							

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: MG/KC

Location and Site Code (**SITENAME, SITEID**): BLDG. 782 Chl. Solvents

Well No. (**LOCID**): SW-115 Well Dia~~meter~~ (CASDIAM): SURFACE WATER

Date (**LOGDATE**): 2/10/03 Weather: LT. SNOW, 15°F

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0
Unit Casing Volume (A) (gal/ft.)	0.04	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0

PURGING INFORMATION: NA

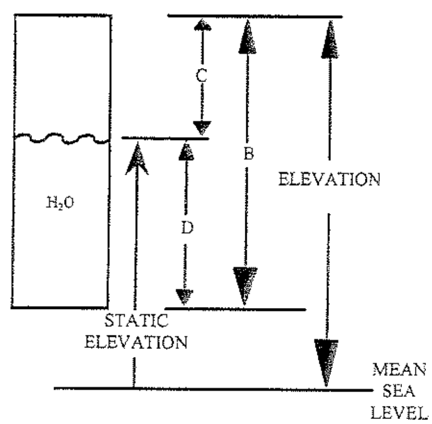
Measured Well Depth (B) (**TOTDEPTH**) ________ ft.

Measured Water Level Depth (C) (**STATDEP**) ________ ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft.

Casing Water Volume (E) = ____ (A) x ____ (D) = ____ gal

Total Purge Volume = ____ (gal)



Purge Date and Method: ________

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1300	NA	5.78	0.226	4.58	99.6	12.47	435

SAMPLE ID: 782SW115Ø1BA TIME: 1300

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: MC/KC

Location and Site Code (**SITENAME, SITEID**): SAA 782 Chl. Solvents

Well No. (**LOCID**): SW-118 Well ~~Diameter~~ (**CASDIAM**): SURFACE WATER

Date (**LOGDATE**): 2/10/03 Weather: LT. SNOW, 15° F

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0
Unit Casing Volume (A) (gal/ft.)	0.04	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0

PURGING INFORMATION: NA

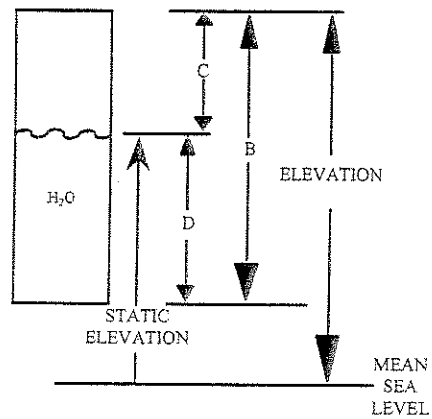
Measured Well Depth (B) (**TOTDEPTH**) ______ ft.

Measured Water Level Depth (C) (**STATDEP**) ______ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Purge Date and Method: ______

Physical Appearance/Comments: ______

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1315	NA	6.07	0.199	2.65	37.5	12.98	441

SAMPLE ID: 782SW118Ø1BA TIME: 1315

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: MG/KC

Location and Site Code (SITENAME, SITEID): 782 Chlorinated Solvents

Well No. (LOCID): SW-119 Well Diameter (CASDIAM): SURFACE WATER

Date (LOGDATE): 2/10/03 Weather: LT. SNOW, 15°F

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0
Unit Casing Volume (A) (gal/ft.)	0.04	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0

PURGING INFORMATION: NA

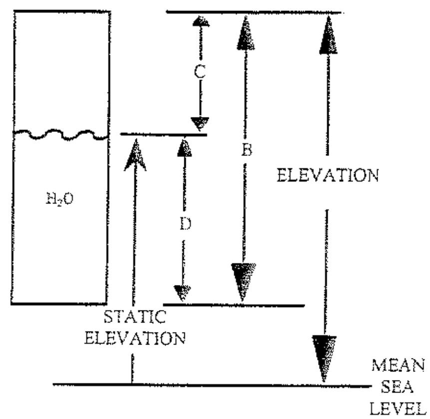
Measured Well Depth (B) (TOTDEPTH) ________ ft.

Measured Water Level Depth (C) (STATDEP) ________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ (gal)



Purge Date and Method: ________

Physical Appearance/Comments: ________

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1330	NA	6.41	0.196	2.33	5.6	12.48	434

SAMPLE ID: 782SW119Ø1BA TIME: 1330

WELL PURGING & SAMPLING FORM

Project: 444-97-10 Sampled by: MG/KC

Location and Site Code (SITEID): 782 Chlorinated Solvents

Well No. (LOCID): SW-120 Well Diameter (SDIAM): SURFACE WATER.

Date (LOGDATE): 2/10/03 Weather: LT. SNOW, 15°F

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION: NA

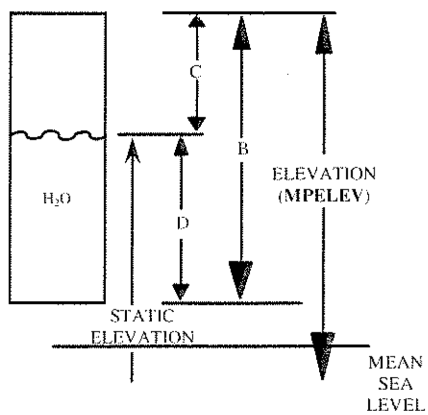
Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

Measured Water Level Depth (C) (**STATDEP**) ________ ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments:

Dissolved Ferrous Iron (mg/L):

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (µS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1345	NA	6.61	0.198	2.22	~10.0	12.64	430	

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAC

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782VMW-82 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6.25.03 Weather: Sunny - 90°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ft. (optional)

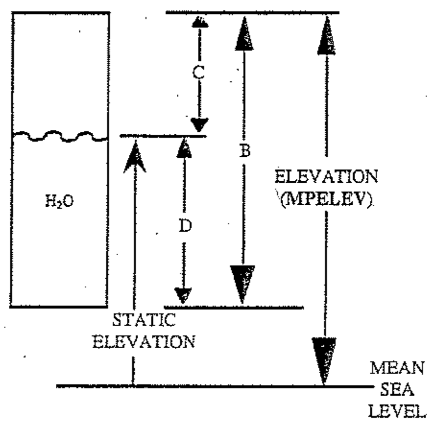
Measured Water Level Depth (C) (STATDEP) 19.64 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46'

Depth during Purging/Sampling: 19.81-19.90 78 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Silty Brown, No odor/sheen.

Dissolved Ferrous Iron (mg/L): 1.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1700	19.80	6.78	0.372	14.31	715	2.80	-147	220
1705	19.86	6.76	0.375	14.09	660	2.40	-151	220
1710	19.84	6.77	0.377	14.13	611	2.32	-155	220

Sample Time: 1712 Sample ID: 782M8220CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

ʬ

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: KAC & ATMcC

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-98 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6·25·03 Weather: HOT! & Sunny 90°F

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ft. (optional)

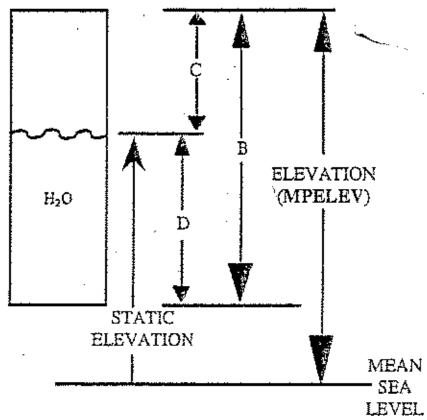
Measured Water Level Depth (C) (STATDEP) 17.29 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 17.31 - 17.51 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: CLEAR, NO SHEEN/ODOR

Dissolved Ferrous Iron (mg/L): 0.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1503	17.34	7.10	0.342	13.58	396	7.40	17	500
1505	17.51	6.97	0.330	13.31	388	6.87	14	500
1507	17.32	6.91	0.336	13.48	383	6.85	20	500
1509	17.35	6.89	0.336	13.27	371	6.95	24	500

Sample Time: 1510 Sample ID: 782M9817CA

CS

CD

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01　　Sampled by: DB

Location and Site Code (**SITEID**): Bldg 782

Well No. (**LOCID**): WL- 782VMW-77　　Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/25/03　　Weather: Sunny 70's °

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

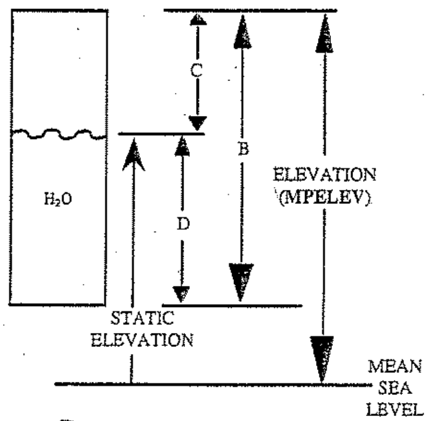
Measured Water Level Depth (C) (STATDEP) 18.15 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 30.08

Depth during Purging/Sampling: 25.08 - 35.08 ft (provide range) 19.1 - 19.4

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 6-25-03

Physical Appearance/Comments: clear/silt / no odor

Dissolved Ferrous Iron (mg/L): 4.1

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1105	19.15	6.77	0.527	17.32	209.0	3.09	-84	180
1112	19.35	6.79	0.522	16.40	318.0	2.33	-85	100
1118	19.30	6.78	0.520	16.82	259.0	1.86	-86	80
1123	19.30	6.78	0.522	16.71	154.0	1.55	-90	80
1128	19.30	6.78	0.520	17.38	167.0	1.38	-92	80
1133	19.30	6.77	0.518	18.10	150.0	1.31	-94	80

Sample Time: 1145　　Sample ID: 782VM7730CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB

Location and Site Code (SITEID): Bldg. 782

Well No. (LOCID): WL-782VMW-100 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6/25/03 Weather: Sunny, Humid, 80's°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

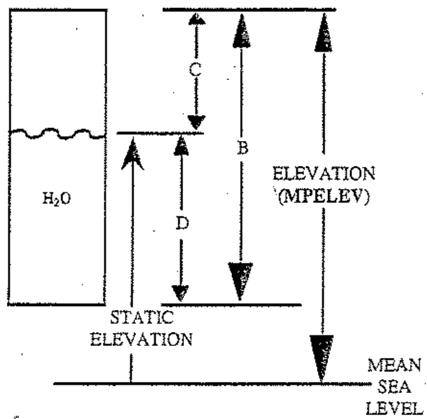
Measured Water Level Depth (C) (STATDEP) 15.85 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 23

Depth during Purging/Sampling: 16.15 - 16.45 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 6/25/03

Physical Appearance/Comments: Clear, Some silt, No odor, No Sheen

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ✓ ± 3% ✓ ± 10% ✓ ± 10% ± 10mV ✓

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1445	16.13	7.29	0.268	18.04	132	10.84	-42	100
1458	16.25	7.32	0.270	15.35	116	5.03	-52	100
1502	16.40	7.32	0.271	14.20	128	4.60	-55	100
1506	16.39	7.31	0.266	15.89	111.0	4.20	-52	100
1510	16.27	7.30	0.264	17.61	87.8	4.51	-46	100
1514	16.22	7.30	0.269	18.05	80.6	4.86	-40	100
1518	16.21	7.30	0.268	19.25	85.0	5.00	-30	100
1522	16.20	7.30	0.267	20.06	74.6	5.10	-19	100
1526	16.15	7.29	0.276	18.52	79.4	5.40	-20	100

Sample Time: 1535 Sample ID: 782VM10023CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB

Location and Site Code (SITEID): 782 VMW-102

Well No. (LOCID): WL-782VMW-102 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6-25 Weather: 90°F Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

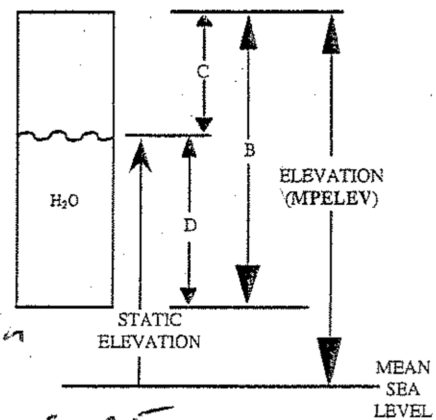
Measured Water Level Depth (C) (STATDEP) 8.63

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 19

Depth during Purging/Sampling: 8.63-8.75 ft (provide range)

Comments (re: Depth during purging/sampling): 400 ml/min



Purge Date and Method: BLADDER PUMP 6-25

Physical Appearance/Comments: clear/silty no odor

Dissolved Ferrous Iron (mg/L): 2.5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
16.06	8.69	6.98	0.404	12.89	444.0	5.55	-135	400
16.07	8.70	6.95	0.464	12.22	467.0	4.22	-134	400
16.08	8.69	6.95	0.403	11.78	470.0	3.89	-131	400
16.09	8.65	6.95	0.398	11.76	487.0	3.43	-130	400
16.10	8.65	6.95	0.399	11.57	484.0	3.25	-129	400
16.11	8.65	6.95	0.401	11.55	455	3.22	-129	400

Sample Time: 1615 Sample ID: 782VM102 09 CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAC

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782VMP-78 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/26/03 Weather: Sunny - 90+ Humid

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____ ft. (optional)

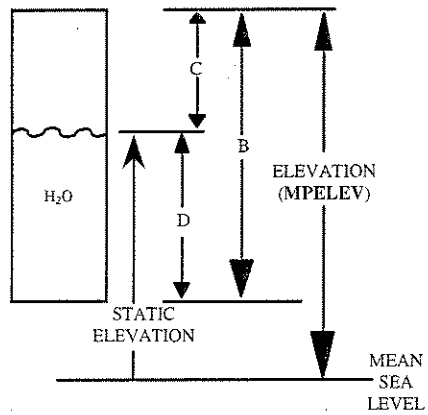
Measured Water Level Depth (C) (**STATDEP**) 23.96 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: 23.88? - 23.96 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Silty orange, no sheen/odor.

Dissolved Ferrous Iron (mg/L): 2.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1614	23.96	6.56	0.412	14.91	835	2.68	-117	300
1616	23.88	6.52	0.411	14.76	824	2.40	-120	300
1619	23.95	6.50	0.414	14.59	774	2.20	-124	300

Sample Time: 1622 Sample ID: 782M7824CA
782M7824CC
782M7824CX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAL / AM

Location and Site Code (**SITEID**): CHL. PLUME.

Well No. (**LOCID**): WL-782VMW-81 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/26/03 Weather: Sunny - 90F

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

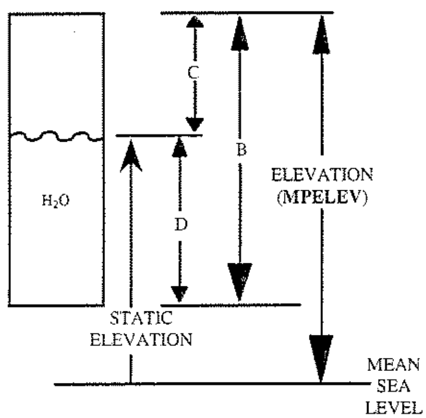
Measured Water Level Depth (C) (**STATDEP**) 21.26 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46

Depth during Purging/Sampling: ~~21.40~~ 21.38 - 21.46 ft (provide range)

Comments (re: Depth during purging/sampling): TEMPERATURE NOT STABALIZING.



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: CLEAR, no odor / sheen

Dissolved Ferrous Iron (mg/L): 0.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp.* (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1412	21.45	6.87	0.406	19.48	265	1.91	-139	50
1420	21.41	6.94	0.396	19.97	272	1.60	-150	60
1429	21.38	7.01	0.394	21.55	254	1.49	-153	50
1438	21.41	7.06	0.393	21.81	205	1.31	-160	50
1446	21.56*	7.07	0.405	17.78	258	1.36	-166	~~50~~ 70
	*TURNED PUMP UP SLIGHTY.							

Sample Time: 1450 Sample ID: 782M81Z1CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of __

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB

Location and Site Code (SITEID): Bldg. 782

Well No. (LOCID): WL-782vmw-88 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6/26/03 Weather: Sunny, Muggy, 80°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

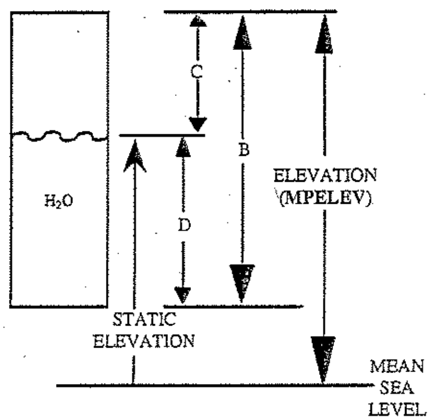
Measured Water Level Depth (C) (STATDEP) 26.83 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33.79

Depth during Purging/Sampling: 26.85- 27.15 (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 6/26/03

Physical Appearance/Comments: clear/slight silt → orange color no odor or sheen

Dissolved Ferrous Iron (mg/L): 5.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1040	27.1	6.89	0.458	14.88	498.0	6.00	-114	400
1041	27.1	6.90	0.454	14.34	578.0	4.58	-115	400
1042	27.1	6.90	0.447	13.91	575.0	3.61	-115	400
1043	27.1	6.90	0.453	14.01	569.0	2.89	-116	400
1044	27.1	6.90	0.449	13.92	558.0	2.40	-117	400
1045	27.1	6.90	0.453	13.52	469.0	1.97	-113	400
1046	27.1	6.90	0.454	13.58	425.0	1.87	-120	400
1047	27.1	6.89	0.456	13.48	410.0	1.69	-121	400
1048	27.1	6.88	0.456	13.30	370.0	1.52	-123	400
1049	27.1	6.88	0.458	13.70	350.0	1.42	-124	400
1050	27.1	6.88	0.458	13.58	330.0	1.37	-124	400

Sample Time: 1055 Sample ID: 782VM8834CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB, JD

Location and Site Code (SITEID): B 782

Well No. (LOCID): M-782VMW-92 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6-26 Weather: 85°F sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

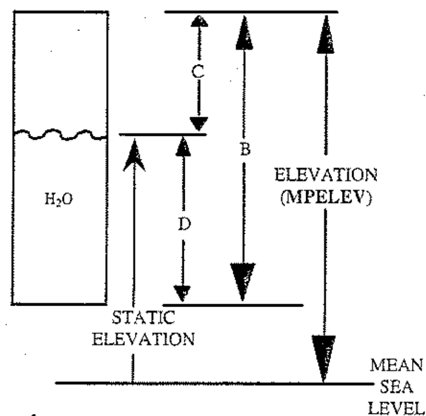
Measured Water Level Depth (C) (STATDEP) 21.89 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35.21

Depth during Purging/Sampling: 21.9 - 22.2 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 6-23

Physical Appearance/Comments: clear / slight silt no odor

Dissolved Ferrous Iron (mg/L): 6.5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1406	22	6.91	0.454	17.27	111.0	7.86	-125	320
1407.30	22	6.90	0.468	16.34	94.7	4.80	-126	320
1410	22	6.90	0.462	15.88	86.6	3.01	-131	320
1411.30	22	6.90	0.460	15.63	87.6	2.71	-133	320
1413	22	6.90	0.460	15.46	84.3	2.30	-135	320
1414.30	22	6.91	0.459	15.51	88.2	2.02	-136	320
1416	21.98	6.90	0.461	15.41	88.1	1.84	-137	320
1417.30	22	6.90	0.460	15.37	88.4	1.68	-137	320
1419.0	22.1	6.90	0.460	15.43	85.9	1.60	-138	320
1421	22	6.91	0.460	15.30	84.0	1.50	-138	320

Sample Time: 1425 Sample ID: 782VM9235CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 3203-01 Sampled by: DB

Location and Site Code (**SITEID**): ~~782 VMW-94~~ Bldg. 782

Well No. (**LOCID**): WL-782VMW-94 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/26/03 Weather: Sunny, Mussy, 90's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

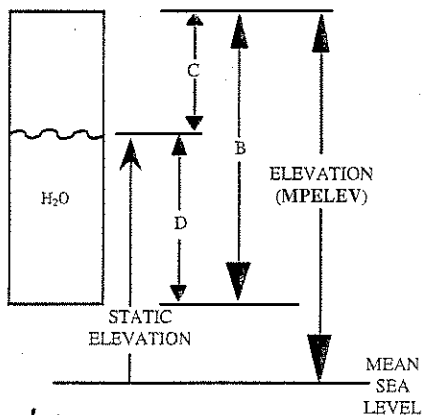
Measured Water Level Depth (C) (STATDEP) 21.85 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 39.55

Depth during Purging/Sampling: 21.85 - 22.15 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 6/26/03

Physical Appearance/Comments: Clear/silt no

Dissolved Ferrous Iron (mg/L): ______

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1601	22.1	7.69	0.642	16.04	138.0	2.65	-154	180
1604	22.1	7.60	0.644	15.94	123.0	2.26	-154	180
1607	22.1	7.49	0.647	16.01	114.0	1.80	-149	180
1610	22.1	7.41	0.650	16.08	99.0	1.64	-145	180
1613	22.1	7.35	0.650	15.98	96.1	1.34	-143	180
1616	22.1	7.32	0.653	15.80	103.0	1.28	-141	180

Sample Time: 1625 Sample ID: 782VM 94 40 CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (**SITEID**): B 782

Well No. (**LOCID**): WL-782VMW-96 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6-26 Weather: 90°F Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

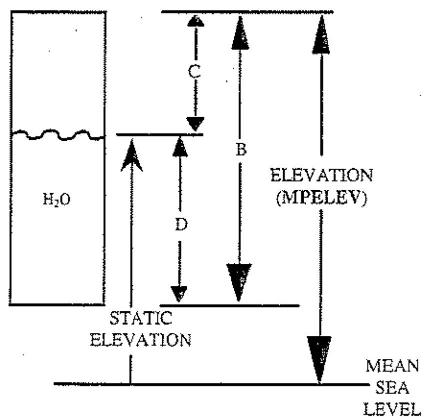
Measured Water Level Depth (C) (**STATDEP**) 21.43 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 37.67

Depth during Purging/Sampling: 21.4 – 21.7 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 6-26

Physical Appearance/Comments: clear/silt /no odor

Dissolved Ferrous Iron (mg/L): 3.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1507	21.5	7.15	0.389	15.48	104.0	10.74	-110	400
1508	21.5	7.10	0.393	14.88	95.8	5.62	-110	400
1509	21.5	7.05	0.395	14.82	103.0	3.79	-109	400
1510	21.5	7.04	0.396	14.73	104.0	3.30	-110	400
1511	21.5	7.02	0.397	14.53	98.9	3.03	-110	400
1512	21.5	7.01	0.397	14.57	97.7	2.70	-110	400
1513	21.5	7.01	0.397	14.61	93.2	2.28	-111	400
1514	21.5	7.00	0.398	14.55	88.0	2.12	-112	400
1515	21.6	7.00	0.400	14.58	89.0	1.85	-112	400
1516	21.6	7.00	0.397	14.66	85.0	1.78	-113	400
1517	21.6	6.99	0.399	14.65	85.1	1.70	-113	400

Sample Time: 1525 Sample ID: 782VM9638CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: KAC / AM

Location and Site Code (**SITEID**): CHL. PLUME

Well No. (**LOCID**): WL-782VMW-97 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/26/03 Weather: Sunny - 85°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

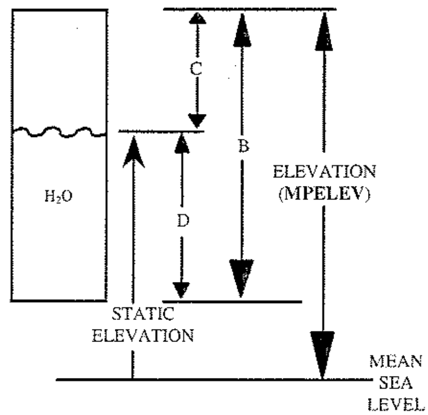
Measured Water Level Depth (C) (**STATDEP**) 19.00 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33'

Depth during Purging/Sampling: 19.02 - 19.17 ft (provide range)

Comments (re: Depth during purging/sampling): BLACK PARTICLES FLOCED TOGETHER WHEN SITTING.



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: CLEAR W/ BLACK SUSPENDED SEDIMENT, NO SHEEN/ODOR.

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1130	19.17	6.52	0.349	12.93	679	1.85	97	480
1134	19.10	6.41	0.351	12.70	646	0.74	98	480
1137	19.15	6.38	0.355	12.73	533	0.53	96	480
1142	19.08	6.41	0.362	12.79	499	0.44	91	480

Sample Time: 1144 Sample ID: 782M9719CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB

Location and Site Code (SITEID): Bldg 782

Well No. (LOCID): WL-782MW-101 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6/26/03 Weather: Sunny, Muggy, 70's°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ~~14.27~~ ft. (optional)

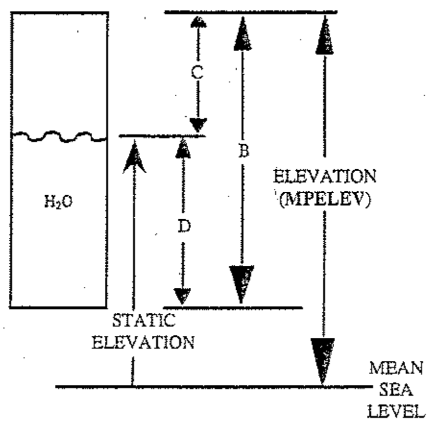
Measured Water Level Depth (C) (STATDEP) 9.77 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 18.27

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): 9.77 10.07



Purge Date and Method: BLADDER PUMP 6-26

Physical Appearance/Comments: clear / slight silt (iron floc) in the beginning

Dissolved Ferrous Iron (mg/L): 2.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
9:14	9.85	6.94	0.268	12.15	101.0	6.32	-128	400
9:15	9.85	6.95	0.267	12.19	91.3	3.72	-130	400
9:16	9.85	6.96	0.266	12.29	80.0	2.90	-132	400
9:18	9.85	6.96	0.267	12.78	78.6	2.73	-132	400
9:19	9.85	6.96	0.266	12.67	79.0	2.66	-132	400
9:20	9.85	6.96	0.267	12.78	74.0	2.57	-131	400

Sample Time: 925 Sample ID: 782MW10118CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: KAC

Location and Site Code (**SITEID**): Chlorinated Plume

Well No. (**LOCID**): WL-782 UMW-104 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6-26-03 Weather: Sunny, 77°F, Humid

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

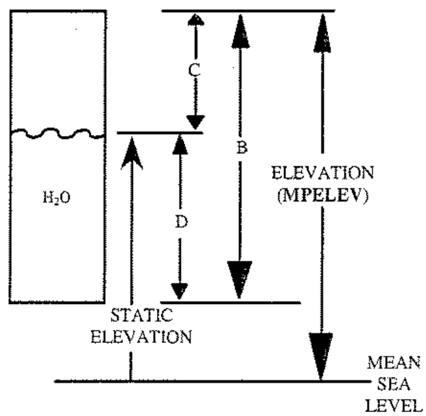
Measured Water Level Depth (C) (**STATDEP**) 17.~~8~~991 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 26

Depth during Purging/Sampling: 18.07-18.21 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: SILTY BROWN, PETRO ODOR, NO SHEEN

Dissolved Ferrous Iron (mg/L): 6.5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0925	18.10	6.23	0.482	13.48	554	2.39	-141	250
0929	18.09	6.21	0.491	13.35	555	1.91	-140	250
0933	18.09	6.22	0.494	13.89	517	1.90	-139	250

Sample Time: 0940 Sample ID: 782M1Ø41BCA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: KAC

Location and Site Code (**SITEID**): Chlorinated Plume

Well No. (**LOCID**): WL782MW-105B Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6-26-03 Weather: Sunny, Hot (80°F), Humid

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

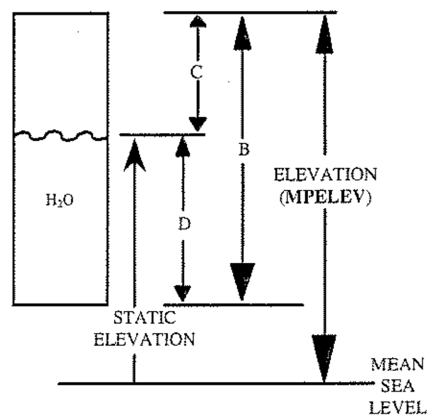
Measured Water Level Depth (C) (**STATDEP**) 19.34 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 36

Depth during Purging/Sampling: 19.48-19.62 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: CLOUDY BROWN, NO ODOR/SHEEN

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1036	19.51	6.67	0.432	14.17	999+	2.18	51	260
1040	19.51	6.61	0.427	13.96	999+	1.59	53	260
1044	19.50	6.61	0.421	13.78	999+	1.30	52	260
1048	19.51	6.62	0.418	13.89	999+	1.15	50	260

Sample Time: 1050 Sample ID: 782M164B19CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAC

Location and Site Code (SITEID): CH CH. PLUME

Well No. (LOCID): WL-782V ~~80~~ MW-76 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6/27/03 Weather: Sunny - 78°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

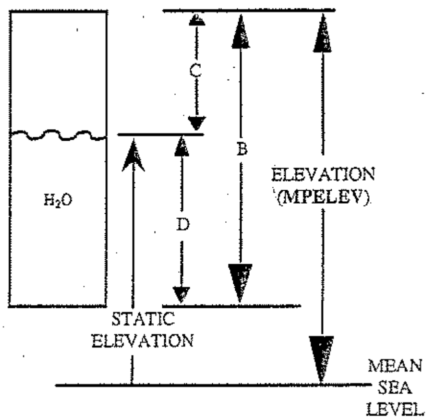
Measured Water Level Depth (C) (STATDEP) 20.23 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 38

Depth during Purging/Sampling: 20.39 - 20.42 ft (provide range)

Comments (re: Depth during purging/sampling): INSTALLED DEDICATED BP TODAY



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: SL. SILTY, NO COLOR/ODOR/SHEEN

Dissolved Ferrous Iron (mg/L): 2.8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1307	20.41	6.63	0.491	19.36	315	1.65	-117	70
1313	20.39	6.65	0.492	19.29	264	1.24	-120	70
1319	20.40	6.66	0.491	19.23	218	1.16	-121	70

Sample Time: 1320 Sample ID: 782M7620CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

MW11

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAC

Location and Site Code (**SITEID**): CH. PLUME

Well No. (**LOCID**): VL-782VMW-80 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/27/03 Weather: Overcast - 70° 75°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

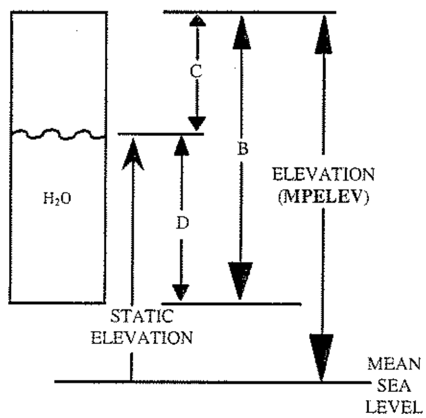
Measured Water Level Depth (C) (**STATDEP**) 19.00 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 19.01 - 19.09 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: SILTY ORANGE, NO SHEEN/ODOR

Dissolved Ferrous Iron (mg/L): 3.7

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0949	19.04	6.44	0.505	14.00	503	5.37	-100	250
0951	19.03	6.40	0.513	13.15	667	2.23	-120	250
0954	19.06	6.40	0.515	13.05	577	1.54	-123	250
0956	19.03	6.41	0.516	12.94	514	1.20	-127	250

Sample Time: 1000 Sample ID: 782M8Ø19CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAC

Location and Site Code (SITEID): CH. PLUME

Well No. (LOCID): WL-782 VMW-84 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6-27-03 Weather: Sunny - 75°

START TIME: 1423

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

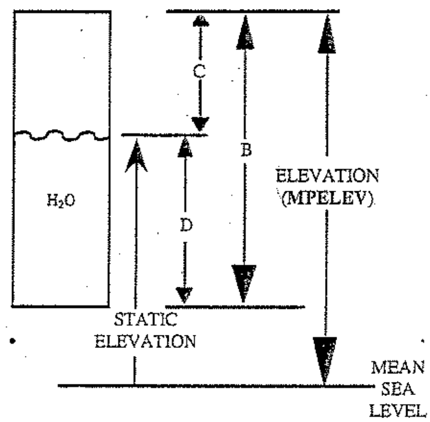
Measured Water Level Depth (C) (STATDEP) 23.34 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: 23.42 - 23.55 ft (provide range)

Comments (re: Depth during purging/sampling): INSTALLED BP TODAY.



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: SL. SILTY. NO ODOR/SHEEN.

Dissolved Ferrous Iron (mg/L): 4.9

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1428	23.48	6.44	0.462	14.35	369	5.60	-123	300
1432	23.44	6.29	0.528	14.33	345	2.69	-119	300
1436	23.52	6.21	0.569	14.20	319	1.57	-114	300
1440	23.43	6.20	0.587	14.32	299	1.11	-115	300
1444	23.50	6.23	0.594	14.51	282	0.90	-117	300
1449	23.50	6.26	0.600	14.43	258	0.77	-119	300

Sample Time: 1450 Sample ID: 782M8423CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAC

Location and Site Code (SITEID): CH. PLUME

Well No. (LOCID): WL-782VMW-87 Well Diameter (SDIAM): 2"

Date (LOGDATE): 2/27/03 Weather: Sunny ~75°

START TIME: 1549

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

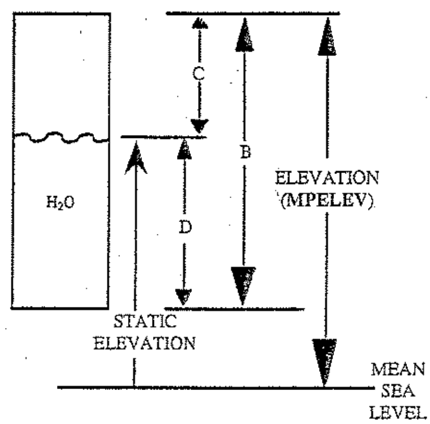
Measured Water Level Depth (C) (STATDEP) 23.88 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35'

Depth during Purging/Sampling: 23.91 - 24.05 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: CLEAR, NO ODOR/SHEEN

Dissolved Ferrous Iron (mg/L): 4.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1553	23.93	6.37	0.515	13.46	333	2.99	-131	400
1556	23.95	6.30	0.554	13.26	332	1.06	-133	400
1559	23.95	6.29	0.559	13.25	312	0.79	-134	400
1602	23.93	6.29	0.563	13.66	309	0.64	-136	400
	* TURNED	DOWN	TO 225ml/min TO		SAMPLE.			

Sample Time: 1604 Sample ID: 782M8724CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAC

Location and Site Code (**SITEID**): CH.PLUME

Well No. (**LOCID**): WL-782VMW-93 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6.27.03 Weather: Overcast - 75°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

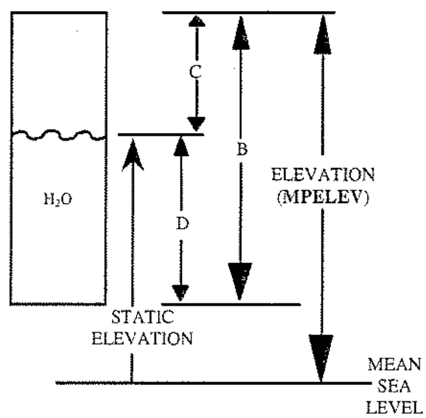
Measured Water Level Depth (C) (**STATDEP**) 21.243 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35'

Depth during Purging/Sampling: 21.41 - 21.50 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: ~~CLEAR~~ SL. SILTY BROWN, NO ODOR, NO SHEEN

Dissolved Ferrous Iron (mg/L): 3.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1043	21.46	6.86	0.455	15.03	232	6.50	-124	230
1048	21.50	6.61	0.472	14.33	239	2.64	-124	230
1053	21.41	6.55	0.475	14.23	218	1.51	-124	230
1057	21.48	6.54	0.478	14.17	208	1.08	-126	230

Sample Time: 1100 Sample ID: 782M9321CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (SITEID): 782

Well No. (LOCID): WL-782VMW-91 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6/27/03 Weather: Sunny Breezy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

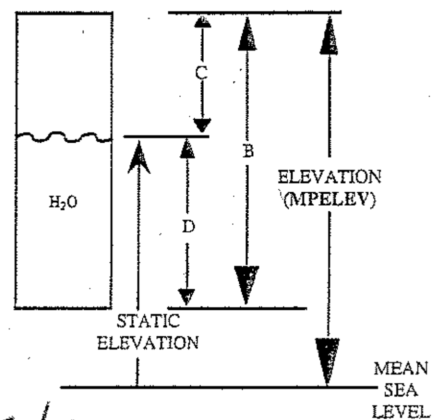
Measured Water Level Depth (C) (STATDEP) 19.43 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 19.43 - 19.73 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 6/27/03

Physical Appearance/Comments: Slight Petro Odor, Clear, Some Sediment, No Sheen

Dissolved Ferrous Iron (mg/L): 8.3

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1547	19.55	6.66	2.05	16.62	71.8	1.67	-130	180
1550	19.62	6.66	2.04	16.01	72.8	1.50	-129	180
1553	19.60	6.67	2.05	15.62	72.4	1.39	-130	180
1556	19.65	6.67	2.04	15.48	71.7	1.26	-150	180
1559	19.65	6.67	2.03	15.44	69.7	1.21	-131	180
1602	19.64	6.67	2.03	15.37	71.6	1.15	-131	180

Sample Time: 1605 Sample ID: 782MW9127CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

23.51

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: ~~SB, DF~~ JP JD

Location and Site Code (SITEID): 782 UMW-95

Well No. (LOCID): WL-782UMW-95 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6-~~23~~ 27-03 Weather: ~~85°F Sunny~~ OVERCAST, BREEZY

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) 37.20 ft. (optional) - silty bottom

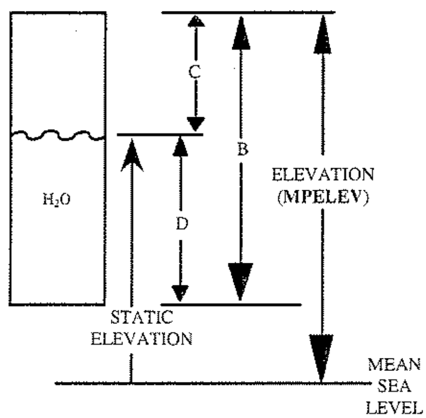
Measured Water Level Depth (C) (STATDEP) 22.87 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 28'

Depth during Purging/Sampling: 22.88 - 23.18 ft (provide range)

Comments (re: Depth during purging/sampling): ____



After TBP installed measured water depth 22.88 ft.

Purge Date and Method: BLADDER PUMP Temporary

Physical Appearance/Comments: clean to slightly tinted brown / no odor

Dissolved Ferrous Iron (mg/L): 4.7

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1645		7.10	.434	14.31	209	2.22	-153	320
1647		7.13	.437	13.45	183	1.62	-156	320
1649		7.14	.438	13.01	172	1.32	-159	320
1651		7.14	.440	12.95	161	1.26	-160	320
1653		7.15	.440	12.91	147	1.09	-160	320
1655		7.14	.436	12.96	145	1.03	-161	320
1657		7.14	.441	12.88	133	.97	-161	320
1659		7.14	0.443	12.87	126	0.94	-160	320
1701		7.13	0.443	12.81	122	0.91	-160	320

Sample Time: 1715 Sample ID: 782MW9528CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

* have to make a bladder pump.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAL

Location and Site Code (SITEID): ____________

Well No. (LOCID): WL-782VMW99* Well Diameter (SDIAM): 2"

Date (LOGDATE): 6.27.03 Weather: SUNNY - 75°

START TIME: 16:29

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

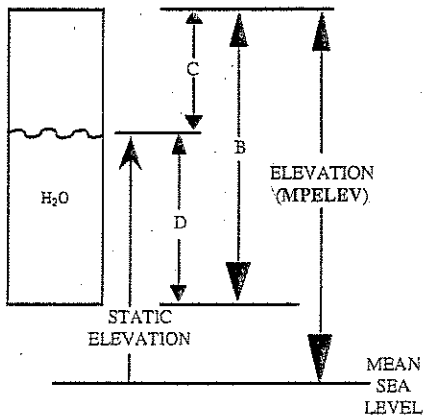
Measured Water Level Depth (C) (STATDEP) 18.54 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: CLEAR, NO ODOR/SHEEN.

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1634	18.58	6.83	0.406	11.50	330	5.21	59	500
1636	18.58	6.78	0.407	11.62	309	4.96	62	500
1638	18.58	6.77	0.408	11.62	313	4.83	63	500
	*TURNED PUMP DOWN TO			ML/MIN	TO SAMPLE.			

Sample Time: 1640 Sample ID: 782M9919CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (**SITEID**): Bldg. 782

Well No. (**LOCID**): WL-782MW-10 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/27/03 Weather: Overcast, 80°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

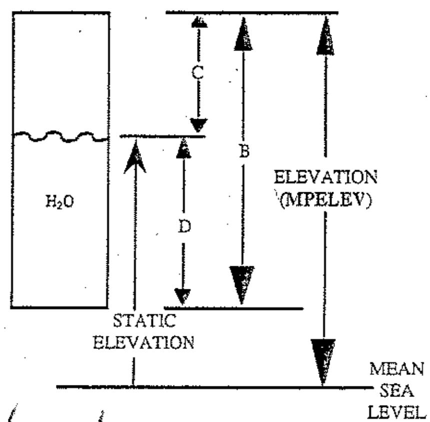
Measured Water Level Depth (C) (STATDEP) 21.90 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 6/27/03

Physical Appearance/Comments: Orange/Rusty Water, Rusty Smell, Some sediment, No Sheen

Dissolved Ferrous Iron (mg/L): 3.7

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ✓ ± 3% ✓ ✓ ± 10% ± 10% ± 10mV ✓

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1438	22.00	6.88	0.439	13.18	>999	2.10	-134	400
1439	22.00	6.89	0.439	13.28	>999	1.91	-135	400
1440	22.02	6.89	0.441	13.28	>999	1.65	-139	400
1441	22.00	6.93	0.443	13.28	>999	1.40	-144	400
1442	22.00	6.93	0.444	13.29	886	1.25	-146	400
1443	22.00	6.94	0.444	13.35	670	1.18	-148	400
1444	22.00	6.95	0.444	13.40	682	1.11	-148	400
1445	22.00	6.95	0.444	13.38	613	1.09	-148	400
1446	22.00	6.95	0.443	13.08	458	1.06	-148	400
1447	22.00	6.95	0.442	13.12	401	1.05	-148	400
1448	22.00	6.95	0.442	13.20	360	1.03	-148	400

Sample Time: 1455 Sample ID: 782M1027CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (SITEID):

Well No. (LOCID): AP2MW-3 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6/27/03 Weather: OVERCAST / BREEZY

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

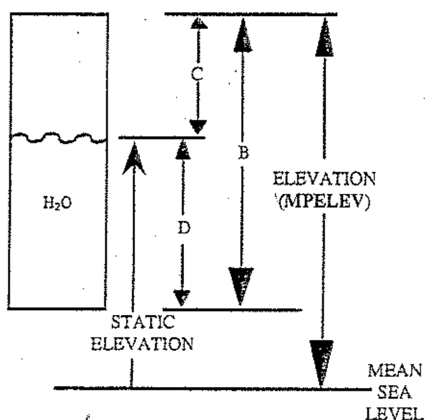
Measured Water Level Depth (C) (STATDEP) 19.75 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27'

Depth during Purging/Sampling: 19.75 - 20.05 ft (provide range)

Comments (re: Depth during purging/sampling):



Purge Date and Method: BLADDER PUMP 6/27

Physical Appearance/Comments:

Dissolved Ferrous Iron (mg/L): 8.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1200	19.80	6.86	0.437	11.77	74.6	2.80	-125	400
1201	19.81	6.88	0.440	11.69	68.5	2.46	-128	400
1202	19.85	6.89	0.440	11.59	61.1	2.19	-130	400
1203	19.78	6.90	0.438	11.62	60.2	1.95	-132	400
1204	19.80	6.90	0.438	11.58	59.8	1.78	-134	400
1205	19.82	6.91	0.437	11.59	59.4	1.64	-135	400
1206	19.83	6.91	0.437	11.64	58.9	1.52	-136	400
1207	19.83	6.91	0.437	11.59	59.1	1.45	-137	400
1208	19.84	6.91	0.439	11.56	59.2	1.36	-138	400
1209	19.83	6.91	0.438	11.58	59.4	1.31	-139	400
1210	19.84	6.91	0.439	11.62	59.5	1.25	-139	400

Sample Time: ~~[illegible]~~ 1217 Sample ID: AP2M0327CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (**SITEID**): Six Mile Creek

Well No. (**LOCID**): SL-7825W-115 Well Diameter (**SDIAM**): N/A

Date (**LOGDATE**): 6/27/03 Weather: Overcast Breezy

CASING VOLUME INFORMATION:

~~Casing ID (inch)~~	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ft. (optional)

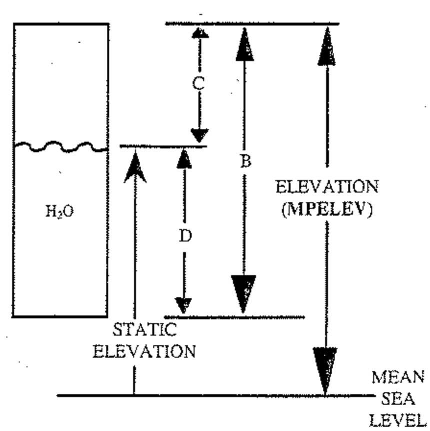
Measured Water Level Depth (C) (**STATDEP**)____________ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft):____________

Depth during Purging/Sampling:____________ft (provide range)

Comments (re: Depth during purging/sampling):____________



Purge Date and Method: BLADDER PUMP____________

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0945	—	6.55	.235	15.85	87	8.28	3	—

Sample Time: 0955 Sample ID: 7825115Ø1CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (**SITEID**): SMC - 782 SW 118

Well No. (**LOCID**): SL-782SW-118 Well Diameter (**SDIAM**): N/A

Date (**LOGDATE**): 6/27/03 Weather: OVERCAST BREEZY

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

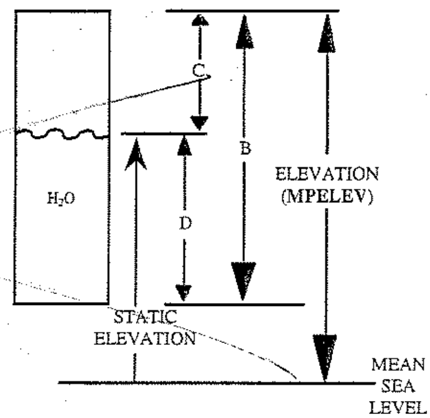
Measured Water Level Depth (C) (**STATDEP**) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): ____________

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: ~~BLADDER PUMP~~ Surface Water

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1010	—	7.32	0.237	16.76	62.8	7.91	-22	—

Sample Time: 1020 Sample ID: 782511801CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (**SITEID**): SMC - 782 SW - 119

Well No. (**LOCID**): SL-782SW-119 Well Diameter (**SDIAM**): ——

Date (**LOGDATE**): 6/27/03 Weather: OVERCAST BREEZY

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

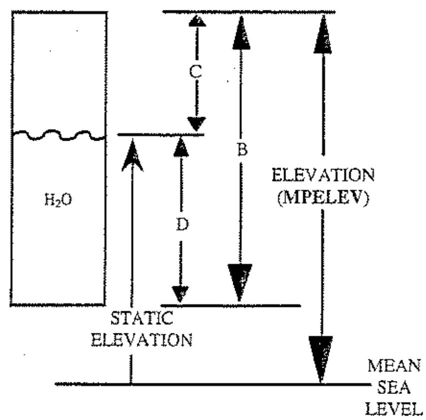
Measured Water Level Depth (C) (**STATDEP**) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): ____________

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: ~~BLADDER PUMP~~ SURFACE WATER

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): .1

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1030	—	7.55	.235	16.88	62.7	9.03	-49	

Sample Time: 1035 Sample ID: 782S11901CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JA

Location and Site Code (**SITEID**): 782SW-20

Well No. (**LOCID**): SL-782SW-120 Well Diameter (**SDIAM**): N/A

Date (**LOGDATE**): 6/27/03 Weather: OVERCAST / BREEZY

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

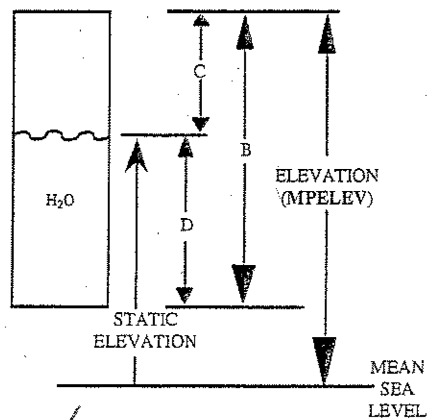
Measured Water Level Depth (C) (STATDEP) ________ ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): ________

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: ~~BLADDER PUMP~~ grab

Physical Appearance/Comments: ________

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1110	Ø1	7.62	0.239	17.44	58	9.26	-8	—

Sample Time: 1115 Sample ID: 782S120Ø1CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03.01 Sampled by: KAC

Location and Site Code (**SITEID**): CH. PLUME

Well No. (**LOCID**): 782MW-6R2 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/30/03 Weather: SUNNY - 75°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

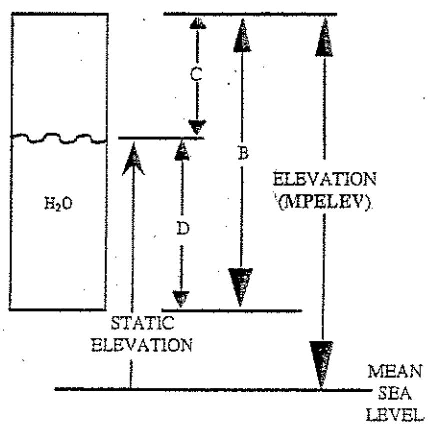
Measured Water Level Depth (C) (**STATDEP**) 23.97 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 30'

Depth during Purging/Sampling: 23.97 - 24.00 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: GW CLEAR, NO ODOR/SHEEN

Dissolved Ferrous Iron (mg/L): 5.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1359	23.98	6.22	0.713	13.11	375	1.39	-136	400
1401	23.97	6.19	0.719	12.51	375	0.99	-136	400
1403	23.97	6.20	0.720	12.48	369	0.76	-137	400
1405	23.98	6.21	0.722	12.51	363	0.64	-139	400

Sample Time: 1410 Sample ID: 782M6R224CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KC/JP

Location and Site Code (SITEID): CH. Plume

Well No. (LOCID): 782MW-6BD Well Diameter (SDIAM): 2"

Date (LOGDATE): 6/30/03 Weather: Overcast - 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

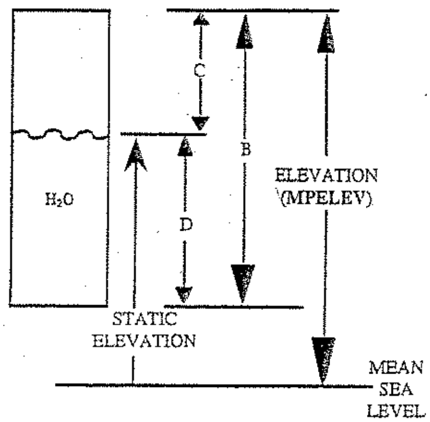
Measured Water Level Depth (C) (STATDEP) 24.80 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 43

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: SL. Silty, No odor/sheen.

Dissolved Ferrous Iron (mg/L): 4.8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0943	24.80	6.37	0.802	13.28	584	1.83	-130	400
0946	24.80	6.41	0.793	13.21	478	1.12	-139	400
0947	24.80	6.41	0.788	13.28	433	0.94	-142	400
0949	24.80	6.42	0.787	13.28	417	0.89	-145	400

Sample Time: 0950 Sample ID: 782M6D43CA

25

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03.01 Sampled by: KAL

Location and Site Code (**SITEID**): CH. PLUME

Well No. (**LOCID**): WL-786MW-~~30~~ 31 Well Diameter (**SDIAM**): ____

Date (**LOGDATE**): 6/30/03 Weather: Sunny - 75

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____ ft. (optional)

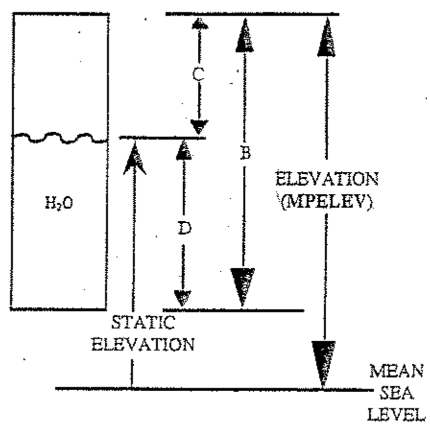
Measured Water Level Depth (C) (**STATDEP**) 16.44 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 22

Depth during Purging/Sampling: ____ ft (provide range)

Comments (re: Depth during purging/sampling): WELL INSIDE BDG 785



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: VERY RUSTY ORANGE, IRON FLOC, SL. PETRO ODOR / NO SHEEN

Dissolved Ferrous Iron (mg/L): 4.4

FIELD MEASUREMENTS:

Allowable Range:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1552	16.71	6.42	0.466	11.18	999+	1.40	34	200
1554	16.71	6.40	0.471	11.18	999+	1.12	19	200
1556	16.71	6.41	0.471	11.17	999+	1.14	11	200
1558	16.71	6.42	0.472	11.16	999+	1.15	-19	

Sample Time: 1600 Sample ID: ~~78LM30116A~~ SAMPLE NOT ANALYZED. WRONG WELL.

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.02.01　Sampled by: Kac

Location and Site Code (**SITEID**): CH-PLUME

Well No. (**LOCID**): WL-182WMW-03　Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6/30/03　Weather: Sunny - 75°

START TIME: 1140

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ft. (optional)

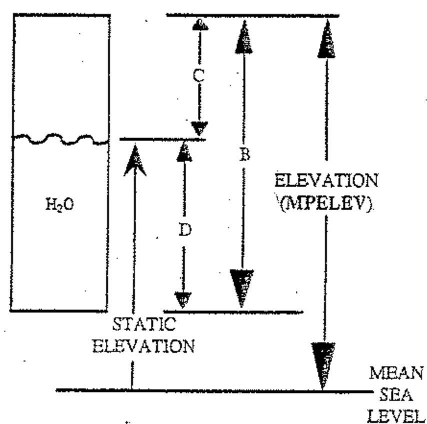
Measured Water Level Depth (C) (**STATDEP**) 18.33 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33'

Depth during Purging/Sampling: ________ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: ~~BLADDER PUMP~~ PERISTALTIC & BAILER

Physical Appearance/Comments: CLEAR, NO ODOR, NO SHEEN

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1, EC ± 3%, Turbidity ± 10%, D.O. ± 10%, ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1142	18.50	7.24	0.526	16.93	249	5.87	106	400
1143	18.50	7.29	0.509	14.97	462	8.30	106	400
1145	18.50	7.10	0.509	14.35	458	8.80	107	400
1147	18.46	7.08	0.511	14.14	455	8.44	113	400
1149	18.46	7.02	0.519	14.00	455	7.18	120	400

Sample Time: 1150　Sample ID: 782M8318CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB, DF

Location and Site Code (SITEID): 782VMW-85

Well No. (LOCID): WL-782VMW-85 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6-~~29~~ 30 DB Weather: 85°F Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) 40.67 ft. (optional)

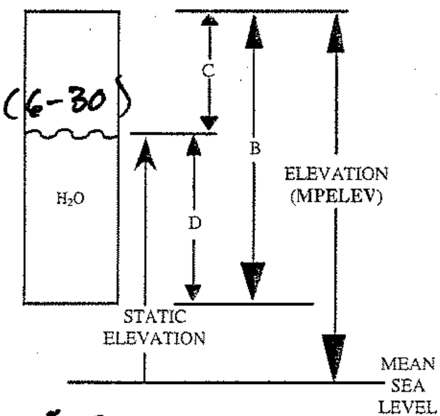
Measured Water Level Depth (C) (STATDEP) 23.97 ft. 24.07 (6-30)

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 36

Depth during Purging/Sampling: 24.07 - 24.37 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 6-30

Physical Appearance/Comments: ~~No~~ temp. pump Slightly Clear no odor/sheen

Dissolved Ferrous Iron (mg/L): 4.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0917	24.20	6.59	1.06	12.42	140.0	10.78	-95	~~24.20~~ 400
0919	24.20	6.68	1.05	12.30	144.0	5.08	-105	3400
0921	24.20	6.73	1.04	12.28	138.0	4.03	-109	3400
0923	24.20	6.77	1.04	12.04	124.0	3.20	-114	3400
0925	24.20	6.78	1.04	12.05	120.0	2.81	-118	3400
0927	24.20	6.80	1.04	12.01	114.0	2.31	-122	3400
0929	24.20	6.80	1.04	11.88	113.0	2.20	-123	3400

DB

Sample Time: 0935 Sample ID: 782VM8536CA

corp dup and dup.

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

have to make a bladder pump.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB, DF

Location and Site Code (SITEID): 782UMW-8[illegible]6

Well No. (LOCID): ~~6-24~~ WL-782UMW-86 Well Diameter (SDIAM): 2"

Date (LOGDATE): 6-24 Weather: 85°F sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

soft bottom 6-30

Measured Well Depth (B) (TOTDEPTH) 38.40 ft. (optional)

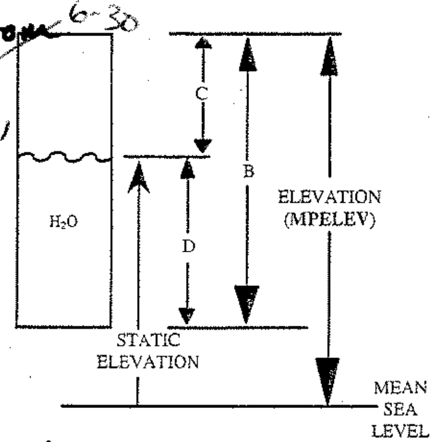
Measured Water Level Depth (C) (STATDEP) 22.82 ft. 22.91

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 22.91 - 23.91 ft (provide range) 2 DB

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 6-30

Physical Appearance/Comments: no temp pump! / clear slightly no odor / recovers wel

Dissolved Ferrous Iron (mg/L): 4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1100	23.10	6.86	0.702	13.01	556.0	7.35	-111	300
1102	23.1	6.83	0.698	12.96	542.0	4.37	-111	300
1104	23.1	6.83	0.705	12.58	681.0	3.17	-111	300
1106	23.1	6.84	0.710	12.60	[illegible]	3.03	-111	300
~~1108~~	~~23.1~~				683.0			300
1108	23.1	6.83	0.711	12.78	667.0	2.76	-110	300
1110	23.05	6.83	0.710	12.78	658.0	2.73	-110	300
1112	23.05	6.83	0.708	12.80	612.0	2.75	-110	300

Sample Time: 1115 Sample ID: 782[illegible]M8633CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

needs to have ~~a~~ bladder pump.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB, DF

Location and Site Code (**SITEID**): 782VMW-89

Well No. (**LOCID**): WL-782VMW-89 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6-24 Weather: 85°F sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

6-30

Measured Well Depth (B) (**TOTDEPTH**) 41.81 ft. (optional) ✓

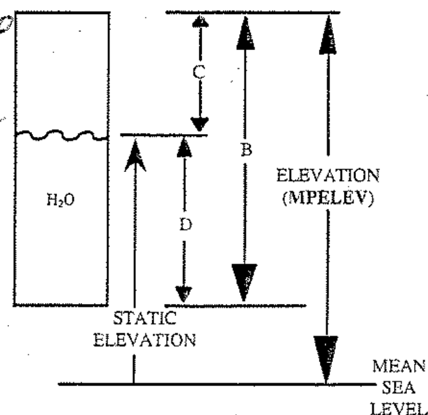
Measured Water Level Depth (C) (**STATDEP**) 24.49 ft. 24.57

Length of Static Water Column (D) = _____ (B) - _____ (C) = _____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: 24.57 - 24.87 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP temp. 6-30

Physical Appearance/Comments: clear - silty brown - no odor

Dissolved Ferrous Iron (mg/L): 5.0

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 (pH), ± 3% (EC), ± 10% (Turbidity), ± 10% (D.O.), ± 10mV (ORP)

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1014	24.66	6.81	0.443	12.11	162.0	11.49	-125	300
1016	24.70	6.81	0.478	11.75	161.0	5.64	-125	300
1018	24.70	6.83	0.498	11.70	157.0	3.84	-127	300
1020	24.70	6.84	0.507	11.71	153.0	3.05	-128	300
1022	24.70	6.83	0.511	11.78	160.0	2.57	-128	300
1024	24.70	6.83	0.513	11.77	152.0	2.22	-129	300
1026	24.70	6.83	0.516	11.87	160.0	2.03	-129	300

Sample Time: 1035 Sample ID: 782VM8935CA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

needs to have a bladder pump made

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB DF

Location and Site Code (**SITEID**): 782VMW-90

Well No. (**LOCID**): WL-782VMW-90 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 6-24-03 Weather: 85°F Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

6-30-03

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

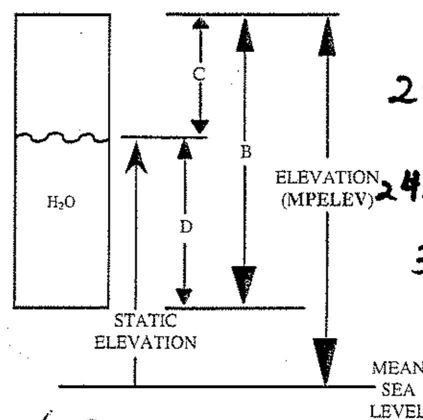
Measured Water Level Depth (C) (**STATDEP**) 25.17 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 29

Depth during Purging/Sampling: 25.17 - 25.47 ft (provide range)

Comments (re: Depth during purging/sampling): ________



24.68 DB product

24.71 water

33.09 ~~Bottom~~

Purge Date and Method: BLADDER PUMP 6-30

Physical Appearance/Comments: Product in well / heavy petro odor / clear in color

Dissolved Ferrous Iron (mg/L): 5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1216	25.25	6.68	0.277	12.73	239.0	8.05	-134	240
1219	25.25	6.71	0.285	13.15	247.0	2.20	-135	240
1222	25.2	6.69	0.295	13.14	254.0	1.87	-136	240
1225	25.22	6.69	0.305	13.37	274	1.48	-136	240
1228	25.21	6.70	0.318	13.45	271	1.16	-138	240

Sample Time: 1235 Sample ID: 782M9029CA

* .03 in of petro product

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: KAL

Location and Site Code (SITEID): CH. PLUME

Well No. (LOCID): WL-786MW-30 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7.1.03 Weather: Inside

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

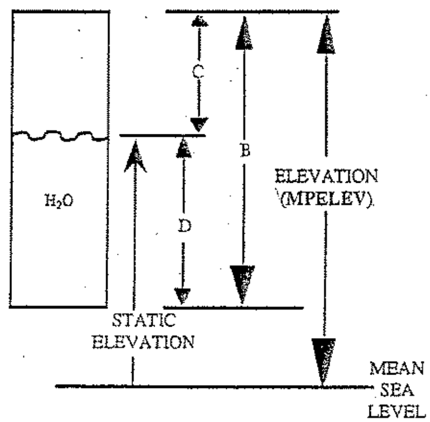
Measured Water Level Depth (C) (STATDEP) 15.08 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 22

Depth during Purging/Sampling: 15.35 – 15.63 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 7.1.03

Physical Appearance/Comments: clean / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1145	15.35	6.61	.254	11.51	217	7.53	60	160
1148		6.66	.253	11.60	208	7.36	35	160
1151		6.70	.253	11.61	205	7.25	24	160
1154		6.74	.254	11.50	203	7.12	13	160
1157		6.78	.255	11.52	204	6.93	7	140

Sample Time: 1200 Sample ID: 786M3015 CA
CS
CD

} THIS SAMPLE IN LOG BOOK #1 TO SATISFY MS/MSD REQUIREMENT.

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): 782 MW-104

Well No. (LOCID): WL-782MW-104 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9-16-03 Weather: 70's sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

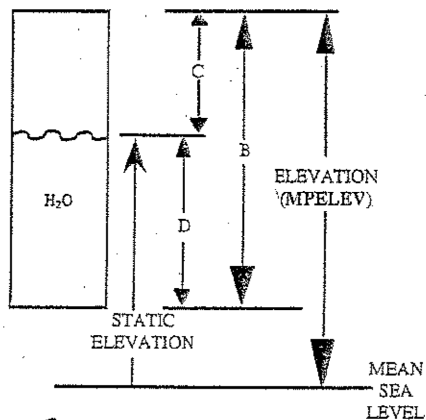
Measured Water Level Depth (C) (STATDEP) 18.58 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 28.38 18.60 - 18.90

Depth during Purging/Sampling: ~~28.40 - 28.70~~ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 9-16

Physical Appearance/Comments: silty brown / ~~[illegible]~~ slight petro odor

Dissolved Ferrous Iron (mg/L): 6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1057	18.76	6.56	0.676	16.16	75.2	6.06	-136	150
1101	18.77	6.53	0.680	15.97	44.5	1.66	-139	150
1105	18.69	6.53	0.681	15.73	40.1	0.81	-142	150
1108	18.70	6.53	0.684	15.43	29	0.00	-145	150

Sample Time: 1110 Sample ID: 782M104 [illegible] DA 28

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP OC

Location and Site Code (SITEID): 782

Well No. (LOCID): WL-782VMW-98 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9.16.03 Weather: Overcast 65°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

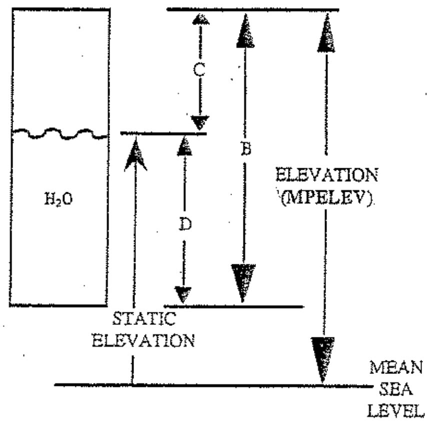
Measured Water Level Depth (C) (STATDEP) 17.95 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 29.74

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear / No odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0910	17.97	6.45	.531	13.17	74.1	9.74	195	400
0911	17.97	6.61	.528	12.87	72.3	8.67	186	400
0912	17.97	6.70	.522	12.45	71.7	8.14	182	400
0913	17.97	6.77	.522	12.54	71.9	7.78	180	400
0914	17.97	6.82	.521	12.34	72.1	7.43	178	400
0915	17.97	6.87	.518	12.32	71.0	7.23	178	400
0916	17.97	6.92	.513	12.34	70.7	6.86	178	400
0917	17.97	6.94	.511	12.37	70.6	6.65	178	400

Sample Time: 0925 Sample ID: 782M9829DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01   Sampled by: DB JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-97   Well Diameter (SDIAM): 2"

Date (LOGDATE): 9/16/03   Weather: Sunny 70's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

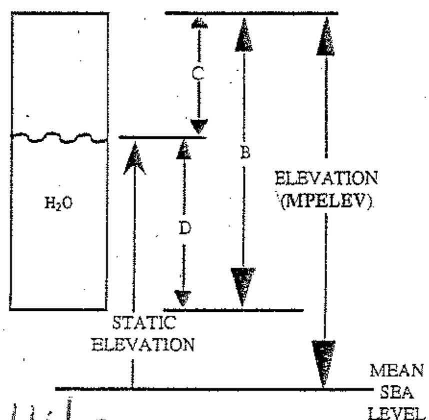
Measured Water Level Depth (C) (STATDEP) 19.60 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 30.78

Depth during Purging/Sampling: 19.60-19.90 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9/16/03

Physical Appearance/Comments: clear to silty/brown / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1154	19.68	6.75	0.474	13.36	78.0	1.90	22	400
1155	19.69	6.70	0.470	13.10	82.6	0.68	25	400
1156	19.68	6.64	0.463	12.89	85.1	0.00	27	400
1157	19.68	6.60	0.463	12.73	77.7	0.00	29	400
1158	19.68	6.57	0.463	12.75	77.6	0.00	30	400

Sample Time: 1200   Sample ID: 782MW97 31DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP PC

Location and Site Code (SITEID): ____________

Well No. (LOCID): WL-782MW-82 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9.16.03 Weather: Sunny /

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

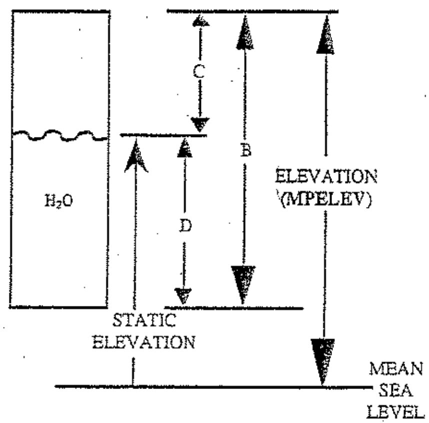
Measured Water Level Depth (C) (STATDEP) 20.06 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46.26

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: ~~clear~~ / Brown silt / no odor

Dissolved Ferrous Iron (mg/L): 1.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	~~± 10%~~	~~± 10mV~~	
1132	20.10	7.65	.564	13.91	130	4.65	-64	200
1134	20.10	7.61	.559	13.47	133	4.06	-112	200
1136	20.10	7.63	.546	13.57	128	3.42	-136	200
1138	20.10	7.60	.546	13.52	123	3.06	-150	200
1140	20.10	7.60	.550	13.02	122	2.85	-162	200
1142	20.10	7.61	.547	12.96	117	2.67	-169	200
1144	20.10	7.59	.546	13.07	109	2.51	-172	200

Sample Time: 1155 Sample ID: 782M8246DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): Bldg. 785

Well No. (LOCID): WL-782VMW-81 Well Diameter (SDIAM): 2"

Date (LOGDATE): ~~8~~ 9/16/03 Weather: Sunny 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

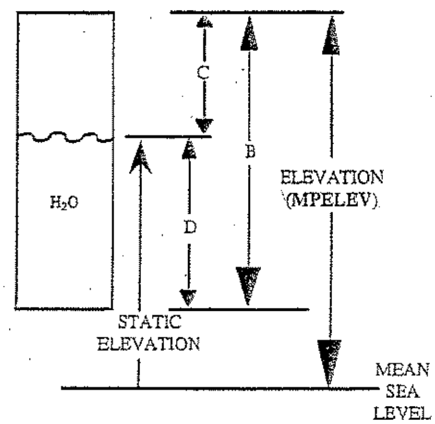
Measured Water Level Depth (C) (STATDEP) 21.64 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46.20

Depth during Purging/Sampling: 21.64 - 21.94 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9-16

Physical Appearance/Comments: clear / odor

Dissolved Ferrous Iron (mg/L): 1.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1555	21.88	7.59	0.530	19.88	74.7	7.14	-165	160
1557	21.88	7.46	0.555	17.09	105.0	3.59	-153	160
1559	21.88	7.35	0.561	16.46	109.0	2.40	-150	200
1601	21.88	7.29	0.558	16.60	115.0	1.79	-149	200
1603	21.88	7.29	0.567	15.77	111.0	0.03 DB	-150	~~200~~ DB 100
~~1605~~ DB						~~0.03~~		
1607	21.90	7.22	0.571	15.78	92.0	0.02	-159	100
1611	21.90	7.21	0.574	15.91	90.0	0.00	-161	100

Sample Time: 1612 Sample ID: 782M8146DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (**SITEID**): 782

Well No. (**LOCID**): WL-782VMW-80 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9/16/03 Weather: Sunny, 70's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) 28.22 ft. (optional)

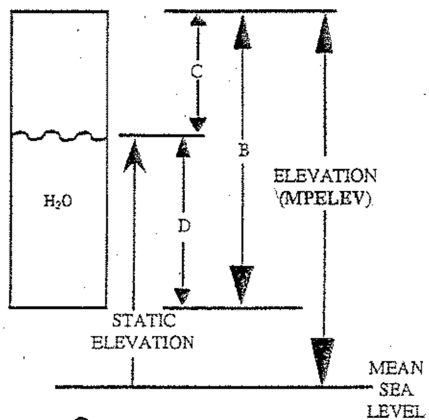
Measured Water Level Depth (C) (STATDEP) 19.20 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33.22

Depth during Purging/Sampling: 19.20 - 22.20 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 9-16

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 2.9

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1500	19.3	6.81	0.665	15.08	164.0	4.56	-120	300
1502	19.3	6.77	0.671	14.78	173	1.74	-125	300
1504	19.3	6.76	0.670	14.62	146	0.22	-127	300
1506	19.3	6.75	0.670	14.59	134.0	0.00	-128	300
1508	19.3	6.74	0.671	14.67	122.0	0.00	-129	300
1510	19.3	6.74	0.671	14.57	89.0	0.00	-130	300
1512	19.3	6.74	0.674	14.70	88.0	0.00	-132	300
1514	19.3	6.75	0.673	14.81	80.0	0.00	-134	300

Sample Time: 1516 Sample ID: 782M8033DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PB JD

Location and Site Code (SITEID): 782 VMW-105B

Well No. (LOCID): WL-782VMW-105B Well Diameter (SDIAM): 2"

Date (LOGDATE): 9-16-03 Weather: 70s Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) __________ ft. (optional)

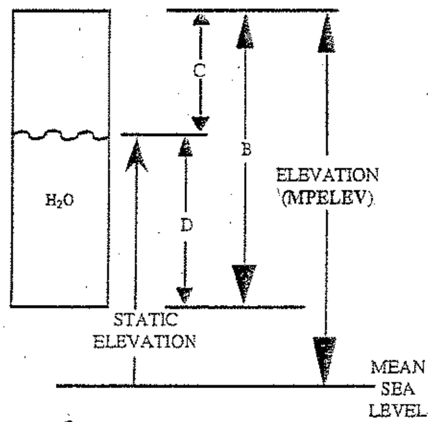
Measured Water Level Depth (C) (STATDEP) 19.90 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33.13

Depth during Purging/Sampling: 19.90 - 20.20 (provide range)

Comments (re: Depth during purging/sampling): __________



Purge Date and Method: BLADDER PUMP 9-16

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1350	20.10	6.97	0.573	15.06	395.0	1.76	60	200
1352	20.10	6.92	0.560	14.86	414.0	0.21	42	200
1354	20.10	6.98	0.555	14.98	395.0	0.00	27	200
1356	20.05	6.88	0.554	14.77	380.0	0.00	16	200
1358	20.05	6.88	0.555	14.60	365.0	0.00	12	200
1400	20.05	6.88	0.554	14.69	385.0	0.00	7	200

Sample Time: 1402 Sample ID: 782M105B33DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: ____________

Location and Site Code (**SITEID**): 782

Well No. (**LOCID**): WL-782UMW-77 Well Diameter (**SDIAM**): 2

Date (**LOGDATE**): 9-16-03 Weather: 80 sunny / breezy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

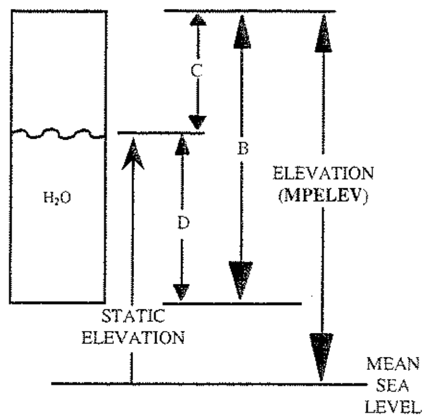
Measured Well Depth (B) (**TOTDEPTH**) 37.6 ft.

Measured Water Level Depth (C) (**STATDEP**) 17.78 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = 3.183 gal

Minimum Purge Volume = 9.54 gal (3 well volumes)



37.66
17.78
19.88
.16
1.1958
19.88
.16
11558
1988
3.1838
3
9.54

Purge Date and Method: Bailer

Physical Appearance/Comments: Rusty Color / Bottom of Well very Silty

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1637	1.	7.22	.855	13.67	>999	10.19	-70
1639	2	6.88	.836	13.18	>999	6.9	-53
1642	3	6.80	.836	12.86	>999	6.02	-32
1646	4	6.81	.827	12.63	>999	4.92	-19
1649	5	6.89	.824	12.55	>999	7.30	-19
1653	6	6.88	.818	12.70	>999	4.83	-16
1655	7	6.89	.813	12.49	>999	4.92	-21
1658	8	6.91	.810	12.53	>999	4.81	-26
1700	9	6.92	.809	12.88	>999	4.87	-30
1702	10	6.91	.808	12.56	>999	4.78	-34

Sample Time: 1705 Sample ID: 782M7730 DA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (**SITEID**): Bldg. 782

Well No. (**LOCID**): WL-782VMW-76 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9/17/03 Weather: Sunny 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

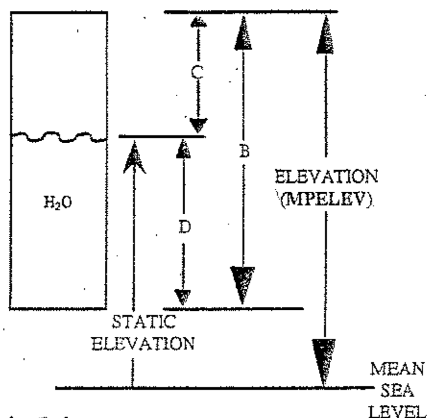
Measured Water Level Depth (C) (STATDEP) 20.61 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 38

Depth during Purging/Sampling: 20.61 - 20.91 ft (provide range)

Comments (re: Depth during purging/sampling): 20.75 - 20.89



Purge Date and Method: BLADDER PUMP 9/17/03

Physical Appearance/Comments: Water is clear, some sediment, No odor, No sheen

Dissolved Ferrous Iron (mg/L): 2.5 mg/L

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0927	20.89	6.81	0.641	17.25	43.3	0.00	-123	70
0933	20.85	6.86	0.643	17.15	47.1	0.00	-137	70
0939	20.75	6.91	0.646	17.33	~~47~~ 46.8	0.00	-144	70
0945	20.86	6.94	0.647	17.73	44.5	0.00	-148	70

Sample Time: 0950 Sample ID: 782M7638DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): Bldg 782

Well No. (LOCID): WL-782MW-78 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9/17/03 Weather: Sunny 70's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

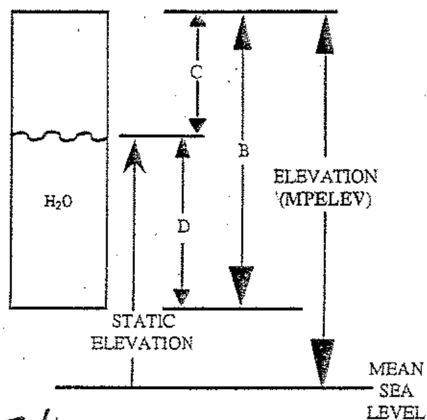
Measured Water Level Depth (C) (STATDEP) 24.35 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: 24.35 – 24.65 ft (provide range)

Comments (re: Depth during purging/sampling): 24.25 – 24.42



Purge Date and Method: BLADDER PUMP 9/17/03

Physical Appearance/Comments: Iron Floc in the begining, water is clear, orange, No odor, No sheen Some sediment

Dissolved Ferrous Iron (mg/L): 3.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1040	24.39	7.14	0.670	16.74	169	1.47	-139	250
1042	24.41	7.14	0.669	14.81	255	0.58	-141	250
1044	24.42	7.11	0.666	14.21	277	0.00	-143	250
1046	24.25	7.16	0.668	13.79	234	0.00	-148	250
1048	24.26	7.10	0.668	13.74	224	0.00	-156	250
1050	24.29	7.10	0.669	13.78	2[illegible]	0.00	-151	250

Sample Time: 1052 Sample ID: 782M7840DA
782M7840DC
782M7840DX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP PC

Location and Site Code (SITEID): 782

Well No. (LOCID): WL-782UMW-84 Well Diameter (SDIAM): ____________

Date (LOGDATE): 9-17-07 Weather: 80° sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

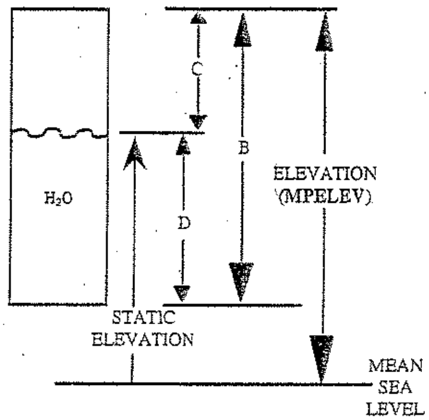
Measured Water Level Depth (C) (STATDEP) 23.46 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP ____________

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 4.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1402	23.46	6.82	.814	14.16	81.6	6.77	-124	400
1404		6.77	.820	13.91	48.6	5.81	-124	400
1405		6.73	.826	13.53	10.7	4.43	-126	400
1406		6.72	.828	13.48	0.7	3.94	-127	400
1407		6.71	.828	13.42	-1.7	3.65	-127	400
1408		6.69	.829	13.34	-2.9/0	3.31	-127	400
1409		6.68	.829	13.34	-3.5/0	3.11	-126	400
1410		6.68	.828	13.28	-3.4/0	3.09	-126	400
1411		6.67	.828	13.25	-1.6/0	2.76	-126	400
1412		6.67	.828	13.23	-2.8/0	2.76	-125	400
1413		6.66	.828	13.22	-3.1/0	2.61	-125	400

Sample Time: 1415 Sample ID: 782M84400A

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP PC

Location and Site Code (SITEID): Chlm. Plume

Well No. (LOCID): WL-782VMW-87 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9.17.03. Weather: Sunny / 75°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

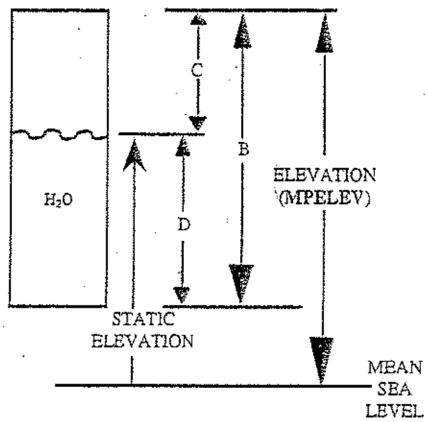
Measured Water Level Depth (C) (STATDEP) 23.59 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear/no odor

Dissolved Ferrous Iron (mg/L): 5.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1300	29.99	6.67	.725	13.6	45.8	5.61	-130	360
1302	29.95	6.63	.744	12.82	42.1	4.85	-130	360
1304	↓	6.61	.762	12.62	35.0	4.34	-135	360
1306		6.62	.775	12.47	30.2	3.86	-136	360
1308		6.62	.783	12.33	24.1	3.27	-138	360
1310		6.62	.790	12.27	18.8	3.05	-140	360
1312		6.63	.788	12.40	15.1	2.88	-141	360

Sample Time: 1325 Sample ID: 782M8735DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP PC

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782VMW-88 Well Diameter (SDIAM): 2" (Flushmount)

Date (LOGDATE): 9.17.03 Weather: Sunny / 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ ft. (optional)

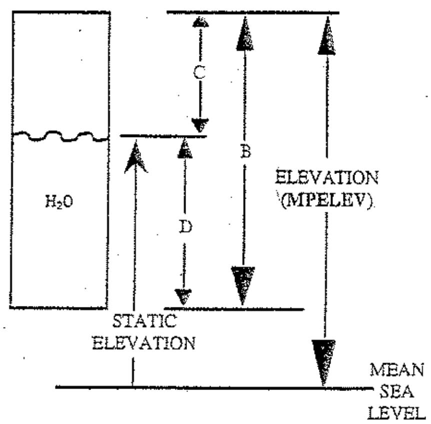
Measured Water Level Depth (C) (STATDEP) 27.17 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 37'

Depth during Purging/Sampling: ____ (provide range) ft

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Started Rusty / Cleared Gradually / No odor

Dissolved Ferrous Iron (mg/L): 3.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0955	27.17	6.61	.92	13.49	961	7.57	-76	420
0956		6.63	.91	13.24	>999	6.46	-89	420
0957		6.65	.91	12.96	>999	5.49	-101	420
0958		6.68	.90	12.83	>999	4.82	-111	420
0959		6.69	.90	12.78	688	4.25	-118	420
1000		6.70	.90	12.79	499	4.09	-121	420
1001		6.72	.90	12.79	361	3.81	-125	420
1002		6.74	.91	12.78	232	3.54	-129	420
1003		6.74	.90	12.81	173	3.36	-132	420
1004		6.73	.90	12.79	144	3.21	-133	420
1005		6.72	.90	12.81	129	3.09	-134	420

Sample Time: 1015 Sample ID: 782M8837ΔA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): 782UMW-93

Well No. (LOCID): WL-782UMW-93 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9-17-03 Weather: 70's sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

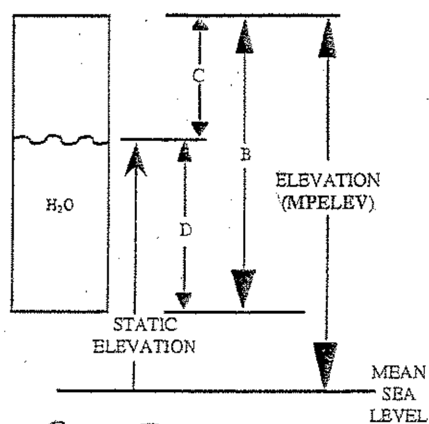
Measured Water Level Depth (C) (STATDEP) 21.47 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: 21.47 - 21.80 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 9-17-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 3.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1407	21.7	7.09	0.610	16.85	202.0	1.80	-129	150
1410	21.7	7.01	0.612	16.05	190.0	1.03	-129	150
1412	21.75	6.93	0.617	15.40	185.0	0.01	-128	200
1414	21.75	6.87	0.620	15.22	179.0	0.00	-129	200
1416	21.70	6.84	0.618	15.10	160.0	0.00	-131	200

Sample Time: 1420 Sample ID: 782M9335DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

95 ft. from B783 in line with fifth light

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (**SITEID**): 782UMW-94

Well No. (**LOCID**): WL-782UMW-94 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-17-03 Weather: 70s sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____ ft. (optional)

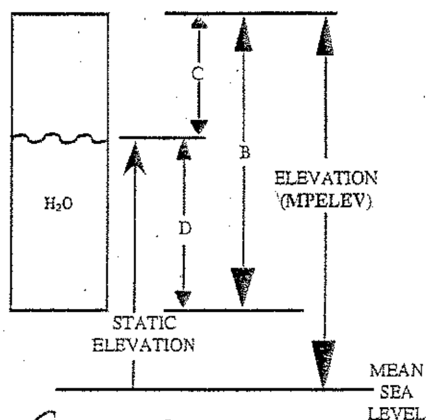
Measured Water Level Depth (C) (STATDEP) 22.22 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: 22.22 - 22.55 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 9-17

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 3.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1501	22.45	7.52	0.978	15.59	201.0	0.68	-142	150
1504	22.45	7.49	0.976	15.60	191.0	0.00	-158	150
1507	22.45	7.40	0.981	15.50	181.0	0.00	-160	150
1510	22.45	7.35	0.979	15.20	177.0	0.00	-160	150
1513	22.45	7.33	0.977	15.17	171.0	0.00	-160	150
1516	22.45	7.32	0.975	15.15	169.0	0.00	-161	150

Sample Time: 1520 Sample ID: 782M9440DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB

Location and Site Code (SITEID): Bldg. 782

Well No. (LOCID): WL-782MW-99 Well Diameter (SDIAM): Sunny 70's

Date (LOGDATE): 7/17/03 Weather: 2"

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

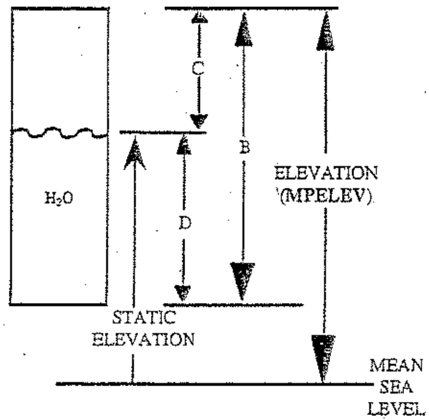
Measured Water Level Depth (C) (STATDEP) 19.18 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: 19.18 - 19.48 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, w/ Some sediment, No odor, No Sheen

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1152	19.28	7.32	0.475	14.40	166	6.51	48	240
1154	19.27	7.25	0.481	13.94	164	5.71	50	250
1156	19.28	7.22	0.480	13.75	161	5.43	52	250
1158	19.28	7.21	0.481	13.47	157	5.23	53	250

Sample Time: 1200 Sample ID: 782M9928 DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC / JP

Location and Site Code (SITEID): 786

Well No. (LOCID): WL-786MW-30 Well Diameter (SDIAM): ______

Date (LOGDATE): 9-17-03 Weather: 80 Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

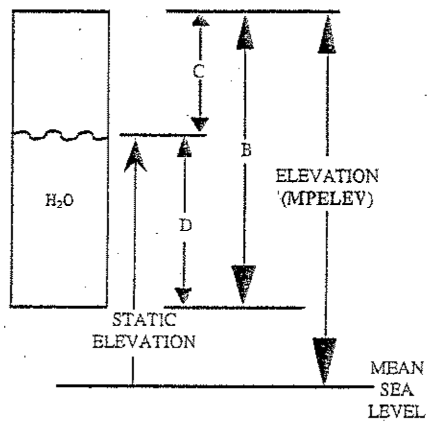
Measured Water Level Depth (C) (STATDEP) 15.82 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 22

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: No odor / Clear

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1527	15.82	7.34	.345	14.05	11.6	8.10	29	80
1532		7.47	.346	13.75	7.8	5.78	-1	80
1537		7.50	.347	13.53	5.5	5.26	-18	80
1542		7.50	.347	13.31	6.7	4.93	-32	80
1547		7.50	.348	13.32	6.3	4.67	-39	80
1552		7.50	.349	13.34	4.2	4.47	-40	80
1557		7.49	.349	13.21	4.5	4.36	-45	80
1602		7.49	.351	13.15	2.1	4.22	-48	80
1607		7.48	.351	13.09	2.0	4.13	-51	80
1612		7.49	.351	13.07	2.1	4.11	-52	80

Sample Time: 1625 Sample ID: 786M3022DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (**SITEID**): 782VMW-6D

Well No. (**LOCID**): WL-782VMW-6D Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-18-03 Weather: 60 sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____ ft. (optional)

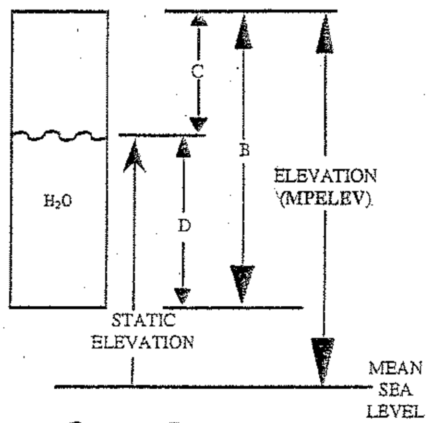
Measured Water Level Depth (C) (STATDEP) 24.3 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 43

Depth during Purging/Sampling: 24.3 – 24.33 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 9-18

Physical Appearance/Comments: Cloudy, No odor, No sheen

Dissolved Ferrous Iron (mg/L): 3.5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0858	24.33	6.49	1.14	12.92	150	0.00	-102	400
0859	24.33	6.53	1.14	12.88	146	0.00	-115	400
0900	24.33	6.57	1.14	12.85	143	0.00	-122	400
0901	24.33	6.59	1.14	12.87	143	0.00	-126	400
0902	24.33	6.61	1.14	12.84	139	0.00	-129	400

Sample Time: 0906 Sample ID: 782M6D43 DA
DS
DD

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PB, JD

Location and Site Code (SITEID): 782UMW - 6R2

Well No. (LOCID): WL-782UMW-6R2 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9-18-03 Weather: 60 sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) __________ ft. (optional)

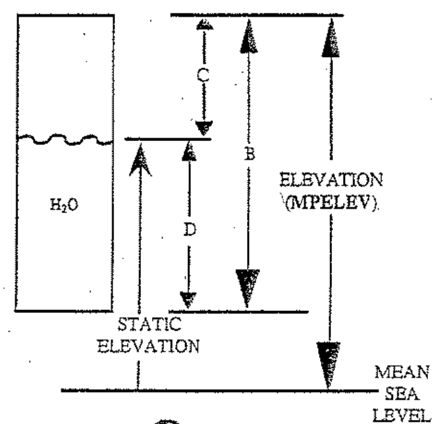
Measured Water Level Depth (C) (STATDEP) 21.19 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 30

Depth during Purging/Sampling: 21.2 - 21.5 ft (provide range)

Comments (re: Depth during purging/sampling): __________



Purge Date and Method: BLADDER PUMP 9-18

Physical Appearance/Comments: Clear / ~~No~~ No odor

Dissolved Ferrous Iron (mg/L): 2.0 mg/L

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0954	21.23	6.79	1.08	12.70	163.0	0.00	-141	400
0955	21.25	6.79	1.08	12.68	172.0	0.00	-143	400
0956	21.25	6.79	1.08	12.71	191.0	0.00	-145	400
0957	21.25	6.79	1.08	12.79	212.0	0.00	-147	400
0958	21.25	6.79	1.08	12.74	220.0	0.00	-148	400
0959	21.25	6.79	1.08	12.75	229.0	0.00	-149	400

Sample Time: 1000 Sample ID: 782M6R230DA
DX
DC

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JD DB

Location and Site Code (SITEID): 782MW-10

Well No. (LOCID): WL-782MW-10 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9-18-03 Weather: 70 sun/windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

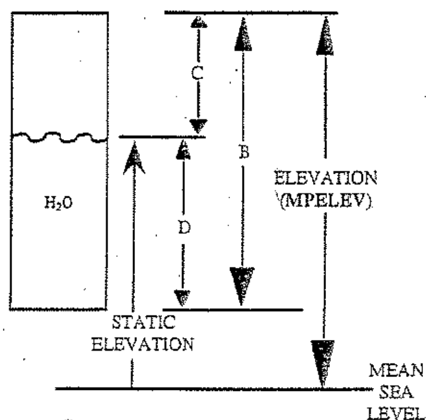
Measured Water Level Depth (C) (STATDEP) 22.14 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 22.14 - 22.44 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 9-18

Physical Appearance/Comments: clear / iron floc / no odor

Dissolved Ferrous Iron (mg/L): 4.5

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 (pH) ± 3% (EC) ± 10% (Turbidity) ± 10% (D.O.) ± 10mV (ORP)

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1439	22.25	6.83	0.675	14.44	250.0	0.14	-120	400
1440	22.29	6.81	0.675	14.42	397.0	0.00	-130	400
1441	22.29	6.81	0.674	14.53	485.0	000	-135	400
1442	22.30	6.81	0.677	1453	489.0	0.00	-135	400
1443	22.30	6.81	0674	1447	488.0	0.00	-138	400

Sample Time: 1450 Sample ID: 782M10270A

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP/PC

Location and Site Code (SITEID): 782

Well No. (LOCID): WL-782UMW-85 Well Diameter (SDIAM): ______

Date (LOGDATE): 9-18-03 Weather: 65°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

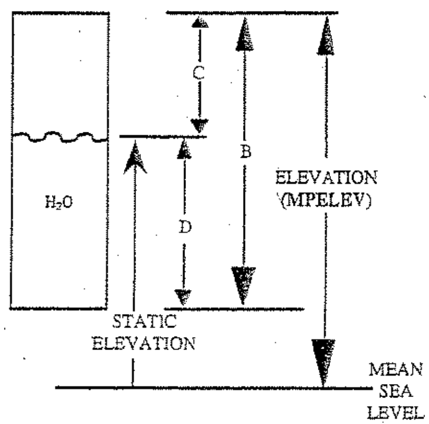
Measured Water Level Depth (C) (STATDEP) 24.22 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 36

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear no odor no sheen

Dissolved Ferrous Iron (mg/L): 7.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0940	24.36	6.50	1.20	11.43	5.1	7.55	-107	300
0942		6.62	1.22	11.40	2.0	5.61	-120	300
0944		6.68	1.22	11.31	0.4	4.80	-128	300
0946		6.69	1.23	11.28	-1.4	4.36	-132	300
0948		6.70	1.22	11.23	-2.1	4.00	-135	300
0950		6.70	1.22	11.22	-3.6	3.81	-136	300
0952		6.72	1.22	11.20	-3.5	3.60	-137	300

Sample Time: 1005 Sample ID: 782M8536DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP / PC

Location and Site Code (SITEID): 782 Chlorinate

Well No. (LOCID): WL-782UMW-86 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-18-03 Weather: 75° sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

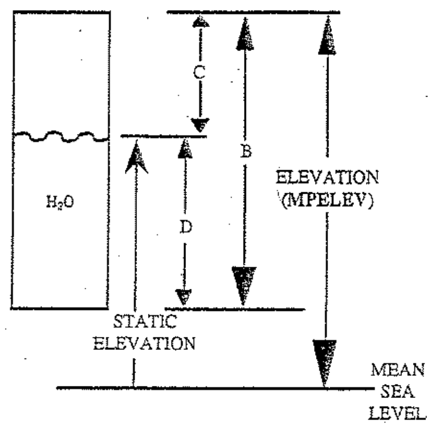
Measured Water Level Depth (C) (STATDEP) 23.08 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear / no odor / no sheen

Dissolved Ferrous Iron (mg/L): 4.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1107	23.30	6.88	1.24	11.35	8.3	4.31	-122	300
1109		6.89	1.21	11.02	6.4	3.94	-124	300
1111		6.90	1.22	11.01	6.5	3.48	-125	300
1113		6.90	1.21	11.02	4.6	3.17	-127	300
1115		6.90	1.19	10.92	3.9	3.00	-128	300

Sample Time: 1125 Sample ID: 782M8633DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP/PC

Location and Site Code (SITEID): 782

Well No. (LOCID): WC-782 VMW-89 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-18-03 Weather: 70 sunny windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

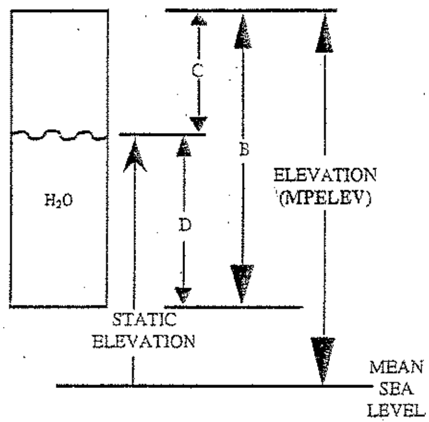
Measured Water Level Depth (C) (STATDEP) 24.72 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear no smell no sheen

Dissolved Ferrous Iron (mg/L): 4.6

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1153	24.88	6.90	.800	11.65	50.3	5.12	-138	420
1154		6.91	.813	11.43	39.9	4.03	-138	420
1155		6.90	.825	11.44	28.9	3.47	-140	420
1156		6.90	.825	11.32	22.5	3.21	-140	420
1157		6.90	.834	11.24	16.1	2.82	-140	420
1158		6.90	.837	11.20	12.6	2.70	-140	420
1159		6.90	.845	11.28	10.6	2.59	-140	420
1200		6.90	.845	11.22	10.6	2.52	-140	420
1201		6.90	.847	11.16	9.8	2.41	-140	420

Sample Time: 1215 Sample ID: 782M8935DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): 782VMW - 91

Well No. (LOCID): WL-782VMW-91 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9-18-03 Weather: 80' sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

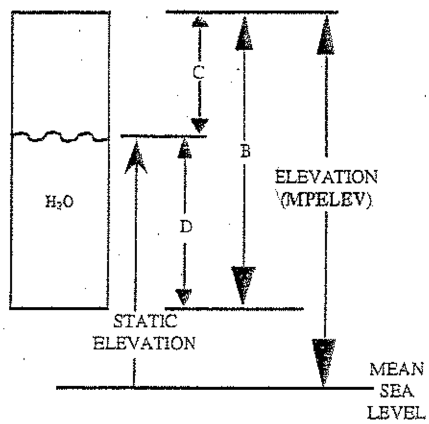
Measured Water Level Depth (C) (STATDEP) 19.68 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 19.7 - 20 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9-18

Physical Appearance/Comments: clear / cloudy / no odor

Dissolved Ferrous Iron (mg/L): 4.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1054	19.8	6.67	2.02	16.07	146.0	0.00	-150	325
1056	19.90	6.66	2.02	15.90	155	0.00	-154	375
1057	19.90	6.65	2.03	15.90	155	0.00	-155	375
1058	19.90	6.65	2.03	15.95	154	0.00	-155	375
1059	19.90	6.65	2.03	16.00	153.0	0.00	-156	375

Sample Time: 1100 Sample ID: 782M9127DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): Apron 2

Well No. (LOCID): WL-782VMW-92 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9/18/03 Weather: Sunny 70', Slight Breeze

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

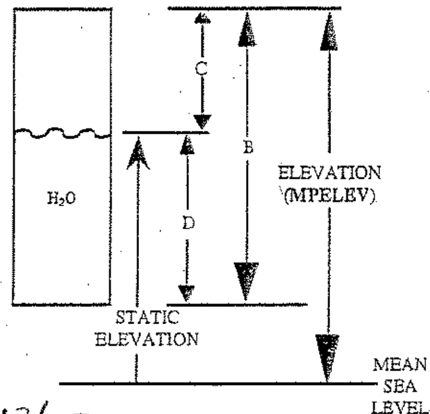
Measured Water Level Depth (C) (STATDEP) 22.22 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: 22.22 – 22.55 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9/18/03

Physical Appearance/Comments: clear/cloudy / no odor

Dissolved Ferrous Iron (mg/L): 5.5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1149	22.25	6.95	0.710	15.01	210.0	2.35	-128	280
1151	22.25	6.92	0.711	14.66	217.0	0.66	-133	280
1153	22.28	6.91	0.714	14.08	227.0	0.00	-137	280
1155	22.30	6.90	0.713	14.07	227.0	0.00	-140	280
1157	22.30	6.88	0.716	14.17	219.0	0.00	-141	280

Sample Time: 1200 Sample ID: 782M9235DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JB/PB

Location and Site Code (SITEID): ~~782…~~ 782UMW-95

Well No. (LOCID): WL-782UMW-95 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-18-03 Weather: 75° sunny windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

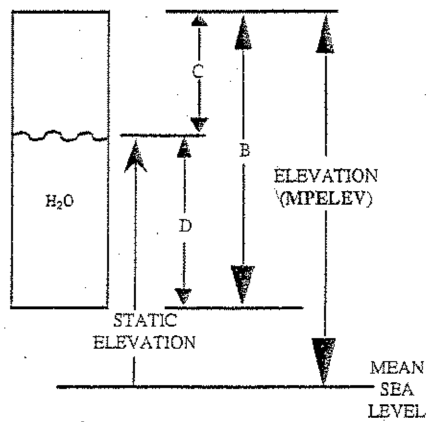
Measured Water Level Depth (C) (STATDEP) 23.18 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: 23.20 - 23.50 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9-18-03

Physical Appearance/Comments: clear/cloudy / no odor

Dissolved Ferrous Iron (mg/L): 4.5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1606	2329	6.79	0.623	17.35	293.0	0.76	-153	3400
1608	2330	6.79	0.628	16.13	324.0	0.20	-156	3400
1610	2330	6.83	0.638	14.70	305.0	0.00	-160	3400
1612	23.40	6.83	0.651	1421	304.0	0.00	-166	320
1613	23.40	6.85	0.669	14.06	302.0	0.00	-169	320

Sample Time: 1620 Sample ID: 782M9528DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JD DB

Location and Site Code (SITEID): 782UMW-96

Well No. (LOCID): NL-782UMW-96 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9-18-03 Weather: 70 windy/sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ ft. (optional)

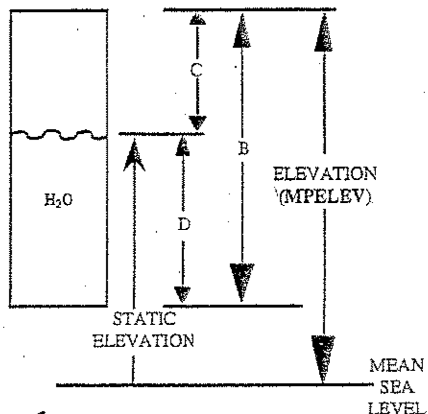
Measured Water Level Depth (C) (STATDEP) 21.76 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 37

Depth during Purging/Sampling: 21.76-22.09 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 9-18

Physical Appearance/Comments: Clear, No odor, No Sheen

Dissolved Ferrous Iron (mg/L): 2.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1355	21.95	7.02	0.633	14.76	200	1.13	-120	320
1357	21.95	6.96	0.632	14.70	197	0.00	-121	320
1359	21.95	6.94	0.628	14.57	184	0.00	-123	320
1401	21.95	6.90	0.629	14.74	187	0.00	-122	300
1403	21.95	6.88	0.629	14.58	184	0.00	-123	300

Sample Time: 1408 Sample ID: 782M9637DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP/JD/PC

Location and Site Code (SITEID): 782 Chlorinated

Well No. (LOCID): WL-782VMW-83 Well Diameter (SDIAM): ________

Date (LOGDATE): 9-19-03 Weather: 70 very windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

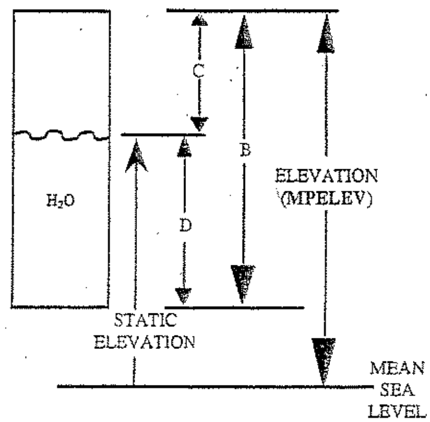
Measured Water Level Depth (C) (STATDEP) 18.98 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear - no odor - no sheen

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
~~0925~~	~~19.14~~	~~6.41~~	~~.656~~	~~16.40~~	~~46.1~~	~~7.90~~	~~176~~	
0926	19.14	6.55	.667	14.63	20.8	2.82	175	400
0927	|	6.67	.708	14.15	16.7	6.26	172	400
0929	|	6.75	.747	13.98	12.7	5.60	171	400
0930	|	6.81	.751	13.87	16.1	5.20	168	400
0931	|	6.89	.769	13.83	10.5	4.98	165	400
0933	|	6.96	.792	13.78	7.5	4.71	161	400

Sample Time: 935 Sample ID: 782M8333DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JD/TP/PC

Location and Site Code (SITEID): 782 Chlorinated

Well No. (LOCID): WL-782VMW-100 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-19-03 Weather: 75 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

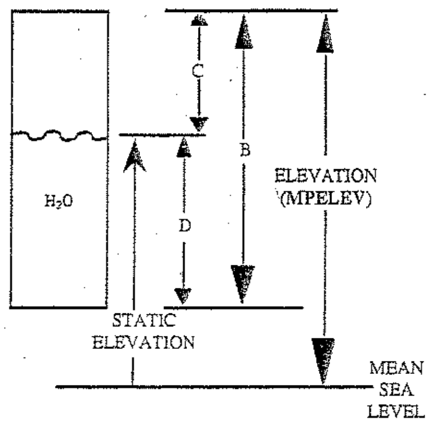
Measured Water Level Depth (C) (STATDEP) 16.35 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 25

Depth during Purging/Sampling: ____________ (provide range) ft

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Silty Brown - no odor - no sheen

Dissolved Ferrous Iron (mg/L): 0.0 alot of sediment from water however

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1113	16.79	7.17	.509	16.51	7999	4.63	65	120
1117		7.13	.517	16.72	7999	3.81	58	120
1121		7.16	.519	16.93	7999	3.48	32	120
1125		7.18	.520	16.52	567	3.32	22	120
1129		7.19	.520	16.51	896	3.08	12	120
1133		7.19	.526	16.91	781	2.89	5	120
1139		7.20	.519	17.09	724	2.76	4	120

Sample Time: 1139 Sample ID: 782M10025 0A

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP

Location and Site Code (**SITEID**): Chlor Plume

Well No. (**LOCID**): UL-782vmw-101 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9.19.03 Weather: windy / sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____ ft. (optional)

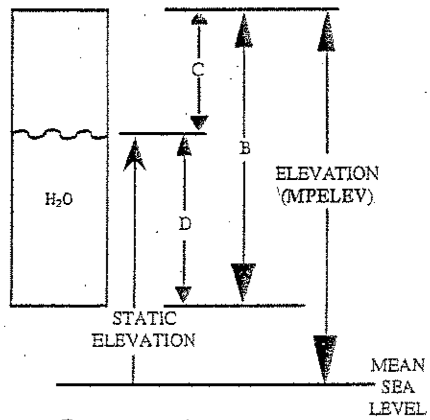
Measured Water Level Depth (C) (STATDEP) 10.25 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 18'

Depth during Purging/Sampling: 10.25 - 10.55 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 9-19

Physical Appearance/Comments: clear / cloudy - no odor

Dissolved Ferrous Iron (mg/L): 3.4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1430	10.25	6.85	0.398	14.57	195.0	9.17	-128	480
1431	10.25	6.76	0.406	13.91	203.0	1.90	-132	480
1432	10.25	6.71	0.412	13.54	207.0	0.00	-134	480
1433	10.25	6.68	0.416	13.47	209.0	0.00	-135	480
1434	10.25	6.66	0.418	13.54	206.0	0.00	-137	480

Sample Time: 1445 Sample ID: 782m10118BA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP/JD/PC

Location and Site Code (SITEID): 782 chlorinated

Well No. (LOCID): w-782UMW-102 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-19-03 Weather: 75 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

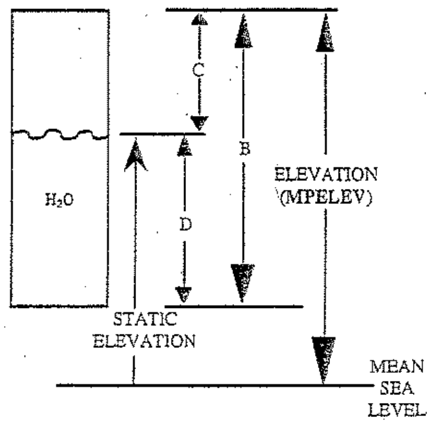
Measured Water Level Depth (C) (STATDEP) 9.18 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 19

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear / no odor / no sheen

Dissolved Ferrous Iron (mg/L): 3.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
13:33	9.14	6.36	.625	13.71	223	0.00	-110	300
1335	9.18	6.38	.624	13.58	222	0.00	-114	300
1337	9.18	6.39	.624	13.52	217	0.00	-115	300
1339	9.18	6.41	.624	13.54	216	0.00	-124	300

Sample Time: 1455 Sample ID: 782M10219DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32.03.01 Sampled by: JP

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): SL-782SW-115 Well Diameter (SDIAM): Surface water

Date (LOGDATE): 9.19.03 Weather: windy / muggy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

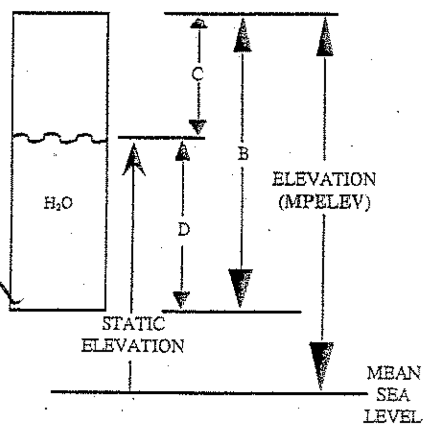
PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft.

Measured Water Level Depth (C) (STATDEP) ______ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal



Minimum
~~Total~~ Purge Volume = N/A gal (min. of 3 well volumes)

Purge Date and Method: Grab

Physical Appearance/Comments: Clear / no odor / no sheen
Ferrous — 0.0

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1415	.25	7.70	.471	17.16	-9.9	7.95	95

Sample Time: 1420 Sample ID: 782S11501DA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: JP

Location and Site Code (SITEID): Chloe. Plume

Well No. (LOCID): SL-782SW-11B Well Diameter (SDIAM): Surface Water

Date (LOGDATE): 9.19.03 Weather: Windy / Hot

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

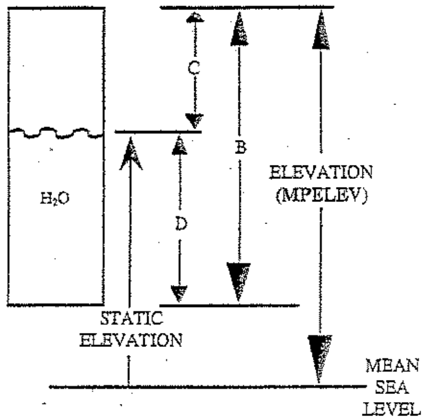
Measured Well Depth (B) (TOTDEPTH) ________ ft.

Measured Water Level Depth (C) (STATDEP) ________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

MINIMUM ~~Total~~ Purge Volume = N/A gal (min. of 3 well volumes)



Purge Date and Method: Grab

Physical Appearance/Comments: Clear, No Odor, No Sheen

- Ferrous: 0.0

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1435	.25	7.62	.486	17.19	-8.7	8.09	-40

Sample Time: 1440 Sample ID: 782S11B01DA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: JO

Location and Site Code (SITEID): Chlor Plume

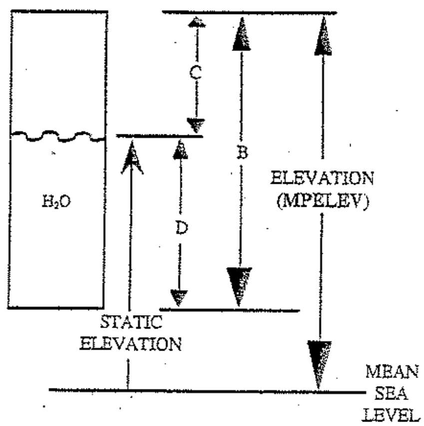
Well No. (LOCID): SL-782SW-119 Well Diameter (SDIAM): Surface Water

Date (LOGDATE): 9.19.03 Weather: windy / Hot

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:



Measured Well Depth (B) (TOTDEPTH) __________ ft.

Measured Water Level Depth (C) (STATDEP) __________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

MINIMUM ~~Total~~ Purge Volume = N/A gal (min. of 3 well volumes)

Purge Date and Method: Grab

Physical Appearance/Comments: Clear / No odor / no sheen

Ferrous: 0.0

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
~~1400~~ 1355	—	7.51	0.482	17.09	-8.5	7.57	-19

Sample Time: 1400 Sample ID: 782 S119 Ø1 DA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32·03·01 Sampled by: JP

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): SL 782SW-120 Well Diameter (SDIAM): Surface Water

Date (LOGDATE): 9·19·03 Weather: Windy / Hot

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

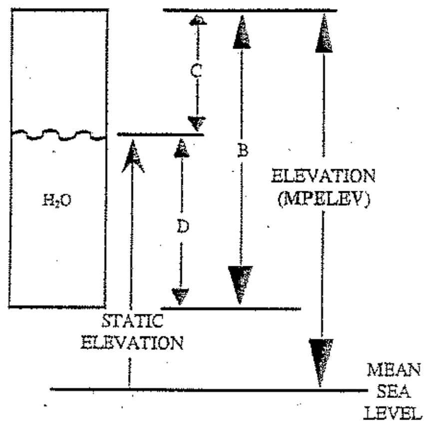
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

MINIMUM ~~Total~~ Purge Volume = N/A gal (min. of 3 well volumes)



Purge Date and Method: Grab

Physical Appearance/Comments: 0.0

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 (pH), ± 5% (EC), ±1°C (Temp.)

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1335	—	7.30	0.486	17.38	-1.8	10.25	26

Sample Time: 1340 Sample ID: 782S126Ø1DA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP/JD/PL

Location and Site Code (SITEID): ~~[illegible]~~ Apron 2 Chlorinated

Well No. (LOCID): Ap2MW-3 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-19-03 Weather: 70 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

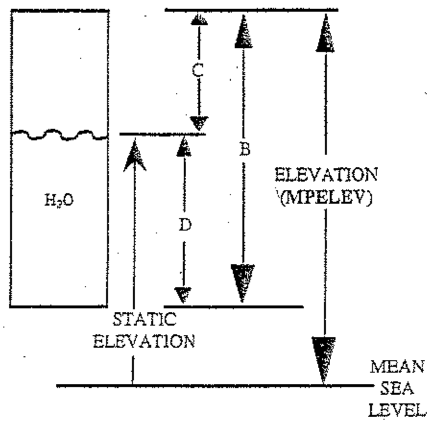
Measured Water Level Depth (C) (STATDEP) 20.26 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, No odor, No Sheen

Dissolved Ferrous Iron (mg/L): 4.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1023	20.26	6.90	.716	11.26	3.5	3.56	-129	420
1024	|	6.88	.721	11.28	1.9	3.22	-133	420
1025	|	6.87	.718	11.28	2.1	3.02	-134	420
1026	|	6.86	.716	11.37	1.4	2.91	-134	420
1027	|	6.84	.716	11.35	1.3	2.88	-135	420
1028	|	6.82	.717	11.39	2.1	2.81	-135	420

Sample Time: 1035 Sample ID: AP2MO327DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP/PC

Location and Site Code (SITEID): 782

Well No. (LOCID): WL-782VMW-90 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-18-03 Weather: 75 sunny windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

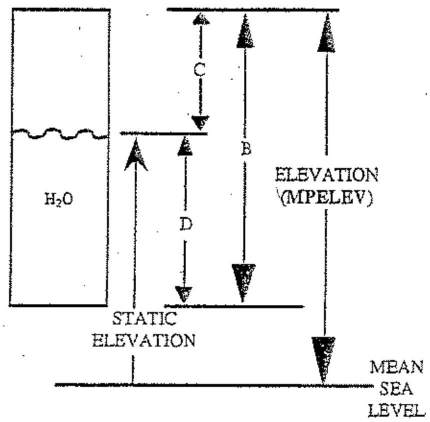
Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 29

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Contained .51 feet of product - Skip this round of sampling due to this

Dissolved Ferrous Iron (mg/L):

Product was reached at 24.88

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)

Sample Time: ______ Sample ID: Not Sampled

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP - PC

Location and Site Code (SITEID): 782

Well No. (LOCID): WL-782UMW-90 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-23-03 Weather: 65 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

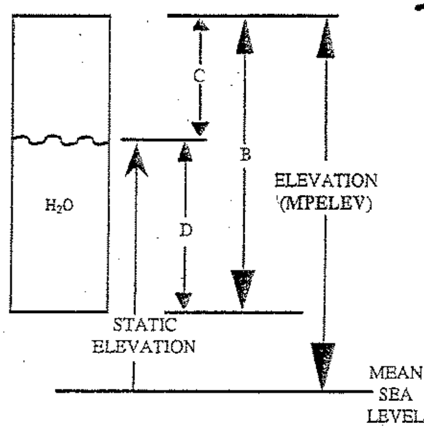
Measured Water Level Depth (C) (STATDEP) ______ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 31

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Top of product 24.93

Top of water 25.19

Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: no sheen/odor -

Dissolved Ferrous Iron (mg/L): ______

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1620	25.19	6.84	.527	12.26	135	4.70	-128	420
1621		6.81	.516	12.15	121	3.78	-129	420
1622		6.80	.514	12.08	88.3	3.23	-131	420
1623		6.79	.527	11.96	64.5	2.84	-134	420
1624		6.80	.583	11.78	46.7	2.39	-141	420
1625		6.80	.598	11.78	42.2	2.29	-143	420
1626		6.80	.614	11.82	40.7	2.22	-144	420
1627		6.81	.621	11.83	36.2	2.15	-146	420
1628		6.81	.624	11.79	30.1	2.11	-148	420

Sample Time: 1635 Sample ID: 782UM9031DA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): 782 Chl. Plume

Well No. (LOCID): WG782UMW-100 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/9/03 Weather: 30 cloudy cold windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

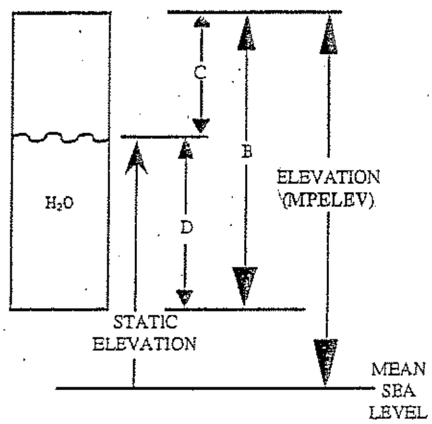
Measured Water Level Depth (C) (STATDEP) 16.18 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 25

Depth during Purging/Sampling: 16.38 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Silty Brown - Sediment whole time while purge

Dissolved Ferrous Iron (mg/L): ____________

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1604	16.38	6.46	.472	6.81	>999	5.69	79	120
1608	16.4	6.52	.430	7.25	>999	4.57	71	120
1612	16.4	6.56	.386	7.18	>999	3.51	71	120
1616	16.4	6.56	.363	7.20	>999	2.90	71	120
1620	16.4	6.59	.350	7.27	>999	2.50	71	120
1624	16.4	6.60	0.351	7.16	>999	2.46	69	120
1628	16.4	6.62	.353	7.10	>999	2.42	61	120

Sample Time: 1630 Sample ID: 782M10625EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): 782 chl Plume

Well No. (LOCID): WL-782MW-101 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/9/03 Weather: 30 windy cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ ft. (optional)

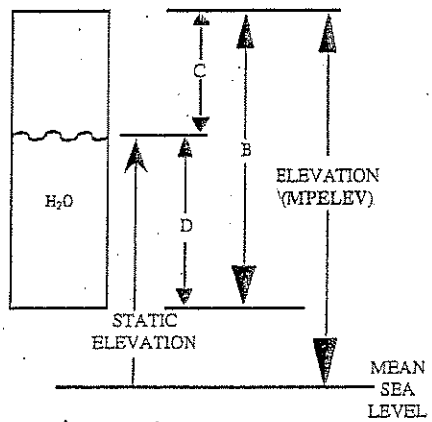
Measured Water Level Depth (C) (STATDEP) 9.63 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 18

Depth during Purging/Sampling: ____ ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 12-~~8~~-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 2.6

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1442	9.63	6.82	0.447	10.84	11.7	2.84	-103	450
1443	9.63	6.86	0.471	10.64	10.2	2.25	-106	450
1444	9.63	6.88	0.475	10.69	10.1	2.12	-106	450
1445	9.63	6.89	0.480	10.68	10.5	1.96	-108	450
1446	9.63	6.90	0.477	10.69	10.6	1.93	-109	450
1447	9.63	6.91	0.481	10.72	10.9	1.90	-109	450

Sample Time: ~~1355~~ 1455 Sample ID: 782 M1011EA
~~EE~~ EC
~~EX~~ EX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01　　Sampled by: PC

Location and Site Code (SITEID): 782 chl. Plume

Well No. (LOCID): WL-782UMW-102　　Well Diameter (SDIAM): 2

Date (LOGDATE): 12/9/03　　Weather: 30 cold, windy, cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

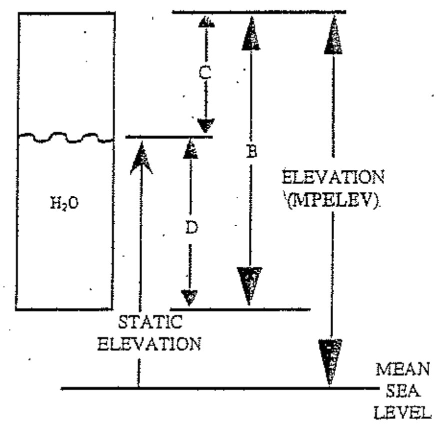
Measured Water Level Depth (C) (STATDEP) 8.66 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 19

Depth during Purging/Sampling: 8.68 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear / no odor

Dissolved Ferrous Iron (mg/L): 4.0

Purge < 10 recharge, 5 discharge

Sample < 13 rc, 2 dis

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1327	8.68	6.59	.646	10.67	13.1	4.01	-99	500
1328		6.59	.653	10.78	12.9	3.47	-102	
1329		6.65	.661	10.83	13.5	3.01	-105	
1330		6.68	.659	10.92	12.2	2.68	-107	
1331		6.73	.660	10.95	12.8	2.43	-109	
1332		6.76	.658	11.02	13.0	1.51	-111	
1333		6.78	.661	11.03	13.1	1.50	-113	
1334		6.80	.662	11.04	13.4	1.60	-114	

Sample Time: 1340　　Sample ID: 782M10219EA
EC
EX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PL DB

Location and Site Code (SITEID): AP2

Well No. (LOCID): WL-AP2mw-3 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/9/03 Weather: 30 windy, Cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

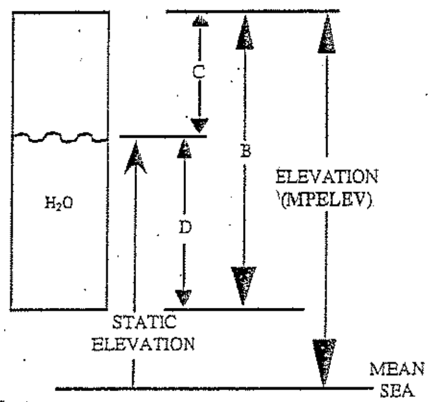
Measured Water Level Depth (C) (STATDEP) 19.69 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 19.70 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 12-9-03

Purge 10.0 sec recharge, 5.0 sec discharge

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 2.2

Sample 150 ml/min 12.5, 2.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1153	19.70	6.83	.686	10.93	10.0	2.72	-106	400
1154	19.70	6.85	.687	11.12	8.8	2.09	-111	400
1155	19.70	6.87	.686	11.22	8.2	1.73	-114	400
1156	19.70	6.86	.685	11.26	7.9	1.57	-116	400
1157	19.70	6.87	.685	11.32	7.7	1.42	-118	400
1158	19.70	6.89	.684	11.38	7.8	1.21	-119	400
1159	19.70	6.89	.684	11.38	7.7	1.19	-120	400
1200	19.70	6.89	.684	11.38	7.9	1.17	-121	400

Sample Time: 1210 Sample ID: AP2M0327EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: JP / JD

Location and Site Code (**SITEID**): Chlorinated Plume

Well No. (**LOCID**): SL-782SW-115 Well Diameter (**SDIAM**): Surface Water

Date (**LOGDATE**): 12/19/03 Weather: Overcast, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

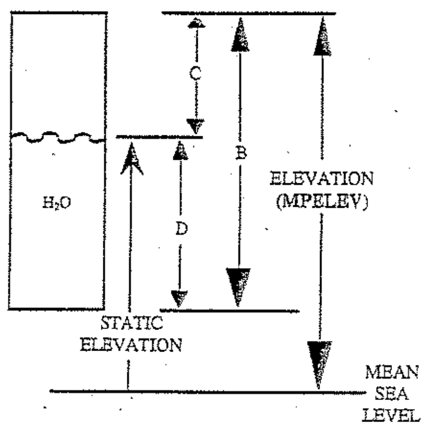
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

MINIMUM ~~Total~~ Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface water w/ S.S. Cup

Physical Appearance/Comments: ____________

DI: 0.4

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1452		5.95	0.414	5.92	31.2	9.37	-8

Sample Time: 1453 Sample ID: 782S11501EA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: JP / JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): SL-782SW-118 Well Diameter (SDIAM): Surface Water

Date (LOGDATE): 12/9/03 Weather: Overcast, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

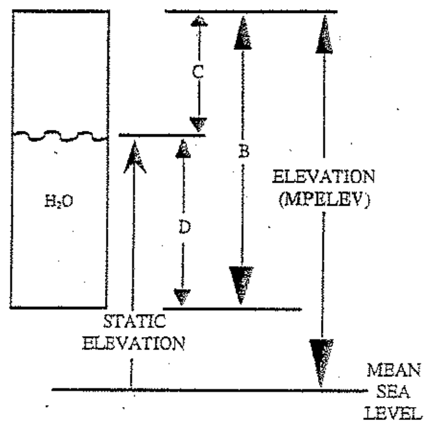
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

MINIMUM ~~Total~~ Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface water w/ S.S. cup

Physical Appearance/Comments: Cloudy, No odor, No sheen DE: 0.6

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
Allowable Range:		± 0.1	± 5%	±1°C			
1434	—	5.84	~~[illegible]~~ 0.419	5.81	34.4	9.55	64

Sample Time: 1435 Sample ID: 782S118Ø1EA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-02-01 Sampled by: JP / JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): SL-782SW-119 Well Diameter (SDIAM): Surface Water

Date (LOGDATE): 12/9/03 Weather: Overcast, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

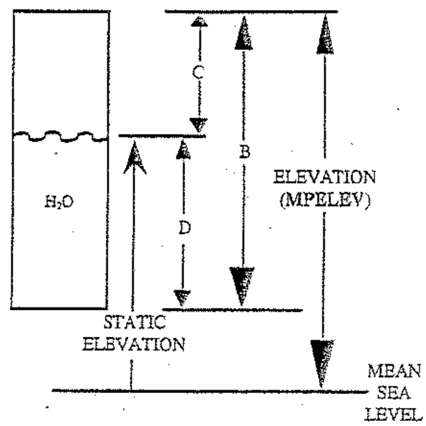
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

MINIMUM ~~Total~~ Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface Water w/ S. S. Cup

Physical Appearance/Comments: Clear, No Odor, No Sheen
DI: 0.4 mg/L

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 (pH), ± 5% (EC), ±1°C (Temp.)

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1416	—	5.73	0.506	5.16	54.2	11.79	64

Sample Time: 1417 Sample ID: 782511901EA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: JP / JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): SL-782SW-120 Well Diameter (SDIAM): Surface water

Date (LOGDATE): 12/9/03 Weather: Overcast, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

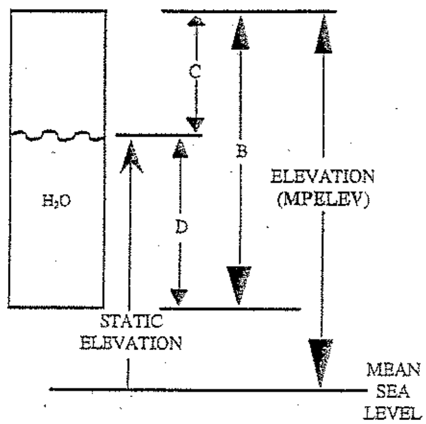
Measured Well Depth (B) (TOTDEPTH) ________ ft.

Measured Water Level Depth (C) (STATDEP) ________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

MINIMUM ~~Total~~ Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface water w/ S.S. Cup

Physical Appearance/Comments: Clear, No odor, No Sheen
DI: 0.2 mg/L

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
Allowable Range:		± 0.1	± 5%	±1°C			
1359	—	5.72	0.423	~~[illegible]~~ 5.71	23.3	9.85	105

Sample Time: 1400 Sample ID: 782S12061EA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01　　Sampled by: JP JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782 MW-6D　　Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/10/03　　Weather: Sunny, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

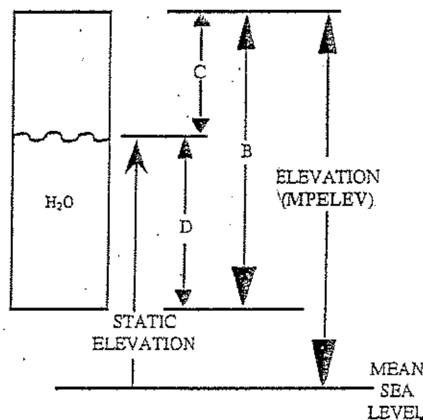
Measured Water Level Depth (C) (STATDEP) 23.97 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 43

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Excellent Recharge

Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Cloudy, Slight Sulfer smell, No sheen

Dissolved Ferrous Iron (mg/L): 5.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1616	23.97	5.93	0.963	11.94	54.3	0.50	-90	480
1617	23.97	6.02	0.972	11.94	38.0	0.00	-98	480
1618	23.97	6.03	0.960	11.94	28.3	0.00	-104	480
1619	23.97	6.02	0.958	11.96	22.5	0.00	-107	480
1620	23.97	6.01	0.961	12.00	20.6	0.00	-109	480
1621	23.97	6.01	0.963	12.00	20.9	0.00	-110	480

Sample Time: 1645　　Sample ID: 782M6D43EA
ED
ES

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): 782 chl Plume

Well No. (LOCID): W-782UMW-76 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/10/03 Weather: 30 clouds, wind

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

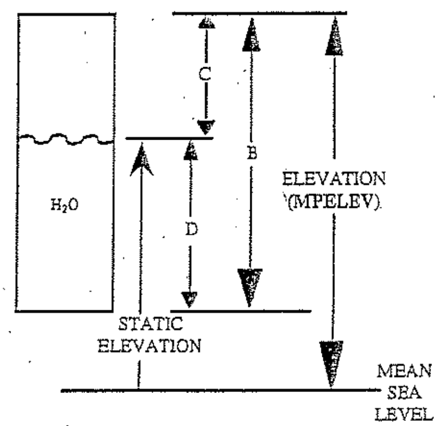
Measured Water Level Depth (C) (STATDEP) 20.24 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 38

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 12-10-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 4.6

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1347	20.50	6.99	0.664	11.97	7.6	4.90	-94	90
1351	20.50	7.07	0.675	12.34	6.9	4.02	-103	90
1354	20.54	7.15	0.680	12.22	6.4	2.76	-111	120
1357	20.54	7.19	0.683	12.10	5.1	2.27	-115	120
1400	20.54	7.21	0.683	11.98	4.7	2.00	-118	120
1403	20.54	7.26	0.684	12.25	4.4	1.95	-121	120
1406	20.54	7.28	0.686	12.05	4.4	1.81	-124	120

Sample Time: 1410 Sample ID: 782M7638EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): 782 Chl. Plume

Well No. (LOCID): WL-782VMW-77 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/10/03 Weather: 30 windy cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

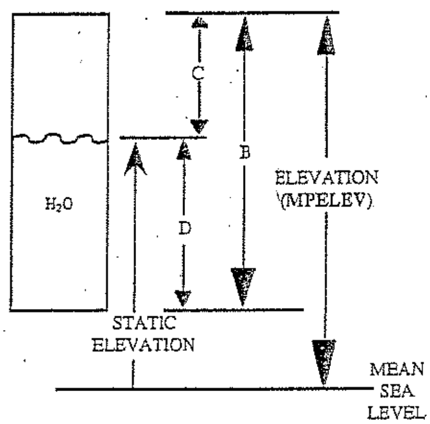
Measured Water Level Depth (C) (STATDEP) 18.06 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 30

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 12-10-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 2.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1503		6.96	0.843	10.45	152.0	2.39	-29	70
1508		6.98	0.846	10.50	128.0	2.06	-33	70
1513		7.00	0.845	10.59	96.9	1.72	-39	70
1519		7.03	0.847	10.48	71.0	1.68	-43	70
1525		7.04	0.847	10.55	58.0	1.49	-44	70
1531		7.05	0.848	10.41	56.3	1.39	-46	70
1537		7.06	0.850	10.36	53.2	1.38	-46	70

Sample Time: 1540 Sample ID: 782M7730EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-80 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/10/03 Weather: Sunny, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

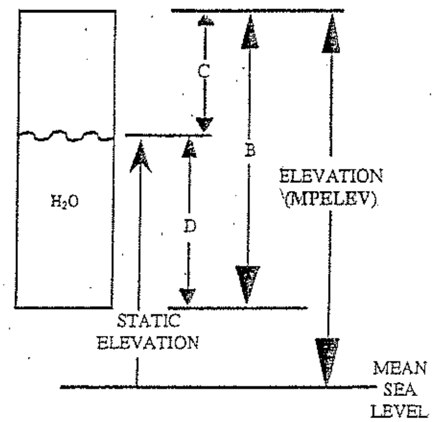
Measured Water Level Depth (C) (STATDEP) 18.97 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33'

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear / slight sulfur odor / no sheen

Dissolved Ferrous Iron (mg/L): 1.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1521	18.97	5.78	.682	11.07	43.7	4.07	-38	280
1523		5.93	.695	11.49	43.2	2.23	-38	280
1525		5.96	.704	11.67	46.5	0.84	-61	280
1527		5.97	.706	11.75	37.6	0.04	-72	280
1529		5.97	.707	11.82	32.0	0.00	-78	280
1531		5.98	.707	11.87	24.6	0.00	-80	280

Sample Time: 1535 Sample ID: 782M8037EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP/JP

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782MW-84 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12.10.03 Weather: cold/30°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

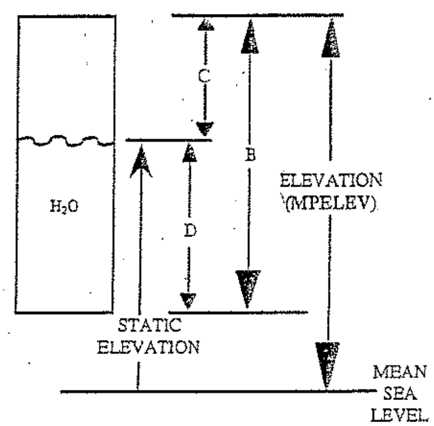
Measured Water Level Depth (C) (STATDEP) 23.20 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40'

Depth during Purging/Sampling ~~23.26~~ ________ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear no odor/no sheen

Dissolved Ferrous Iron (mg/L): 5.5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1016	23.26	5.85	.700	9.91	55.1	8.54	-18	150
1019		5.84	.740	10.49	57.5	4.35	-62	150
1022		5.82	.766	10.69	43.6	2.42	-65	150
1025		5.84	.782	10.63	31.6	1.28	-71	150
1028		5.82	.794	10.54	25.7	1.07	-73	150
1031		5.82	.796	10.52	26.2	0.00	-76	150

Sample Time: 1045 Sample ID: 782M844ØEA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782VMW-88 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/10/03 Weather: Overcast, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

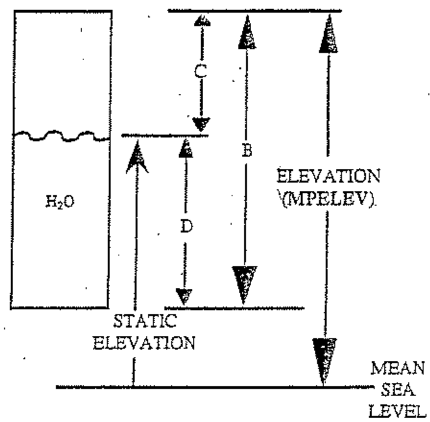
Measured Water Level Depth (C) (STATDEP) 26.91 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 37'

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Orangish, No odor, No sheen

Dissolved Ferrous Iron (mg/L): 5.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0942	26.91	5.84	0.790	11.13	213	0.00	-56	300
0944	26.91	5.83	0.794	11.54	197	0.00	-80	300
0946	26.91	5.86	0.792	11.55	163	0.00	-87	300
0948	26.91	5.86	0.790	11.73	112	0.00	-94	300
0950	26.91	5.87	0.791	11.71	95.2	0.00	-97	300
0952	26.91	5.86	0.790	11.67	84.1	0.00	-99	300
0954	26.91	5.86	0.790	11.71	57.3	0.00	-101	300

Sample Time: 1005 Sample ID: 782M8837EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-92 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/10/03 Weather: Sunny, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ ft. (optional)

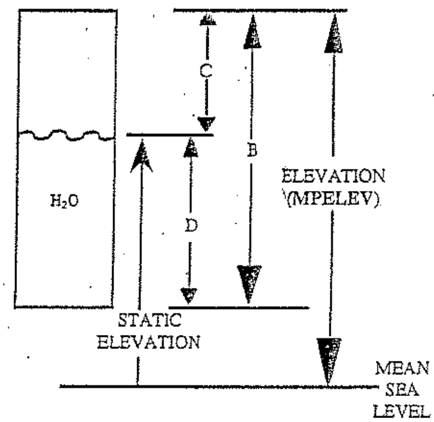
Measured Water Level Depth (C) (STATDEP) 21.88 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ____ ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Cloudy / no odor / no sheen

Dissolved Ferrous Iron (mg/L): 4.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1423	21.92	5.80	.751	11.48	49.5	1.83	-60	300
1425	↓	5.86	.751	11.94	32.4	0.54	-75	300
1427		5.88	.758	12.06	24.4	0.00	-86	300
1429		5.89	.760	12.16	20.7	0.00	-92	300
1431		5.92	.760	12.11	17.0	0.00	-98	300
1433		5.93	.761	12.10	16.4	0.00	-101	300

Sample Time: 1445 Sample ID: 782M9235EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): AY2 Chl. Plume

Well No. (LOCID): WL-782VMW-93 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/10/03 Weather: 30 cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

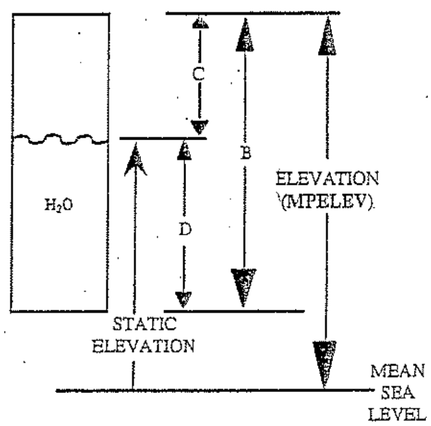
Measured Water Level Depth (C) (STATDEP) 21.22 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: 21.23 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 12-10-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 1.4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1007	21.23	6.81	.642	12.55	12.4	4.24	-8	160
1010		6.90	.645	12.46	9.4	3.11	-95	
1013		6.98	.647	12.37	7.1	2.18	-105	
1016		7.03	.648	12.33	8.2	1.83	-109	
1019		7.08	.647	12.34	8.7	1.49	-113	
1022		7.10	.647	12.45	5.5	1.30	-115	
1025		7.11	.645	12.26	6.0	1.25	-115	
1028		7.12	.643	12.36	5.8	1.20	-115	

Sample Time: 1030 Sample ID: 782M9335EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): 782 Chl. Plume

Well No. (LOCID): WL-782vmw-94 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/10/03 Weather: 30 cloudy windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

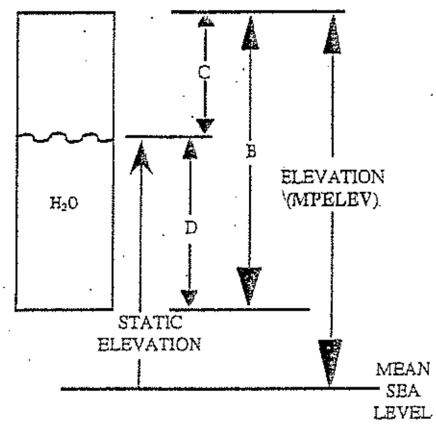
Measured Water Level Depth (C) (STATDEP) 21.92 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: 22.03 ft (provide range)

Comments (re: Depth during purging/sampling): ________



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4 re

Purge Date and Method: BLADDER PUMP 12-10-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): ~~[illegible]~~ 0.4

FIELD MEASUREMENTS:

turb

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1141	22.03	7.04	.985	11.20	15.4	7.24	-34	160
1144	22.05	7.23	1.13	11.39	17.9	4.88	-103	
1147	22.1	7.29	1.15	11.49	11.7	3.81	-111	
1151	22.1	7.32	1.15	11.55	13.7	2.85	-116	160
1154	22.1	7.34	1.15	11.60	~~[illegible]~~ DB	2.34	-118	160
1157	22.1	7.36	1.16	11.70	13.1	1.90	-120	160
1200	22.1	7.33	1.16	11.64	13.0	1.80	-122	160
1203	22.1	7.39	1.14	11.52	12.5	1.75	-123	160

-13.5

Sample Time: 1210 Sample ID: 782m9440EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 52-03-01 Sampled by: JP JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-96 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/10/03 Weather: Overcast, Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

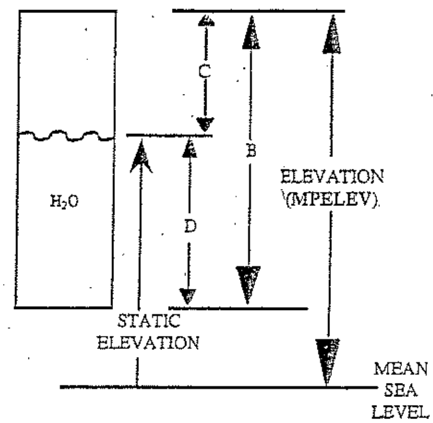
Measured Water Level Depth (C) (STATDEP) 21.48 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 37'

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear / no odor / no sheen

Dissolved Ferrous Iron (mg/L): 3.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1206	21.50	5.82	0.660	12.35	9.8	1.32	-46	320
1208	21.50	5.86	0.668	12.26	9.1	0.00	-68	320
1210	21.50	5.89	0.667	12.55	7.1	0.00	-72	320
1212	21.50	5.89	0.665	12.57	8.7	0.00	-76	320
1214	21.50	5.92	0.664	12.60	10.1	0.00	-78	320
1216	21.50	5.89	0.662	12.55	10.3	0.00	-79	320
1218	21.50	5.93	0.658	12.57	11.5	0.00	-80	320
1220	21.50	5.91	0.655	12.49	11.1	0.00	-79	320

Sample Time: 1221 Sample ID: 782M9637EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782MW-6R2 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12-11-03 Weather: Rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

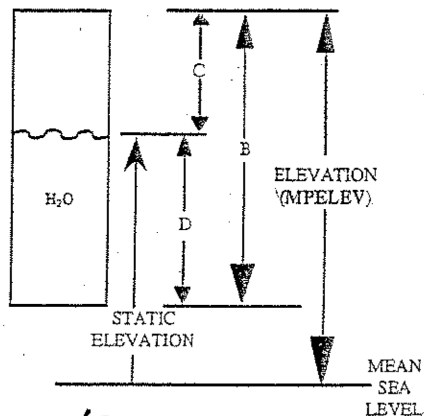
Measured Water Level Depth (C) (STATDEP) 24.71 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 30'

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 12-11-03

Physical Appearance/Comments: (cloudy) silty / clear / no odor (slight rust)

Dissolved Ferrous Iron (mg/L): 5.0 mg/L

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1544	19.2	7.28	0.543	11.11	246.0	2.16	-45	250
1546	19.2	7.33	0.550	11.78	171.0	1.34	-53	320
1548	19.2	7.38	0.552	11.98	170.0	1.07	-55	320
1550	19.2	7.39	0.555	12.00	174.0	0.64	-55	320
1552	19.2	7.40	0.555	12.09	174.0	0.36	-56	320
1554	19.2	7.40	0.556	12.09	135.0	0.17	-56	320
1556	19.2	7.39	0.557	12.07	137.0	0.12	-57	320
1558	19.2	7.41	0.558	12.10	139.0	0.00	-58	320

Sample Time: 1606 Sample ID: 782MW6R230EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JG/PC

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782VMW-85 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12.11.03 Weather: rainy / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ft. (optional)

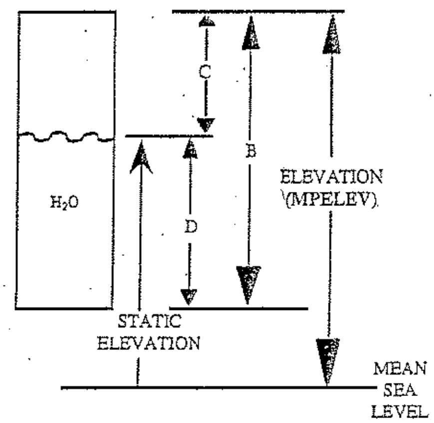
Measured Water Level Depth (C) (STATDEP) 23.89 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 36

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear / no odor /

Dissolved Ferrous Iron (mg/L): 3.4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1501		5.93	1.26	10.47	46.5	.38	-90	240
1503		5.94	1.26	10.49	46.5	0.00	-96	240
1505		5.96	1.26	10.65	46.0	0.00	-101	240
1507		5.99	1.26	10.72	43.1	0.00	-104	240
1509		6.00	1.26	10.66	43.9	0.00	-105	240

Sample Time: 1520 Sample ID: 782M8536EA

EC

EX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP/PC

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782MW-86 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12.11.03 Weather: Rainy/45°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

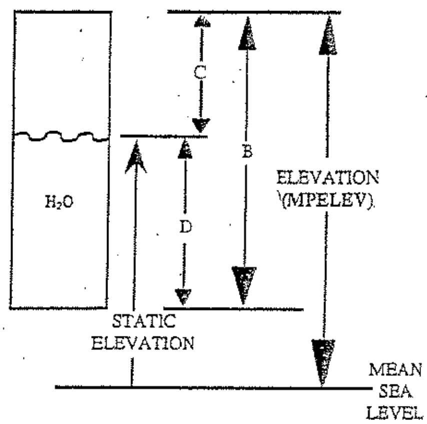
Measured Water Level Depth (C) (STATDEP) 22.75 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33'

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear/no odor

Dissolved Ferrous Iron (mg/L): 1.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1344	22.90	5.89	1.21	10.15	43.6	1.20	-66	225
1346	↓	5.94	1.22	10.23	39.7	0.05	-80	225
1348		5.95	1.22	10.25	45.3	0.00	-85	225
1350		5.96	1.23	10.20	45.1	0.00	-89	225
1352		5.95	1.23	10.13	49.7	0.00	-93	225

Sample Time: 1400 Sample ID: 782M8633EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-78huMW-89 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/11/03 Weather: 40 rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

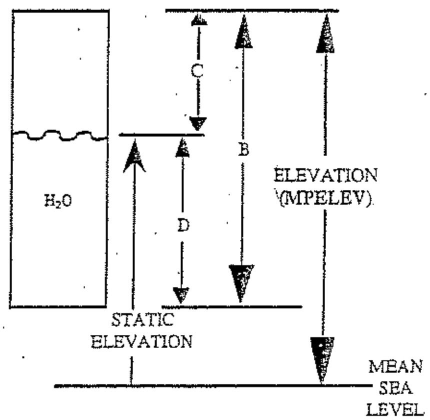
Measured Water Level Depth (C) (STATDEP) 24.40 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: 24.52 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 3.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1412	24.52	5.85	.710	9.94	160.0	0.11	-103	300
1414		5.90	.725	10.25	122.0	0.00	-109	
1416		5.90	.751	10.36	117.0	0.00	-113	
1418		5.94	.785	10.44	125.1	0.00	-117	
1420		5.97	.797	10.46	114.0	0.00	-120	
1422		5.99	.813	10.45	112.0	0.00	-123	
1424		6.01	.815	10.42	111.0	0.00	-124	
1426		6.06	.819	10.42	109.0	0.00	-126	

Sample Time: 1430 Sample ID: 782M8935EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: ______________________ Sampled by: ______________________

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782VMW-97 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12-11-03 Weather: Rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

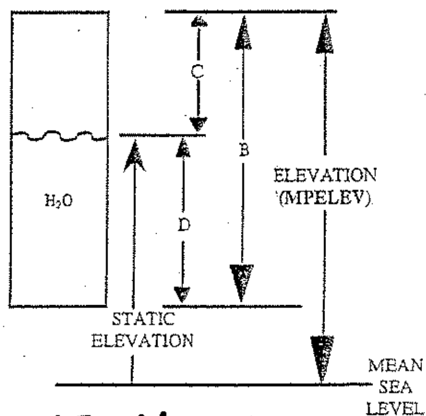
Measured Water Level Depth (C) (STATDEP) 19.15 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 31'

Depth during Purging/Sampling: ______ (provide range) ft

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 12-11-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1441	19.2	7.45	0.297	11.98	-9.2	2.96	166	350
1442	19.2	7.39	0.298	12.13	-10.0	2.25	164	350
1443	19.2	7.42	0.300	12.17	-10.0	1.90	164	350
1444	19.2	7.44	0.309	12.20	78.8	1.95	158	350
1445	19.2	7.46	0.313	12.22	-10.0	0.73	158	350
1446	19.2	7.45	0.316	12.27	-10.0	0.74	157	350
1447	19.2	7.45	0.320	12.29	-10.0	0.70	156	350

Sample Time: 1455 Sample ID: 782M9731EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-07-01 Sampled by: DB JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-98 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/11/03 Weather: Raining, 30's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

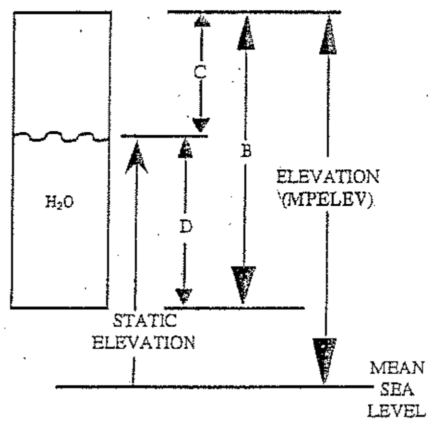
Measured Water Level Depth (C) (STATDEP) 17.50 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 29'

Depth during Purging/Sampling: ________ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 12-11-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): ________

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1, EC ± 3%, Turbidity ± 10%, D.O. ± 10%, ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0938	17.58	6.49	0.291	12.52	18.0	8.80	231	400
0939	17.60	6.63	0.298	12.62	10.9	7.24	228	400
0940	17.60	6.76	0.299	12.71	8.9	5.71	228	400
0941	17.60	6.89	0.293	12.69	6.7	4.82	226	440
0942	17.60	6.98	0.298	12.77	7.0	4.36	222	440
0943	17.60	7.05	0.298	12.78	5.2	4.13	228	440
0944	17.60	7.14	0.297	12.77	5.0	3.92	220	440
0945	17.60	7.23	0.294	12.69	4.0	3.76	221	440
0946	17.60	7.27	0.293	12.77	3.7	3.60	219	440
0947	17.60	~~[illegible]~~	0.295	12.69	3.5	3.49	219	440
		7.28						

Sample Time: 0950 Sample ID: 782M9829EA
EX
EC

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB JD

Location and Site Code (SITEID): chlorinated plume

Well No. (LOCID): WL-782UMW-104 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12-11-03 Weather: RAIN

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

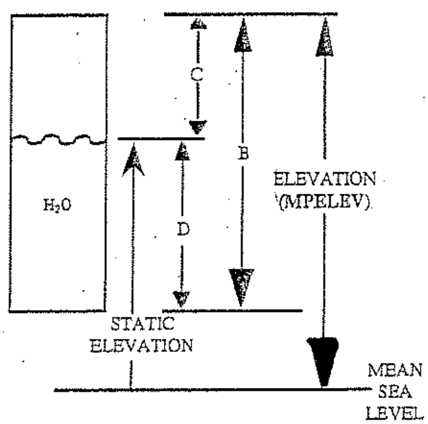
Measured Water Level Depth (C) (STATDEP) 18.12 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 28'

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 12-11-03

Physical Appearance/Comments: clear / odor (slight petro)

Dissolved Ferrous Iron (mg/L): 5.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1047	18.17	7.22	0.376	11.02	2.9	6.89	-39	150
1050	18.20	7.19	0.371	11.73	-2.4	6.06	-60	130
1053	18.20	7.16	0.376	12.03	-2.1	4.32	-72	130
1056	18.20	7.18	0.380	12.19	-4.0	3.03	-82	130
1059	18.20	7.20	0.381	12.24	-4.3	3.07	-88	130
1102	18.20	7.24	0.382	12.23	-4.3	3.07	-93	130
1105	18.20	7.32	0.380	12.34	-4.4	0.98	-100	130
1108	18.20	7.38	0.381	12.41	-4.8	0.47	-104	130
1111	18.20	7.42	0.382	12.51	-5.0	0.24	-108	130
~~1114~~	~~18.20~~							~~130~~

Sample Time: 1114 Sample ID: 782M10428EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB / JO

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782UMW-105B Well Diameter (SDIAM): 2''

Date (LOGDATE): 12-11-03 Weather: rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

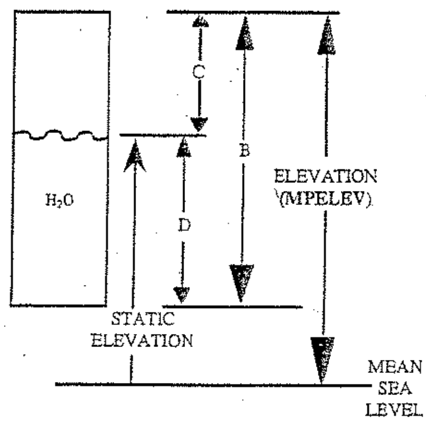
Measured Water Level Depth (C) (STATDEP) 19.48 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33'

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 12-11-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1328	19.6	7.40	0.323	11.88	54.9	3.26	109	200
1330	19.54	7.57	0.320	12.35	67.5	3.76	39	200
1332	19.54	7.65	0.320	12.50	29.1	2.08	22	200
1334	19.54	7.72	0.320	12.57	31.0	2.03	14	200
1336	19.54	7.74	0.319	12.49	32.0	2.00	7	200
1338	19.54	7.76	0.319	12.52	34.1	1.95	5	200

Sample Time: 1345 Sample ID: 782M105B33E[illegible] MS

EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782MW-10 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/12/03 Weather: Sunny/cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

Flush Mount

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

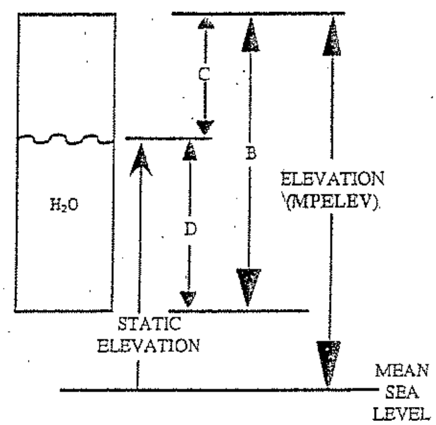
Measured Water Level Depth (C) (STATDEP) 22.15 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 27'

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Orange Color / slight petro odor

Dissolved Ferrous Iron (mg/L): 5.4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1130		6.65	.728	12.24	110	2.53	-81	300
1132		6.81	.730	12.40	77.3	.02	-103	300
1134		6.81	.729	12.46	65.8	0.00	-105	300
1136		6.81	.727	12.35	76.4	0.00	-107	300
1138		6.85	.730	12.36	50.1	0.00	-109	300
1140		6.82	.727	12.16	48.3	0.00	-110	300

Sample Time: 1140 Sample ID: 782M10/27EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): 782 Chl. Plume

Well No. (LOCID): WC-782UMW-81 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/12/03 Weather: 30 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

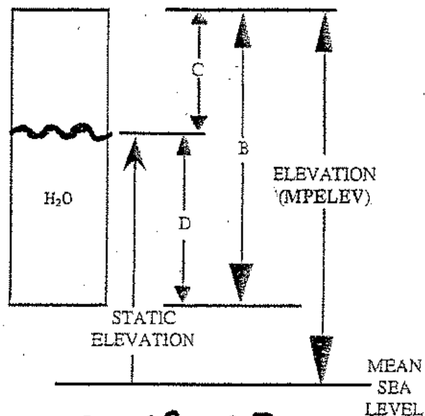
Measured Water Level Depth (C) (STATDEP) 21.53 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 46

Depth during Purging/Sampling: 21.7 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 12-12-03

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 0.8 mg/L

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1335	21.9	7.99	0.418	9.64	44.7	4.37	-90	180
1338	21.7	7.99	0.421	9.89	47.0	1.81	-109	180
1341	21.7	8.00	0.423	10.13	34.0	0.93	-120.	180
1344	21.7	7.99	0.428	10.40	22.8	0.00	-131	180
1347	21.7	8.01	0.428	10.53	22.9	0.00	-138	180
1350	21.7	8.01	0.430	10.62	23.4	0.00	-135	180

Sample Time: 1405 Sample ID: 782M8146EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782UMW-82 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/12/03 Weather: 30 snow/wind

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft.

Measured Water Level Depth (C) (STATDEP) ~~2~~0.94 ft.

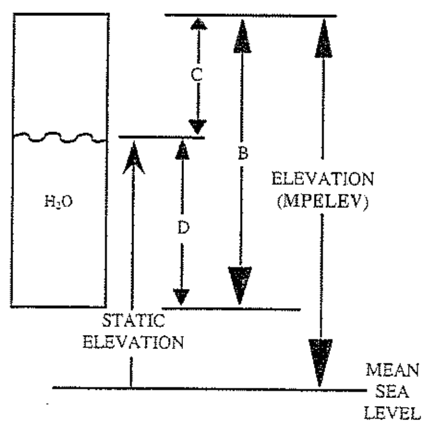
Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft.

Casing Water Volume (E) = ____ (A) x ____ (D) = ____ gal

Intake 46

Total Purge Volume = ____ gal (min. of 3 well volumes)

Depth while purge - 20.



Purge Date and Method: Bladder pump 12-12-03

Physical Appearance/Comments: clear

Iron - 0.6

FIELD MEASUREMENTS:

Time	~~Volume Removed~~ Depth (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate
Allowable Range:		± 0.1	± 5%	±1°C				
15.02	20.1	7.91	0.350	8.86	406.0	3.05	-36	200
1504	20.1	8.01	0.351	9.46	158.0	2.48	-70	200
1506	20.1	8.06	0.353	9.71	215.0	1.81	-93	200
1508	20.1	8.08	0.351	9.90	225.0	1.17	-110	200
1510	20.1	8.11	0.349	9.89	226.0	0.04	-118	200
1512	20.1	8.11	0.348	9.91	220.0	0.00	-124	200
1514	20.1	8.12	0.349	9.94	229.0	0.00	-125	200

Sample Time: 1515 Sample ID: 782M8246EA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782MW-87 Well Diameter (SDIAM): 2" FM

Date (LOGDATE): 12/12/03 Weather: Sunny, Cold

CASING VOLUME INFORMATION: Flush Mount

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

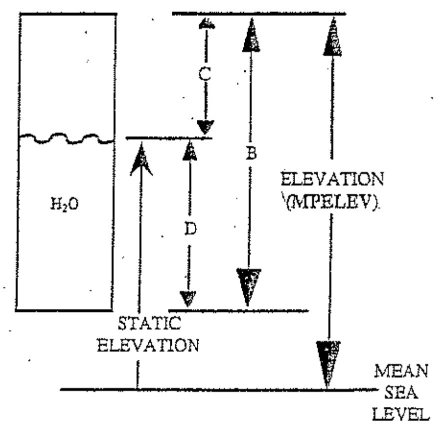
Measured Water Level Depth (C) (STATDEP) 23.86 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35'

Depth during Purging/Sampling: ________ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, Slight off-odor, No sheen

Dissolved Ferrous Iron (mg/L): 4.4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1022	23.86	6.33	0.485	10.42	14.6	6.22	52	225
1024	23.86	6.61	0.689	10.61	9.1	2.87	-47	225
1026	23.86	6.64	0.757	10.56	10.0	0.65	-76	225
1028	23.86	6.66	0.793	10.48	7.9	0.00	-87	225
1030	23.86	6.65	0.803	10.46	8.2	0.00	-93	225
1032	23.86	6.70	0.809	10.21	8.7	0.00	-96	225

Sample Time: 1040 Sample ID: 782MW35EA
87

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP / JD

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782VMW-91 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/12/03 Weather: Sunny / cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

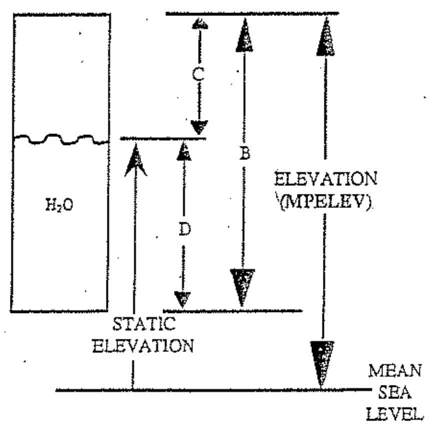
Measured Water Level Depth (C) (STATDEP) 19.53 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear / no odor / no sheen

Dissolved Ferrous Iron (mg/L): 5.6

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1200		6.75	2.19	11.61	79.6	0.00	-108	150
1203		6.78	2.19	11.95	49.5	0.00	-112	150
1206		6.81	2.18	11.93	32.5	0.00	-114	150
1209		6.82	2.19	11.62	34.8	0.00	-114	150
1212		6.89	2.19	11.57	30.5	0.00	-115	150

Sample Time: 1230 Sample ID: 789M9127EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page ___ of ___

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP / JD

Location and Site Code (SITEID): ~~CHR~~ Chlor. Plume

Well No. (LOCID): WL-782MW-95 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/12/03 Weather: Sunny / Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

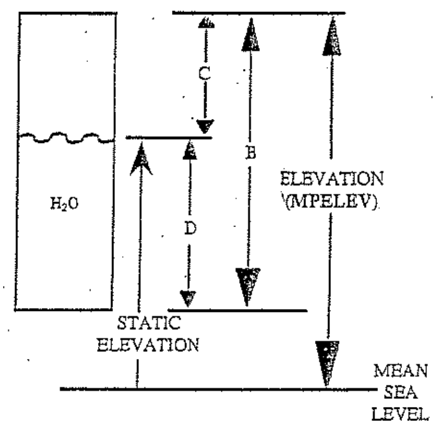
Measured Water Level Depth (C) (STATDEP) 23.15 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 28'

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: orange color

Dissolved Ferrous Iron (mg/L): 3.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1538		6.77	.679	11.81	203	1.69	-105	400
1539		6.83	.684	11.98	122	.49	-112	
1540		6.86	.688	12.10	104	.12	-118	
1541		6.88	.693	12.10	85.2	0.00	-122	
1542		6.92	.698	12.19	57.0	0.00	-127	
1543		6.92	.700	12.05	56.1	0.00	-130	
1544		6.94	.703	12.04	49.3	0.00	-132	

Sample Time: 1550 Sample ID: 782M9528EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC DB

Location and Site Code (SITEID): 782 Chl. Plume

Well No. (LOCID): WL-782UMW-99 Well Diameter (SDIAM): 2

Date (LOGDATE): 12/12/03 Weather: 30 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

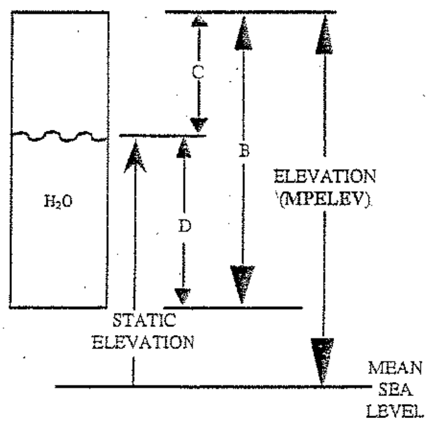
Measured Water Level Depth (C) (STATDEP) 18.79 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: 18.81 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1240	18.81	7.54	.321	10.24	34.1	12.75	177	320
1242		7.64	.326	10.39	35.1	11.09	169	
1244		7.75	.331	10.59	25.2	8.96	164	
1246		7.78	.337	10.64	19.7	8.52	160	
1248		7.83	.337	10.66	19.6	8.25	159	
1250		7.85	.339	10.70	19.0	8.20	157	

Sample Time: 1255 Sample ID: 782M9928EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

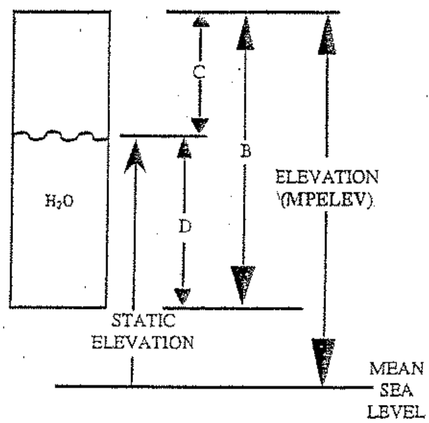
Project: 32-03-01 Sampled by: PC DB
Location and Site Code (SITEID): 78B Chl. Plume
Well No. (LOCID): U-786UMW-30 Well Diameter (SDIAM): 2
Date (LOGDATE): 12/18/03 Weather: 30 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)
Measured Water Level Depth (C) (STATDEP) 15.48 ft.
Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)
Pump Intake Depth (ft): 22
Depth during Purging/Sampling: 15.71 ft (provide range)
Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP
Physical Appearance/Comments: Slighty Brown / no odor
Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1136	15.71	6.96	.217	9.69	119	7.81	205	100
1140		7.20	.217	10.22	64.1	7.22	196	
1144		7.19	.216	10.27	63.2	7.17	192	
1148		7.32	.216	10.44	47.1	7.01	170	
1152		7.41	.215	10.56	40.1	6.93	152	
1156		7.38	.216	10.57	32.2	6.80	150	
1200		7.45	.215	10.53	36.0	6.80	150	

Sample Time: 1205 Sample ID: 78B M3022 EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JD JP

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-78 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/15/03 Weather: Snowing, overcast

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

Measured Water Level Depth (C) (STATDEP) 23.96 ft.

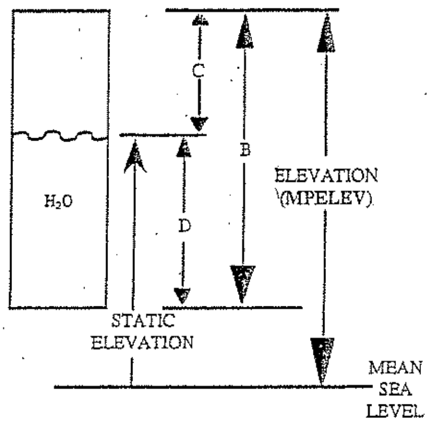
Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

40'

Pump Intake Depth (ft): ______

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Slight orange tint

Dissolved Ferrous Iron (mg/L): 3.0

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1; EC ± 3%; Turbidity ± 10%; D.O. ± 10%; ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1150	23.96	6.40	.765	10.15	90.0	1.57	105	420
1151	24.00	6.56	.766	10.32	74.2	.63	73	
1152		6.64	.765	10.38	72.1	.34	21	
1153		6.72	.767	10.50	61.1	0.00	-25	
1154		6.82	.765	10.55	54.2	0.00	-46	
1155		6.84	.766	10.60	51.8	0.00	-59	
1156		6.88	.765	10.61	51.3	0.00	-69	
1157		6.91	.764	10.54	52.3	0.00	.75	
1158		6.92	.763	10.56	49.8	0.00	-82	
1159		6.93	.763	10.56	55.0	0.00	-86	
1200		6.96	.762	10.54	48.3	0.00	-90	

Sample Time: 1205 Sample ID: 782M7840EA

EC

EX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JA / JD

Location and Site Code (SITEID): Chlor. Plane

Well No. (LOCID): WL-782VMW-83 Well Diameter (SDIAM): 2" FM

Date (LOGDATE): 12/15/03 Weather: ~~Sunny~~ Cloudy / Cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

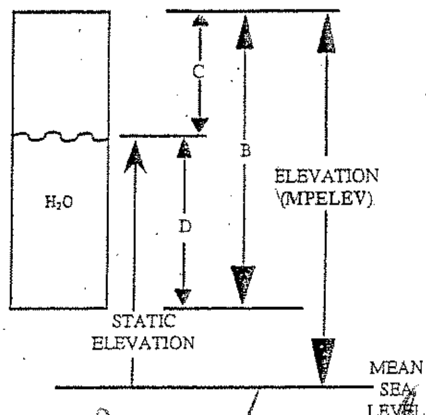
Measured Water Level Depth (C) (STATDEP) 18.58 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: ~~BLADDER PUMP~~ Peristaltic Pump / Bailer VOCs

Physical Appearance/Comments: ________

Dissolved Ferrous Iron (mg/L): ________

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1515	18.70	5.70	0.646	11.91	99.9	0.91	310	450
1516	18.70	5.79	0.697	12.15	70.8	0.54	309	450
1517	18.70	5.86	0.687	12.28	53.5	0.00	306	450
1518	18.70	5.91	0.727	12.39	50.6	0.00	303	450
1519	18.70	5.98	0.747	12.48	29.9	0.00	299	450
1520	18.70	6.00	0.755	12.43	28.4	0.00	297	450
1521	18.70	6.06	0.787	12.57	28.8	0.00	293	450
1522	18.70	6.09	0.790	12.56	25.1	0.00	291	4.50
1523	18.70	6.10	0.796	12.62	26.0	0.00	288	450

Sample Time: 1525 Sample ID: 782M8333EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JP JD

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): W-782VMW-90 Well Diameter (SDIAM): 2"

Date (LOGDATE): 12/15/03 Weather: Overcast, cold

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

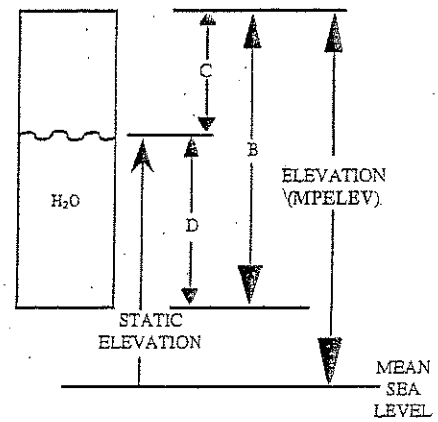
Measured Water Level Depth (C) (STATDEP) 24.79 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 29

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear / Slight Solvent Odor / NO SHEEN

Dissolved Ferrous Iron (mg/L): 4.7

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1606	24.80	6.51	.515	9.48	20.4	0.00	-79	300
1608	↓	6.64	.511	9.84	13.5	0.00	-93	300
1610		6.73	.524	9.85	12.6	0.00	-98	300
1612		6.77	.551	9.94	15.3	0.00	-105	300
1614		6.78	.597	9.92	17.5	0.00	-110	300
1616		6.80	.628	9.79	20.0	0.00	-114	300
1618		6.81	.642	9.87	20.7	0.00	-116	300
1620		6.83	.660	9.86	22.6	0.00	-119	300
1622		6.83	.668	9.83	22.8	0.00	-119	300
1624		6.84	.673	9.79	23.0	0.00	-120	300

Sample Time: 1630 Sample ID: 782M9029EA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC - JP

Location and Site Code (SITEID): ND / APL Chlorinated

Well No. (LOCID): WL-782UMW-91 Well Diameter (SDIAM): 2

Date (LOGDATE): 4/5/04 Weather: 18° windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

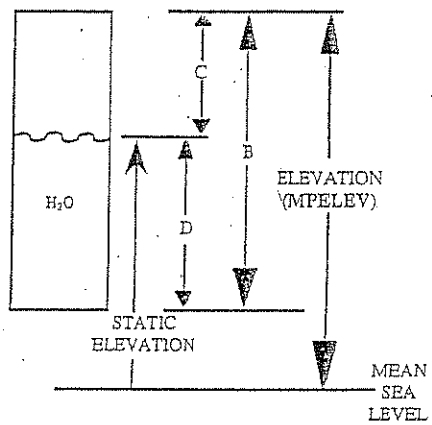
Measured Water Level Depth (C) (STATDEP) 19.91 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 20.05 - 20.87 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Cloudy, no odor, no sheen

Dissolved Ferrous Iron (mg/L): 3.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1436	20.07	6.45	0.20	8.42	98	2.6	-76	250
1438		6.56	0.20	8.59	55	2.2	-88	
1440		6.60	0.20	8.59	38	1.7	-95	
1442		6.62	0.20	8.46	25	1.2	-99	
1444		6.63	0.20	8.42	17	1.0	-102	
1446		6.63	0.20	8.40	14	0.9	-103	
1448		6.64	0.20	8.36	9	0.8	-106	

Sample Time: 1500 Sample ID: 782M9127FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JP

Location and Site Code (SITEID): ND/AP2 Chlorinated

Well No. (LOCID): WL-782MW-6R2 Well Diameter (SDIAM): 2

Date (LOGDATE): 4/5/04 Weather: 20 windy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

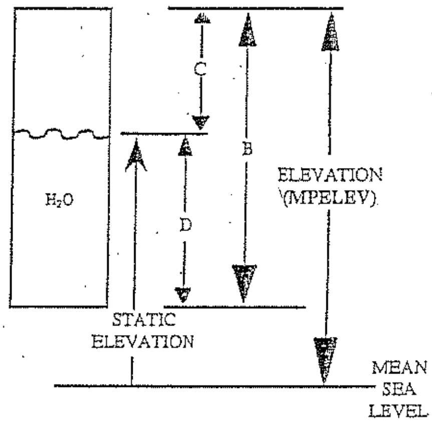
Measured Water Level Depth (C) (STATDEP) 24.22 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 30

Depth during Purging/Sampling: 24.22 - 24.23 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, no sheen, no odor

Dissolved Ferrous Iron (mg/L): 5.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1511	24.22	6.99	89	9.44	33	5.2	-80	400
1512		6.98	91	10.29	48	2.9	-87	
1513		6.99	91	10.21	59	2.7	-87	
1514		6.98	90	10.35	56	2.6	-86	
1515		6.98	90	10.38	56	2.6	-85	

Sample Time: 1520 Sample ID: 782M6R230FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-63-01 Sampled by: PC JD

Location and Site Code (SITEID): ND/AP2 Chlorinated

Well No. (LOCID): WL-782UMW-83 Well Diameter (SDIAM): 2

Date (LOGDATE): 4/2/04 Weather: 50 rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) 36.77 ft. (optional)

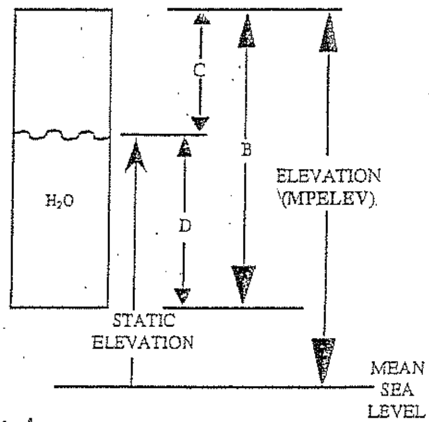
Measured Water Level Depth (C) (STATDEP) 18.50 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 18.58 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: ~~BLADDER PUMP~~ Peristaltic + Bailer

Physical Appearance/Comments: no odor, some particulate, cloudy

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1025	18.58	7.80	56	10.3	43	9.3	253	300
1027	|	7.29	56	11.2	21	3.6	260	|
1030	|	7.30	56	11.3	11	3.2	256	|
1033	|	7.37	56	11.3	12	4.3	251	|
1036	|	7.35	57	11.4	10	4.0	251	|
1039		7.40	56	11.4	10	4.0	250	

Sample Time: 1040 Sample ID: 782M8333FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB / JP

Location and Site Code (SITEID): chlor. Plume

Well No. (LOCID): WL-782VMW-84 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-2-04 Weather: clouds

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

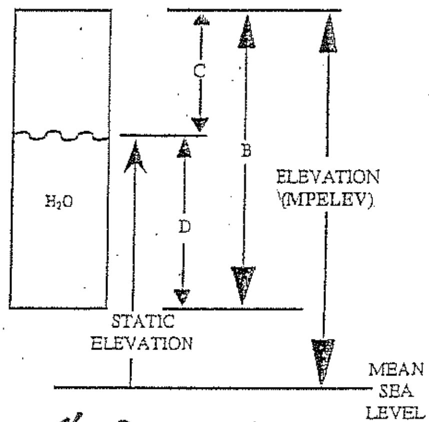
Measured Water Level Depth (C) (STATDEP) 23.51 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 4-2-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 0.0 mg/L

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1256	23.55	7.42	69	10.55	160	10.0	-9	150
1259	23.55	6.73	74	11.51	41	8.1	-56	~~150~~ 200
1301	23.55	6.64	75	11.80	25	5.9	-63	200
1303	23.55	6.70	75	11.96	26	3.7	-72	200
1305	23.55	7.75	76	12.12	14	2.4	-78	200
1307	23.55	6.77	76	12.14	13	1.3	-81	200
1309	23.55	6.77	76	12.16	13	1.2	-83	200
1311	23.55	6.77	76	12.17	12	1.2	-84	200

Sample Time: 1315 Sample ID: 782M8440FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB /JP

Location and Site Code (SITEID): chlor. Plume

Well No. (LOCID): WL-782UMW-85 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-2-04 Weather: clouds

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) DB ft. (optional)

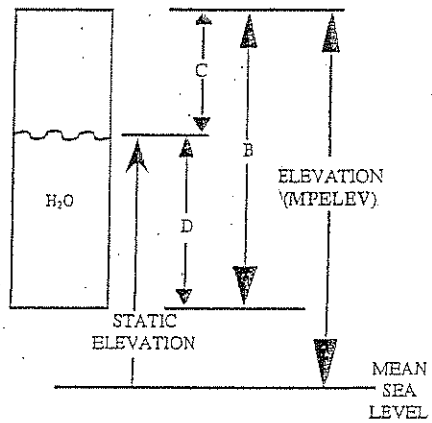
Measured Water Level Depth (C) (STATDEP) 24.~~38~~40 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 36

Depth during Purging/Sampling: ____ (provide range) ft

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 4-2-04

Physical Appearance/Comments: silty brown to clear / no odor

Dissolved Ferrous Iron (mg/L): 3.6 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
11:33	24.50	6.78	0.11	10.53	27	0.9	-100	300
1135	24.50	6.77	0.11	10.52	38	0.5	-101	300
1137	24.50	6.76	0.11	10.63	~~40~~37	0.5	-101	300
1139	24.50	6.76	0.11	10.65	35	0.5	-103	300
1141	24.50	6.78	0.11	10.70	34	0.5	-104	300

Sample Time: 1155 Sample ID: 782M8536FA, FC, FX

purge 5 gallons - (liq) soap observed

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB / JP

Location and Site Code (SITEID): chlor. Plume

Well No. (LOCID): WL-782WMW-86 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-2-04 Weather: cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

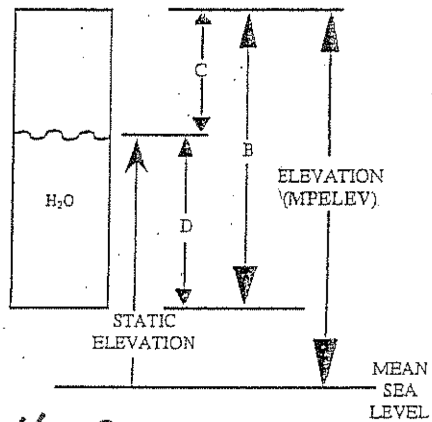
Measured Water Level Depth (C) (STATDEP) 23.28 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 4-2-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 3.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0911	23.36	6.13	0.11	9.11	120	4.6	11	200
0913	23.36	6.31	0.11	9.31	120	3.0	-22	200
0915	23.36	6.56	0.11	9.43	120	2.2	-50	200
0917	23.36	6.74	0.11	9.56	96	1.6	-68	200
0919	23.36	6.77	0.11	9.58	79	1.4	-74	200
0921	23.36	6.79	0.11	9.61	83	1.3	-79	200
0923	23.36	6.81	0.11	9.64	80	1.3	-83	200

Sample Time: 0935 Sample ID: 782MW8633FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB/JP

Location and Site Code (SITEID): chlor. Plume

Well No. (LOCID): WL-782vmw-87 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-2-04 Weather: clouds

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) 24.05 ft. (optional)

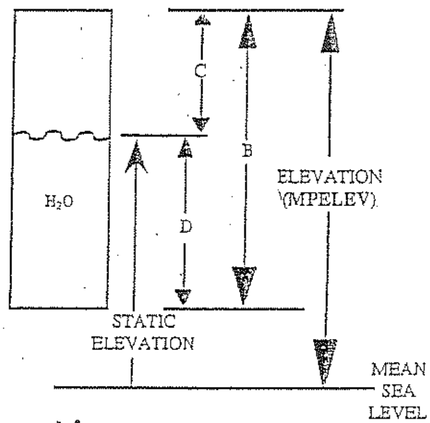
Measured Water Level Depth (C) (STATDEP)______ ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling:______ ft (provide range)

Comments (re: Depth during purging/sampling):______



Purge Date and Method: BLADDER PUMP 4-2-04

Physical Appearance/Comments: silty orange - no odor turns clear

Dissolved Ferrous Iron (mg/L): 5.4 mg/L

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1, EC ± 3%, Turbidity ± 10%, D.O. ± 10%, ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1227	24.06	6.76	77	11.18	4	1.5	-95	225
1229	24.06	6.73	77	10.92	5	0.7	-98	250
1231	24.06	6.70	77	10.88	3	0.6	-98	250
1233	24.06	6.71	77	10.88	~~4~~ 3	0.6	-99	250
1235	24.06	6.72	77	10.89	3	0.6	-100	250

Sample Time: 1237 Sample ID: 782M8735FA

purge well volume to remove any liquinox residue

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB/JR

Location and Site Code (SITEID): chlor. Plume

Well No. (LOCID): WL-782UMW-89 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-2-04 Weather: cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ ft. (optional)

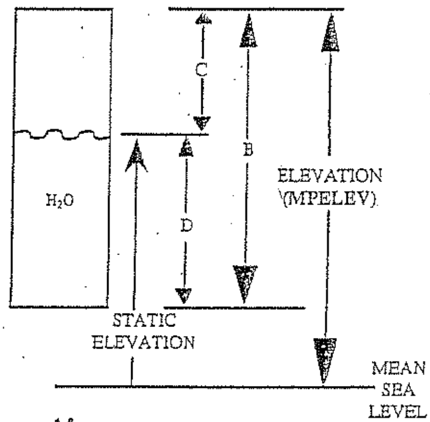
Measured Water Level Depth (C) (STATDEP) 24.90 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ____ ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 4-2-04

Physical Appearance/Comments: silty brown to clear / no odor

Dissolved Ferrous Iron (mg/L): 4.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1048	24.98	6.77	83	9.78	9	2.7	-91	400
1049	24.98	6.76	84	9.98	8	1.8	-93	400
1050	24.98	6.77	84	10.15	8	1.7	-97	400
~~1051~~								~~400~~ DB
1051		6.81	85	10.26	8	0.6	-100	400

Sample Time: 1055 Sample ID: 782M8935FA

After purging 5 gallons (residue from liquinox was observed)

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: JD PC

Location and Site Code (SITEID): Building 782

Well No. (LOCID): WL-782VMW-90 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4/2/04 Weather: Overcast, 40's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

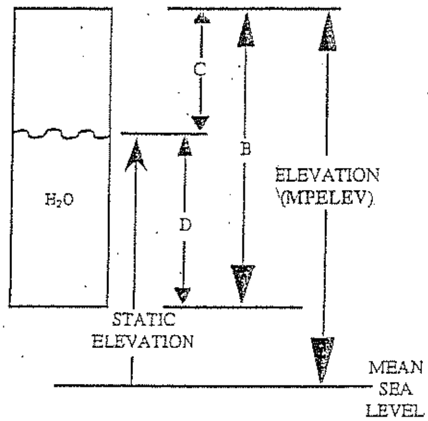
Measured Water Level Depth (C) (STATDEP) 25.31 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 29'

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Top of Product: 25.06

Top of Water: 25.31

Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Strong Petro odor, No Sheen, Clear

Dissolved Ferrous Iron (mg/L): 4.8

FIELD MEASUREMENTS:

Time	Depth to ~~Water~~ Product (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1451	25.12	6.61	44	10.1	0	0.8	-69	325
1453	25.12	6.68	43	10.5	0	0.5	-88	325
1455	25.12	6.74	45	10.7	0	0.5	-99	325
1457	25.12	6.78	47	10.8	0	0.4	-105	325
1459	25.12	6.81	50	10.8	0	0.4	-109	325
1501	25.12	6.82	52	10.8	0	0.4	-111	325
1503	25.12	6.82	53	10.8	0	0.4	-113	325
1505	25.12	6.83	54	10.8	0	0.3	-115	325
1507	25.12	6.83	55	10.8	0	0.3	-117	325
1509	25.12	6.84	55	10.7	0	0.3	-117	325

Sample Time: 1512 Sample ID: 782M9029FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-61   Sampled by: RC JD

Location and Site Code (SITEID): ND / AP2 Chlorinated

Well No. (LOCID): WL-782VMW-99   Well Diameter (SDIAM): 2

Date (LOGDATE): 4/2/04   Weather: 50 rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

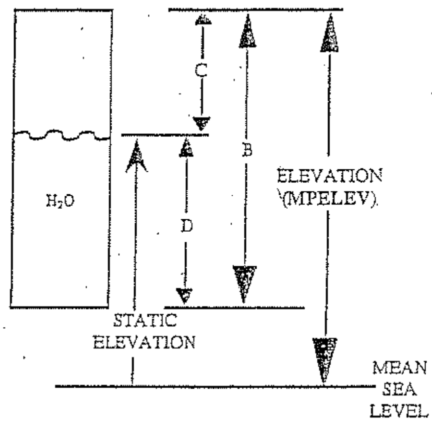
Measured Water Level Depth (C) (STATDEP) 18.61 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: 18.75 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear, no odor, no sheen

Dissolved Ferrous Iron (mg/L): 0.0

Water seemed foamy when collecting samples

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0858	18.75	6.56	46	9.6	9	7.8	226	350
0900		6.76	46	9.7	3	7.3	232	
0902		6.82	46	9.7	0	7.2	234	
0904		6.94	46	9.8	0	7.1	235	
0906		7.04	46	9.8	0	6.9	236	
0908		7.13	46	9.9	0	6.8	237	
0910		7.19	46	9.8	0	6.7	237	
0912		7.25	46	9.9	0	6.6	236	
0914		7.28	46	9.9	0	6.5	235	

Sample Time: 0918   Sample ID: 782M9928FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Resampled

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JD

Location and Site Code (SITEID): ND / AP2 Chlorinated

Well No. (LOCID): WL-782VMW-99 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4/2/04 Weather: 50, overcast

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

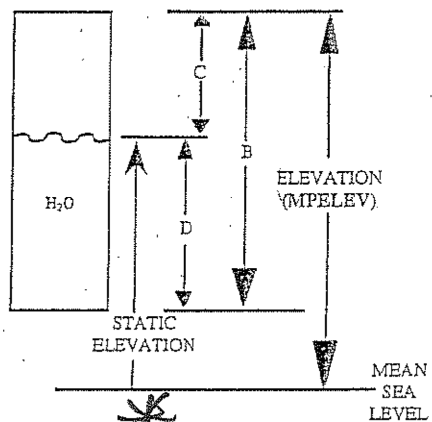
Measured Water Level Depth (C) (STATDEP) 18.61 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP *Resample* one well volume purged

Physical Appearance/Comments: Clear, No odor, No sheen

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1150	18.75	7.35	51	10.2	0	5.9	243	350
1152	|	7.34	51	10.2	0	5.9	243	|
1154	|	7.34	51	10.2	0	5.9	242	|

Sample Time: 1156 Sample ID: 782M9928FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JD

Location and Site Code (SITEID): Drilling 786

Well No. (LOCID): WL-786 MW-30 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4/2/04 Weather: Overcast, 40's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ft. (optional)

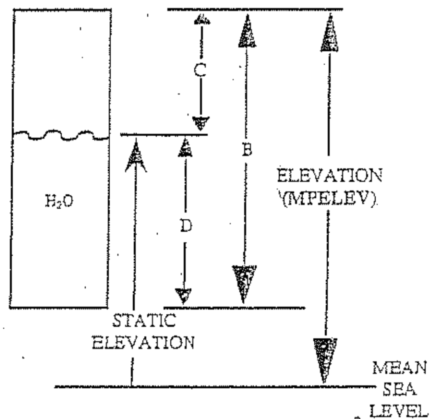
Measured Water Level Depth (C) (STATDEP) 15.78 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 22'

Depth during Purging/Sampling: 16.15 ft (provide range)

Comments (re: Depth during purging/sampling):____



Purge Date and Method: BLADDER PUMP Purged 1 well volume

Physical Appearance/Comments: Silty-Brown, no odor, no sheen

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1406	16.15	7.07	31	8.4	30	2.9	99	225
1408	|	7.06	31	8.5	21	3.0	89	|
1410	|	7.06	31	8.5	21	3.4	86	|
1412	|	7.07	31	8.5	22	3.4	85	|
1414	|	7.07	31	8.5	22	3.4	83	|

Sample Time: 1418 Sample ID: 786M3022FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP / DB

Location and Site Code (SITEID): AP2 (Chlor. Plume)

Well No. (LOCID): WL-782VMW-76 Well Diameter (SDIAM): ~~78~~ 2" (Flush)

Date (LOGDATE): 4.1.04 Weather: Breezy / 45-50°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

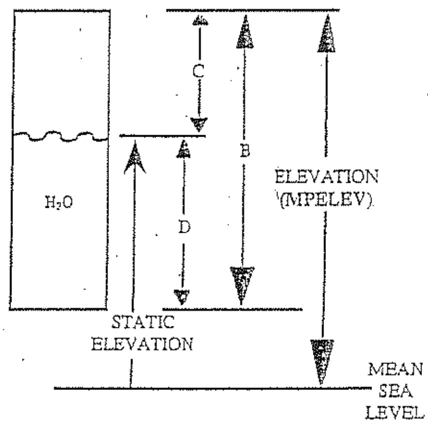
Measured Water Level Depth (C) (STATDEP) 20.59 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 38

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: cloudy / no odor

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1135	19.95	7.06	62	10.32	16	6.4	175	100
1139	↓	6.94	52	10.96	12	2.8	69	100
1143		6.98	53	11.04	14	1.7	-4	100
1147		7.03	54	11.09	16	1.4	-33	100
1151		7.07	54	11.14	23	1.1	-46	100
1154		7.06	54	11.23	24	1.0	-47	100
1157		7.07	55	11.25	20	1.0	-50	100
1200		7.07	55	11.23	21	1.0	-51	100

Sample Time: 1201 Sample ID: 782M7638FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-07 Sampled by: EB / JP

Location and Site Code (SITEID): chlorinated plume

Well No. (LOCID): WL-782UMW-77 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-1-04 Weather: rain / cool

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ ft. (optional)

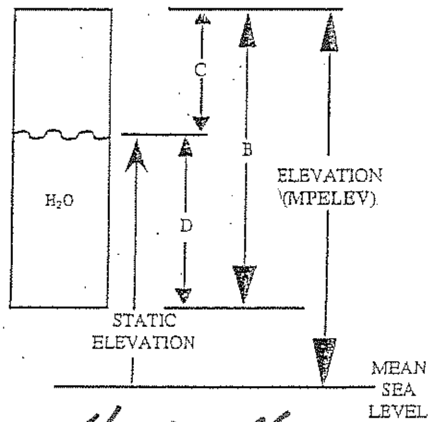
Measured Water Level Depth (C) (STATDEP) 18.15 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 30

Depth during Purging/Sampling: ____ ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 4-1-04

Physical Appearance/Comments: orange clear / no odor / wr level stabilized at 19.01

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1357	19.10	6.63	83	9.68	2100	4.2	207	50
1403	19.01	6.55	89	9.77	300	3.2	207	75
1409	19.01	6.63	91	9.76	400	1.8	198	75
1415	19.01	6.72	91	9.64	420	1.2	191	75
1421	19.01	6.74	91	9.58	420	1.0	188	75
1427	19.01	6.75	91	9.49	390	1.0	182	75

Sample Time: 1435 Sample ID: 782M7730FA

poor recharge

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32·03·01 Sampled by: JP / DB

Location and Site Code (SITEID): AP (Chlor. Plume)

Well No. (LOCID): WL-782VMW-78 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4·1·04 Weather: Breezy / 45-50°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

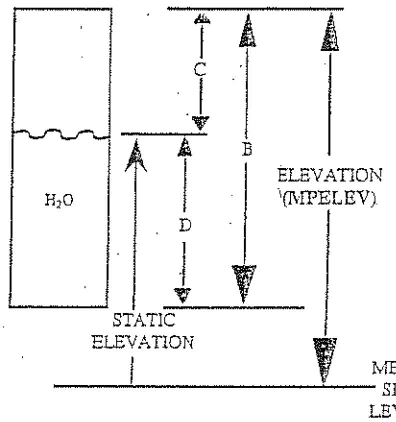
Measured Water Level Depth (C) (STATDEP) 24.35 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear (slight orange tint) / no odor

Dissolved Ferrous Iron (mg/L): 1.8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1005	24.35	7.09	73	11.30	250	4.0	26	400
1006	↓	7.04	74	11.54	260	2.7	-15	400
1007		7.04	74	11.75	210	2.1	-35	400
1008		7.06	75	11.80	160	1.6	-51	400
1009		7.10	75	11.90	130	1.2	-60	400
1010		7.13	75	11.94	110	1.2	-69	400
1011		7.14	75	11.93	120	1.2	-71	400
1012		7.15	75	11.95	110	1.2	-72	400

Sample Time: 1020 Sample ID: 782M7840FA
FE
FX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP / DB

Location and Site Code (SITEID): AP2 (Chlor. Plume)

Well No. (LOCID): WL-782VMW-80 Well Diameter (SDIAM): 2" (Flush)

Date (LOGDATE): 4.1.04 Weather: overcast / 45°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

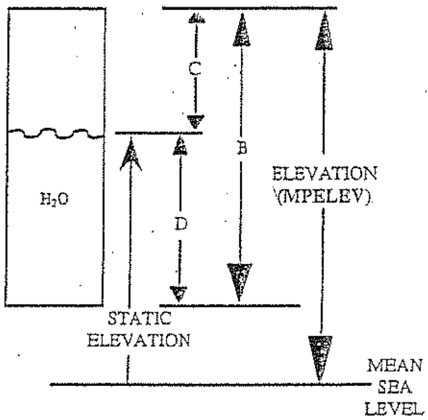
Measured Water Level Depth (C) (STATDEP) 19.18 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 3.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0911	19.18	6.33	65	9.78	11	8.0	64	120
0915		6.87	68	10.40	40	5.0	-22	120
0919		6.95	71	10.55	90	3.8	-42	120
0923		6.99	73	10.61	96	2.3	-59	150
0926		7.06	74	10.61	77	2.0	-63	150
0929		7.01	74	10.65	78	1.6	-69	150
0932		7.03	74	10.64	73	1.3	-73	150

Sample Time: 0940 Sample ID: 782M8033FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC / JD

Location and Site Code (SITEID): NO/AP Chlorinated

Well No. (LOCID): WL-782UMW-88 Well Diameter (SDIAM): 2

Date (LOGDATE): 4/1/04 Weather: 50 rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

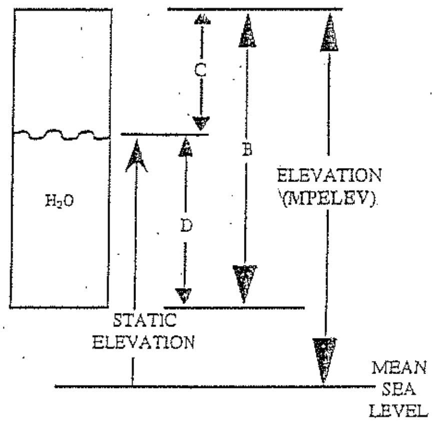
Measured Water Level Depth (C) (STATDEP) 27.09 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 37

Depth during Purging/Sampling: 27.17 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Slightly cloudy, no odor, no sheen

Dissolved Ferrous Iron (mg/L): 4.1

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1546	22.17	6.79	71	11.0	99	0.7	-74	200
1548	|	6.79	69	11.2	210	0.5	-77	250
1550	|	6.81	69	11.2	210	0.4	-78	|
1552	|	6.81	68	11.2	210	0.4	-79	|
1554	|	6.81	69	11.2	180	0.4	-79	|

Sample Time: 1600 Sample ID: 782M8837FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-69-01 Sampled by: PC JD

Location and Site Code (SITEID): ND/AP2 Chlorinated

Well No. (LOCID): WL-782VMW-92 Well Diameter (SDIAM): 2

Date (LOGDATE): 4/1/04 Weather: 50 rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

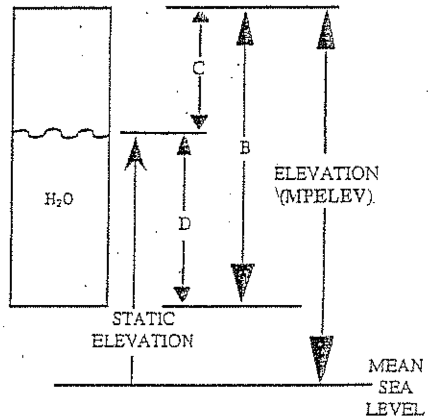
Measured Water Level Depth (C) (STATDEP) 22.28 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: somewhat cloudy, no odor, no sheen

Dissolved Ferrous Iron (mg/L): 7.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1137	22.3[illegible]9	6.87	72	12.0	63	1.7	-79	300
1139	22.39	6.89	73	12.0	65	1.2	-85	300
1141	|	6.90	73	12.0	60	1.0	-90	|
1143	|	6.90	73	12.1	58	0.9	-92	|
1145	|	6.9	73	12.1	41	0.8	-93	

Sample Time: 1148 Sample ID: ~~[illegible]~~- 782m923SFA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB / JP

Location and Site Code (SITEID): chlorinated plume

Well No. (LOCID): WL-782VMW-93 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-1-04 Weather: rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

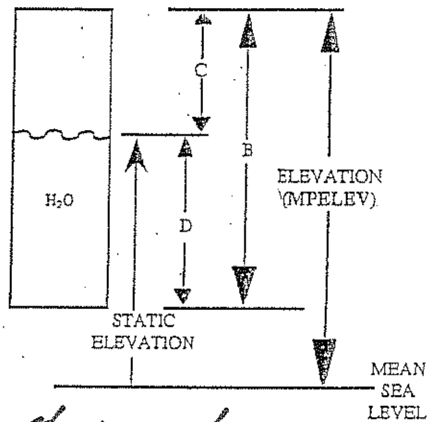
Measured Water Level Depth (C) (STATDEP) 21.51 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 4-1-04

Physical Appearance/Comments: clear / silty - no odor

Dissolved Ferrous Iron (mg/L): 0.0 mg/L

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1458	21.59	8.08	55	9.24	39	8.5	169	150
1501	21.59	7.58	47	9.96	23	7.0	175	150
1504	21.59	7.52	43	10.42	23	6.7	176	150
1507	21.59	7.60	37	10.74	23	6.5	169	150
1510	21.59	7.74	32	10.98	28	6.4	161	150
1513	21.59	7.89	28	11.01	28	6.4	154	160
1516	21.59	8.04	25	11.06	28	6.4	150	150
1519	21.59	7.96	26	11.05	29	6.4	140	150
1522	21.59	7.42	33	11.09	20	5.7	-24	150
1525	21.59	7.35	34	11.09	18	5.3	-31	150
1528	21.59	7.33	33	11.09	20	5.2	-32	150

Sample Time: 1525 Sample ID: 782M9335FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JN

Location and Site Code (SITEID): ND/AP2 Chlorinated

Well No. (LOCID): wc-78hUmw-94 Well Diameter (SDIAM): 2

Date (LOGDATE): 4/1/04 Weather: 50 overcast

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

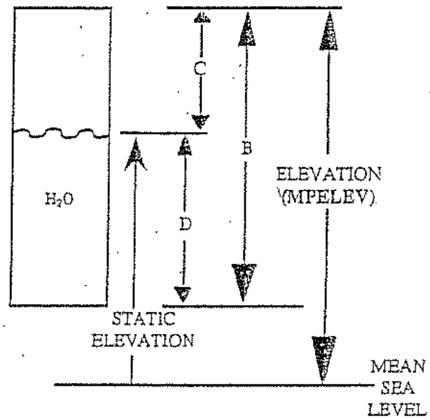
Measured Water Level Depth (C) (STATDEP) 22.32 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: 22.44-22.46 ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Slightly Cloudy, no odor, no sheen

Dissolved Ferrous Iron (mg/L): 1.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1037	22.44	7.38	97	10.0	1	4.2	-27	160
1040		7.24	98	10.4	1	2.9	-55	
1043		7.22	98	10.5	2	1.9	-70	
1046		7.28	98	10.6	0	1.4	-77	
1049		7.30	98	10.5	0	1.2	-81	
1052		7.32	98	10.5	0	1.0	-85	
1055		7.32	98	10.5	0	.8	-87	

Sample Time: 1058 Sample ID: 782M9440FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB/JP

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782VMW-96 Well Diameter (SDIAM): 2"

Date (LOGDATE): 4-1-04 Weather: cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) __________ft. (optional)

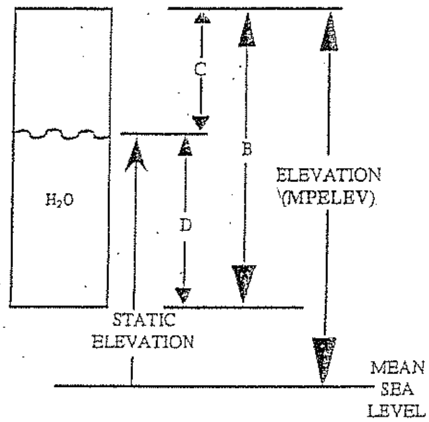
Measured Water Level Depth (C) (STATDEP) 21.79 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 37

Depth during Purging/Sampling: __________ft (provide range)

Comments (re: Depth during purging/sampling): __________



Purge Date and Method: BLADDER PUMP 4-1-04

Physical Appearance/Comments: clear with no odor

Dissolved Ferrous Iron (mg/L): 1.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1600	21.85	7.02	61	10.49	12	7.0	8	200
1602	↓	6.95	65	11.03	7	4.1	-35	↓
1604		6.93	66	11.49	6	2.5	-51	
1606		6.94	66	11.76	4	1.8	-58	
1608		6.95	66	11.74	4	1.6	-60	
1610		6.95	65	11.75	4	1.5	-61	

Sample Time: 16[illegible]9 Sample ID: 782M9637 FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-07 Sampled by: PC / JD

Location and Site Code (SITEID): WD / AP2 Chlorinator

Well No. (LOCID): WL-782MW-6D Well Diameter (SDIAM): 2

Date (LOGDATE): 4/1/04 Weather: 50 Rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

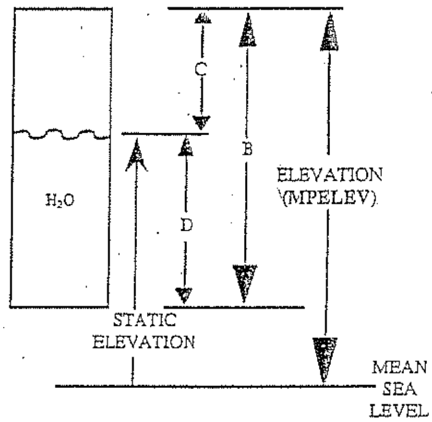
Measured Water Level Depth (C) (STATDEP) 24.39 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 43

Depth during Purging/Sampling: 24.39 - 24.45 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, slight sulfer odor, no sheen

Dissolved Ferrous Iron (mg/L): 3.4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1400	24.39	6.86	86	12.0	0	0.6	-79	500
1401	24.45	6.83	86	12.0	4	0.5	-83	|
1402	|	6.82	86	12.1	9	0.5	-85	|
1403	|	6.82	85	12.1	9	0.5	-86	|
1404	|	6.82	85	12.1	9	0.5	-86	

Sample Time: 1408 Sample ID: 782MGD43FA FD FX
FS FC

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JD

Location and Site Code (SITEID): ND/AP2 Chlorinated

Well No. (LOCID): WL-782MW-10 Well Diameter (SDIAM): 2

Date (LOGDATE): 4/1/04 Weather: Overcast, 50, Breezy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

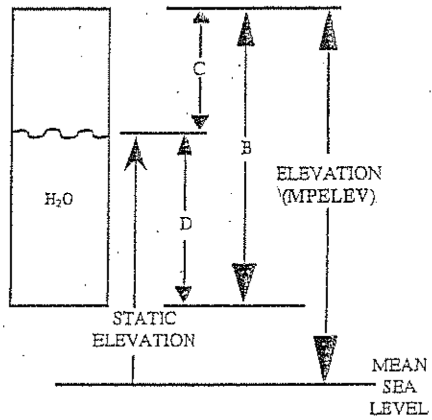
Measured Water Level Depth (C) (STATDEP) 22.30 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 22.30 - 22.40 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Cloudy, no odor, slight orange tint

Dissolved Ferrous Iron (mg/L): 5.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0944	22.40	6.42	66	11.6	34	0.4	-47	400
0945	|	6.44	66	11.7	28	0.4	-54	|
0946	|	6.45	67	11.8	22	0.4	-58	|
0947	|	6.48	67	11.9	20	0.3	-63	|

Sample Time: 0950 Sample ID: 782M1027FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: PC JD

Location and Site Code (**SITEID**): ND / AP2 Chlorinated

Well No. (**LOCID**): SW-782SW-115 Well Diameter (**SDIAM**): Surface

Date (**LOGDATE**): 4/1/04 Weather: 50 overcast

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

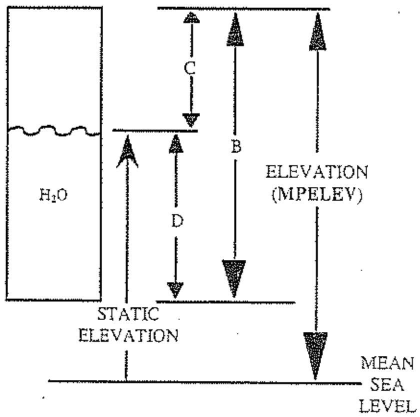
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) Surface ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface water

Physical Appearance/Comments: Clear, no odor

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 (pH), ± 5% (EC), ±1°C (Temp.)

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
0858		6.16	31	7.3	3	11.7	208

Sample Time: 0900 Sample ID: 782S11501FA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP / DB

Location and Site Code (SITEID): AP 2 (Chlor. Plume)

Well No. (LOCID): WL-782VMW-81 Well Diameter (SDIAM): 2"

Date (LOGDATE): 3.31.04 Weather: cool / 45° / overcast

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

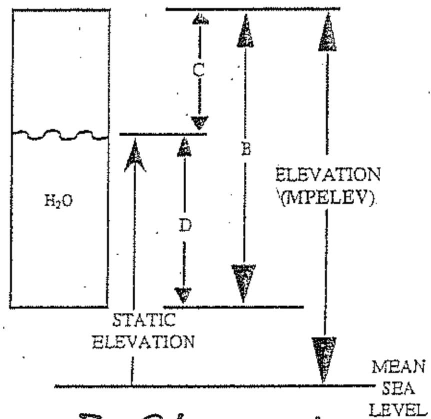
Measured Water Level Depth (C) (STATDEP) 21.45 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 3-31-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 4.1

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1600	21.71	7.28	69	9.76	0	3.2	48	100
1604	21.71	7.28	68	10.48	0	2.2	-20	100
1608	21.71	7.39	67	10.79	0	1.5	-63	100
1612	21.72	7.47	65	10.85	1	1.1	-86	100
1616	21.71	7.51	65	10.89	3	0.8	-102	100
1620	21.71	7.51	65	10.97	3	0.8	-108	100
1624	21.71	7.51	65	10.98	3	0.8	-111	100

Sample Time: 1650 Sample ID: 782M8146FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP / DB

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782UMW-82 Well Diameter (SDIAM): 2"

Date (LOGDATE): 3-31-04 Weather: wind / cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ft. (optional)

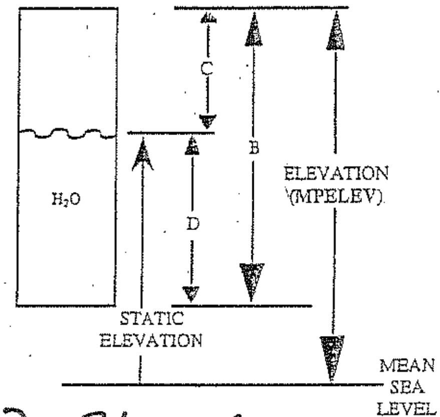
Measured Water Level Depth (C) (STATDEP) 20.00 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 3-31-04

Physical Appearance/Comments: clear / no odor / poor checkvalve in BP

Dissolved Ferrous Iron (mg/L): 0.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1505	20.10	7.53	56	9.46	44	8.0	207	150
1508	↓	7.21	55	10.03	34	5.4	97	150
1510		7.21	56	10.31	54	4.1	-2	225
1512		7.23	57	10.47	74	3.3	-61	225
1514		7.26	57	10.48	65	2.3	-63	225
1516		7.27	57	10.51	54	2.0	-70	225
1518		7.28	57	10.52	50	1.8	-76	225
1520		7.30	57	10.52	41	1.6	-83	225
1522		7.32	57	10.53	30	1.4	-89	225
1524		7.34	57	10.48	err	1.2	-98	225

Sample Time: 1525 Sample ID: 782MR246FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: DB/JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782VMW-97 Well Diameter (SDIAM): 2"

Date (LOGDATE): 3-31-04 Weather: rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

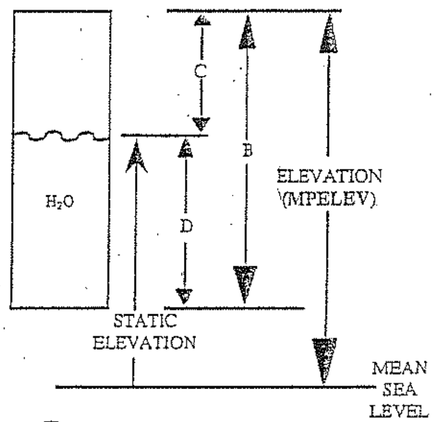
Measured Water Level Depth (C) (STATDEP) 19.18 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 31

Depth during Purging/Sampling: ________ (provide range) ft

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 3-31-04

Physical Appearance/Comments: Clear/no odor

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1154	19.18	6.96	53	10.16	3	4.6	153	360
1156	|	6.81	52	10.59	2	2.5	153	360
1158	↓	6.84	52	10.83	2	1.7	147	360
1200		6.90	53	10.92	6	1.2	142	360
1202		6.94	54	10.98	6	.9	139	360
1204		6.94	54	11.01	7	.7	137	360

Sample Time: 1210 Sample ID: 782M9731FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP / DB

Location and Site Code (SITEID): AP2 (Chloe Plume)

Well No. (LOCID): WL-782MW-98 Well Diameter (SDIAM): 2"

Date (LOGDATE): 3.31.04 Weather: OVERCAST / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

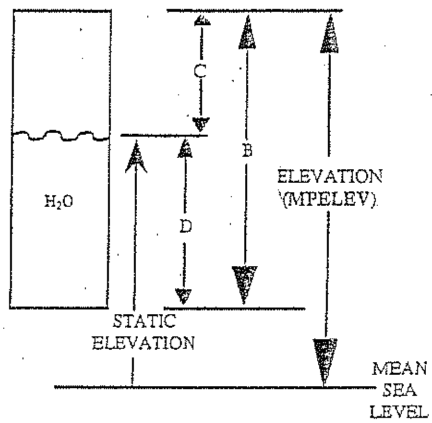
Measured Water Level Depth (C) (STATDEP) 17.50 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 29

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0933	17.50	6.77	47	9.63	0	11.4	219	300
0935	↓	7.88	46	10.37	0	10.9	207	300
0937		8.09	47	10.69	0	10.7	205	300
0939		8.02	47	10.82	0	10.5	208	300
0941		7.93	47	10.86	0	10.3	212	300
0943		7.87	47	10.87	0	10.2	214	300
0945		7.81	47	10.88	0	9.9	216	300
0947		7.78	47	10.91	0	9.88	216	300

Sample Time: 1000 Sample ID: 782M9829FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JD

Location and Site Code (SITEID): ND / Ap2 Chlorinated

Well No. (LOCID): WL-782MW-100 Well Diameter (SDIAM): 2

Date (LOGDATE): 3/31/04 Weather: 50 rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

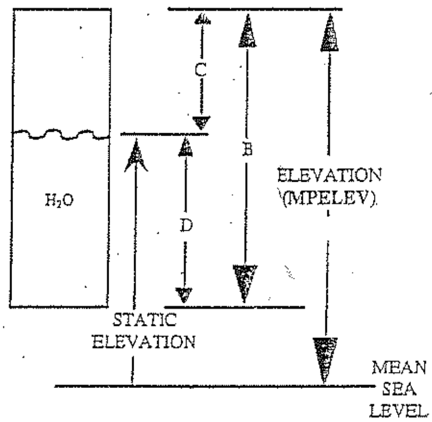
Measured Water Level Depth (C) (STATDEP) 15.57 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 25

Depth during Purging/Sampling: 15.85 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Silty Brown, organic sediment, no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1108	15.85	7.25	43	5.2	>999	6.1	141	60
1114	15.85	7.39	39	5.0	>999	3.7	135	60
1120	15.85	7.41	38	5.1	>999	2.5	134	60
1126	15.85	7.44	36	5.4	>999	1.8	131	60
1133	15.85	7.47	35	5.6	>999	1.6	126	60
1140	15.85	7.48	35	6.0	>999	1.4	125	60

Sample Time: 1146 Sample ID: 782M10025FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC / JD

Location and Site Code (SITEID): AP2 / NO Chlorinated

Well No. (LOCID): WL-782UMW-101 Well Diameter (SDIAM): 2

Date (LOGDATE): 3/31/04 Weather: 50

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

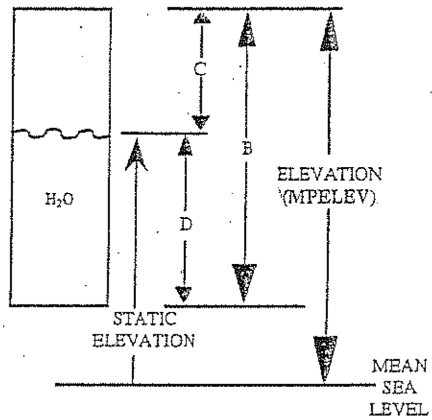
Measured Water Level Depth (C) (STATDEP) 9.07 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 18

Depth during Purging/Sampling: 9.09 - 9.11 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, slight sulfur smell, no sheen

Dissolved Ferrous Iron (mg/L): 4.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1406	9.09	6.71	61	8.3	0	3.7	-38	400
1401	9.11	6.70	61	8.3	0	3.4	-39	400
1402	9.11	6.61	61	8.3	0	2.8	-38	400
1403	9.11	6.54	61	8.3	0	2.2	-41	400
1404	9.11	6.54	61	8.3	0	2.3	-42	400
1405	9.11	6.54	61	8.3	0	2.2	-45	400

Sample Time: 1408 Sample ID: 782m10118FA FD FC FS FX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-03-01 Sampled by: PC JD

Location and Site Code (SITEID): ND/AP2 Chlorinated Plume

Well No. (LOCID): WL-782UMW-102 Well Diameter (SDIAM): 2

Date (LOGDATE): 3/31/04 Weather: 50 overcast/rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

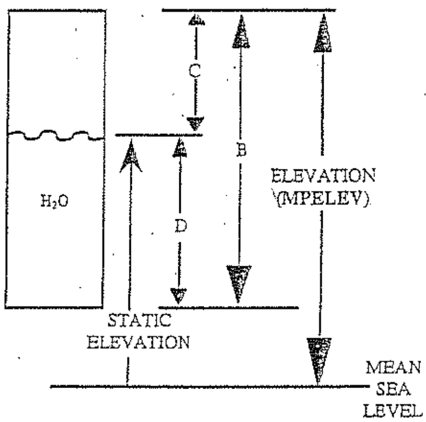
Measured Water Level Depth (C) (STATDEP) 8.07 ft.

Length of Static Water Column (D) = ____(B) - ____(C) = ____(D) ft. (optional)

Pump Intake Depth (ft): 19

Depth during Purging/Sampling: 8.07 - 8.09 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: , no odor, no sheen, cloudy

Dissolved Ferrous Iron (mg/L): 4.0

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1, EC ± 3%, Turbidity ± 10%, D.O. ± 10%, ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1516	8.09	6.91	67	9.6	170	2.8	-42	410
1517	8.09	6.81	68	9.6	210	1.7	-47	410
1518	8.09	6.72	67	9.7	270	1.2	-49	410
1519	8.09	6.66	67	9.6	250	0.8	-51	410
1520	8.09	6.60	67	9.6	260	0.7	-51	410
1521	8.09	6.57	67	9.6	300	0.6	-53	410
1522	8.09	6.56	67	9.6	290	0.6	-54	410
1523	8.09	6.56	67	9.6	300	0.7	-55	410

Sample Time: 1528 Sample ID: 782M10219FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: JD PC

Location and Site Code (**SITEID**): LF1

Well No. (**LOCID**): WL-LF1MW-103 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 3/30/04 Weather: Sunny, 50°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

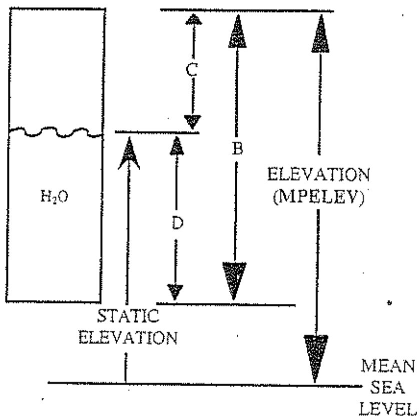
Measured Well Depth (B) (**TOTDEPTH**) 35.23 ft.

Measured Water Level Depth (C) (**STATDEP**) 33.77 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = 1.46 (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = 0.2336 gal

Total Purge Volume = .7008 gal (min. of 3 well volumes)



Purge Date and Method: Bailer

Physical Appearance/Comments:

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1035	.25	~~6~~7.59	52	10.8	7999	4.1	180
Bailed Dry after 0.30 gal							

Sample Time: 1414 Sample ID: LF1M10334BA Collected rest of VOCs on 3/31/04

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 2-03-01 Sampled by: JP · DB

Location and Site Code (SITEID): AP2 (Chlor Plume)

Well No. (LOCID): WL-782VMW-104 Well Diameter (SDIAM): 2"

Date (LOGDATE): 3-31-04 Weather: Rain / 40°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

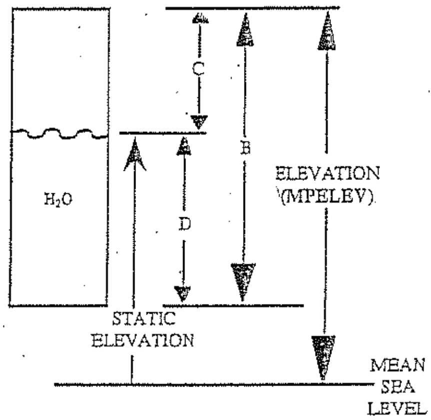
Measured Water Level Depth (C) (STATDEP) 18.13 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear / strong petro odor

Dissolved Ferrous Iron (mg/L): 4.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1025	18.19	6.69	58	8.08	50	5.4	-37	150
1028	18.19	6.75	58	8.70	21	2.8	-63	150
1031	↓	6.89	58	8.94	19	2.0	-78	150
1034		6.95	58	9.02	38	1.4	-63	↓
1037		6.96	58	9.04	91	1.2	-88	
1040		6.97	59	9.00	70	1.1	-93	
1043		6.97	59	9.04	50	1.0	-95	

Sample Time: 1045 Sample ID: 782M10428FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32.03.01 Sampled by: JP / DB

Location and Site Code (SITEID): AP2 (Cloe. Plume)

Well No. (LOCID): WL-782VMW-105B Well Diameter (SDIAM): 2"

Date (LOGDATE): 3.31.04 Weather: OVERCAST / 45° / BREEZY

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

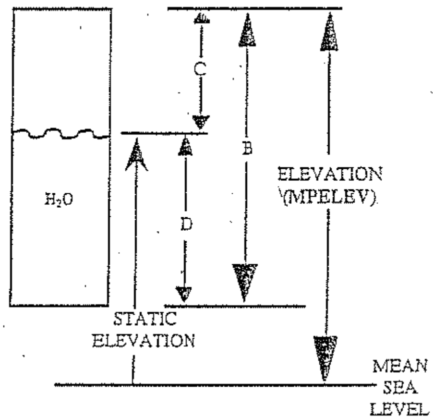
Measured Water Level Depth (C) (STATDEP) 19.57 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1345	15.61	7.16	55	10.31	76	4.2	213	150
1348	↓	6.88	52	11.17	250	1.4	216	150
1351		6.89	51	11.44	360	1.1	211	150
1354		6.92	51	11.57	390	0.9	206	150
1357		6.96	52	11.56	560	0.7	201	150
1400		7.03	52	11.54	540	0.6	195	150
1403		7.07	52	11.48	560	0.6	190	150
1406		7.16	52	11.46	520	0.5	183	150
1409		7.30	52	11.51	420	3.8	178	150
1412		7.28	52	11.52	460	2.1	177	150
1415		7.28	52	11.48	470	1.0	175	150

Sample Time: 1410 Sample ID: 782M105B33FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-83-01   Sampled by: PC JD

Location and Site Code (SITEID): ND/AP2 Chlorinated

Well No. (LOCID): WC-AP2MW-3   Well Diameter (SDIAM): 2

Date (LOGDATE): 3/31/04   Weather: 50 rain

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

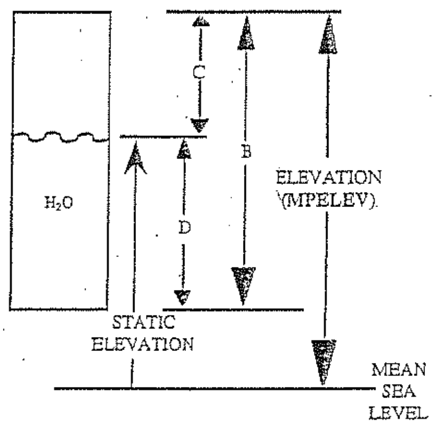
Measured Water Level Depth (C) (STATDEP) 19.28 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 19.28 - 19.29 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, no odor, no sheen

Dissolved Ferrous Iron (mg/L): 3.8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1010	19.28	6.40	73	10.6	0	0.5	-9	400
1011	19.28	6.45	73	10.7	0	0.4	-12	450
1012	19.28	6.56	73	10.7	0	0.4	-26	450
1013	19.28	6.62	73	10.7	0	0.3	-30	450
1014	19.28	6.66	73	10.7	0	0.3	-35	450

Sample Time: 1016   Sample ID: AP2MO327FA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-07 Sampled by: PC JD

Location and Site Code (**SITEID**): ND / AP2 Chlorinated

Well No. (**LOCID**): 782 SW-118 Well Diameter (**SDIAM**): Surface

Date (**LOGDATE**): 3/31/04 Weather: 50

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

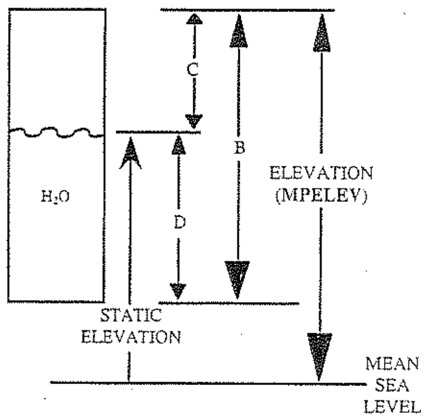
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) ____________ ft.

Length of Static Water Column (D) = ______ - ______ = ______ ft.
(B) (C) (D)

Casing Water Volume (E) = ______ x ______ = ______ gal
(A) (D)

Total Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface water

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1558	—	7.20	20	8.3	0	11	48

Sample Time: 1600 Sample ID: 78211801FA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: PC JO

Location and Site Code (**SITEID**): ND/AP2 Chlorinated

Well No. (**LOCID**): 7825119 Well Diameter (**SDIAM**): Surface

Date (**LOGDATE**): 3/31/04 Weather: 50

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

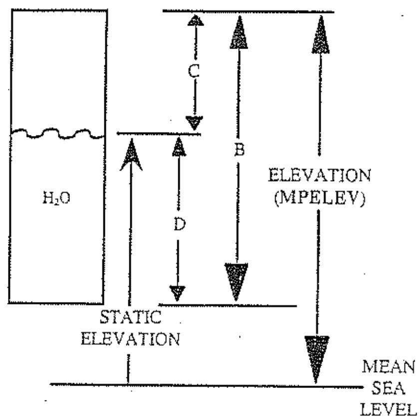
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface water

Physical Appearance/Comments: ____________

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 (pH), ± 5% (EC), ±1°C (Temp.)

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1550	-	7.28	20	8.3	0	11.1	47

Sample Time: 1552 Sample ID: 782511901FA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-03-01 Sampled by: RC JO

Location and Site Code (SITEID): AP2 / ND Chlorinated

Well No. (LOCID): SW-7825120 Well Diameter (SDIAM): — surface

Date (LOGDATE): 3/31/04 Weather: 50

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

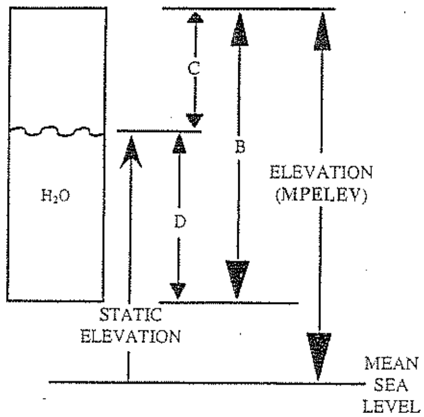
Measured Well Depth (B) (TOTDEPTH) ____________ ft.

Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface water

Physical Appearance/Comments: Clear, no sheen, no odor

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 5% ±1°C

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1536		7.68	24	8.5	1	11.2	37

Sample Time: 1540 Sample ID: 782512001FA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB/JP

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782VMW-76 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-1-04 Weather: 70 Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

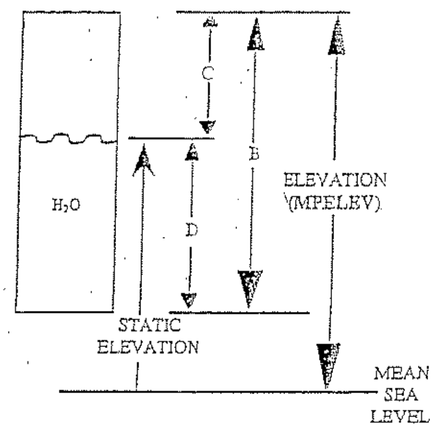
Measured Water Level Depth (C) (STATDEP) 20.19 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 38

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: silty

Dissolved Ferrous Iron (mg/L): 1.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1100	20.4	6.97	54.6	17.6	35.0	~~40.2~~ 4.0	-22	150
1104	20.4	6.76	59.0	17.3	27.4	1.89	-50	110
1108	20.4	6.77	61.4	17.0	27.6	1.50	-64	110
1112	20.4	6.90	65.3	15.9	23.0	1.07	-79	110
1116	20.4	6.94	66.3	15.8	19.5	0.81	-86	110
1120	20.4	6.99	66.7	15.8	16.6	0.80	-91	110
1124	20.4	7.07	65.8	16.5	19.0	0.63	-99	110
1128	20.4	7.13	65.8	17.0	20.0	0.50	-104	110
1132	20.4	7.16	66.0	17.5	21.0	0.40	-107	110

Sample Time: 1140 Sample ID: 782M7638GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB | JP

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782VMW-80 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-1-04 Weather: 70° Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

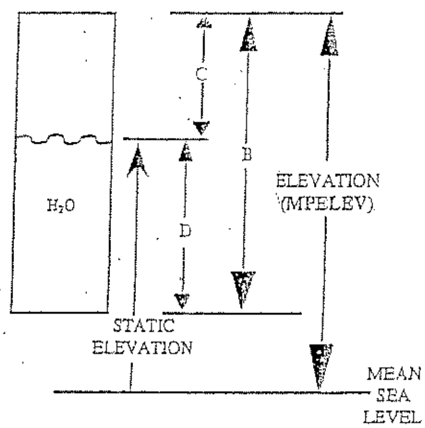
Measured Water Level Depth (C) (STATDEP) 18.80 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 18.80 - 19.10 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: silty brown

Dissolved Ferrous Iron (mg/L): .2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1003	18.80	7.84	62.5	18.2	45.5	10.25	124	100
1007	18.80	7.14	66.9	18.7	41.5	7.42	4	100
1011	18.8	7.00	69.4	19.0	34.5	6.11	-47	100
1015	18.8	7.02	71.6	19.3	34.0	4.54	-70	100
1019	18.8	7.11	72.8	19.6	34.2	3.37	-83	100
1023	18.8	7.16	73.2	19.8	33.3	2.60	-89	100
1027	18.8	7.15	73.5	19.3	32.5	2.07	-90	100

Sample Time: 1030 Sample ID: 782M8033GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC-AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782VMW-81 Well Diameter (SDIAM): " 2

Date (LOGDATE): 7/1/04 Weather: 75 Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

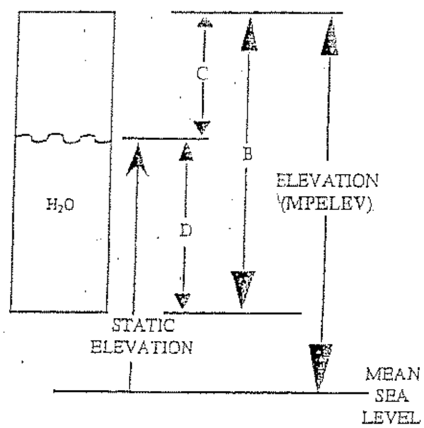
Measured Water Level Depth (C) (STATDEP) 21.19 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: water is cloudy - no odor

Dissolved Ferrous Iron (mg/L): 0.6

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1027	21.45	7.44	64	14.3	26	2.4	-84	110
1031		7.25	63	14.1	32	2.5	-79	
1035		7.19	62	14.5	78	1.9	-83	
1039		7.20	62	14.5	92	1.6	-88	
1043		7.24	62	14.5	120	1.4	-94	
1048		7.33	62	14.9	120	1.1	-105	
1052		7.37	62	15.3	110	1.0	-109	
1056		7.41	62	15.1	120	1.0	-113	

Sample Time: 1059 Sample ID: 782M8146GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782UMW-83 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/1/04 Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

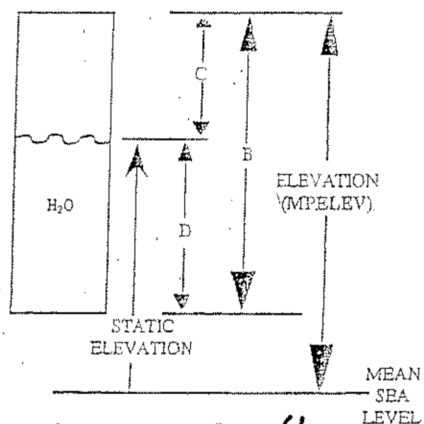
Measured Water Level Depth (C) (STATDEP) 18.35 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 18.45 ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: ~~BLADDER PUMP~~ Peristaltic - Bladder

Physical Appearance/Comments: Cloudy - no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1630	18.45	7.82	56	15.7	55	0.4	83	400
1631		7.76	55	14.9	110	1.3	91	
1632		7.46	54	13.7	68	3.0	103	
1633		7.26	54	13.5	64	0.1	110	
1634		7.19	54	13.5	68	0.1	112	
1635		7.12	55	13.5	80	0.4	113	
1636		7.06	55	13.5	80	0.4	114	
		7.05	55	13.5	84	0.6	115	
		6.99	56	13.5	78	0.6	115	

Sample Time: 1645 Sample ID: 782m8333GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

32-04-02 (LOW FLOW)

Project: ~~32-04-02~~ DB Sampled by: DB / JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782UMW-90 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-1-04 Weather: 80 sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

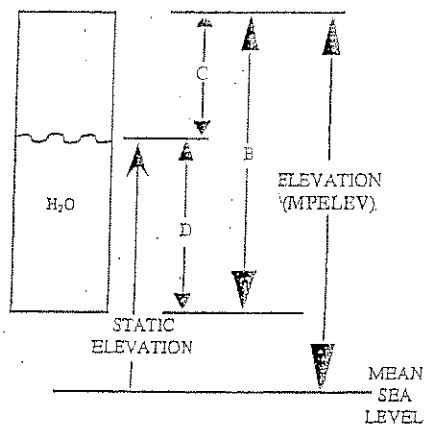
Measured Water Level Depth (C) (STATDEP) 24.96 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 29

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: silty brown - petro odor

Dissolved Ferrous Iron (mg/L): 7.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1525	24.96	6.71	45.1	13.2	18.8	1.75	-71	400
1526	24.96	6.58	42.5	12.6	20.4	0.71	-71	400
1527	24.96	6.60	41.9	12.7	20.3	0.52	-69	400
1528	24.96	6.30	41.3	12.5	19.7	0.17	-67	400
1529	24.96	6.26	41.8	12.3	19.8	0.02	-70	400
1530	24.96	6.26	43.4	12.2	18.9	0.00	-71	400
1531	24.96	6.26	44.0	12.2	18.6	0.00	-72	400
1532	24.96	6.26	44.5	12.1	18.7	0.00	-73	400

Sample Time: 1540 Sample ID: 782UM9029GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02   Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782UMW-91   Well Diameter (SDIAM): 2

Date (LOGDATE): 7/1/04   Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) __________ ft. (optional)

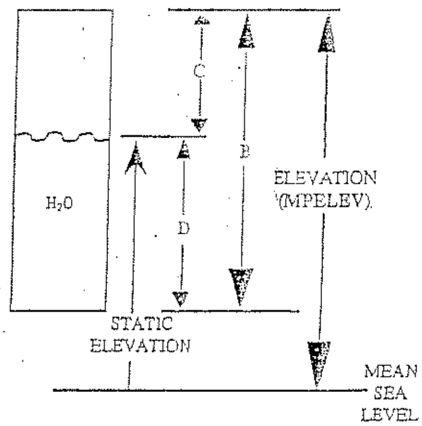
Measured Water Level Depth (C) (STATDEP) 19.39 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: __________ ft (provide range)

Comments (re: Depth during purging/sampling): __________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Cloudy - Pine odor

Dissolved Ferrous Iron (mg/L): 2.8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1503	19.45	6.51	0.20	21.1	208	1.5	-80	120
1507		6.57	0.20	19.2	166	0.9	-112	
1511		6.60	0.20	18.7	100	2.2	-120	
1515		6.58	0.20	19.7	84	1.0	-129	
1519		6.60	0.20	19.7	72	1.9	-129	

Sample Time: 1525   Sample ID: 782M9127GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782UMW-92 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/1/04 Weather: rain 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

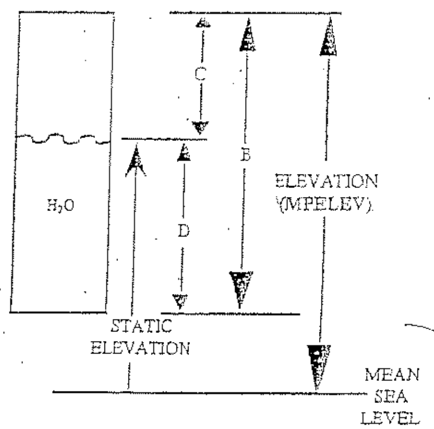
Measured Water Level Depth (C) (STATDEP) 21.96 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: no odor - slightly silty

Dissolved Ferrous Iron (mg/L): 4.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1425	21.90	7.29	77	17.1	190	8.6	25	300
1427		6.82	77	16.1	62	11.3	-94	
1429		6.63	78	15.9	160	11.3	-96	
1431		6.49	78	15.5	84	8.9	-97	
1433		6.47	78	15.6	70	8.4	-97	
1435		6.46	78	15.5	70	6.6	-100	
1437		6.48	79	15.6	67	4.8	-100	

Sample Time: 1441 Sample ID: 782m923SGA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): W-782UMW-93 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/1/04 Weather: 80 Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

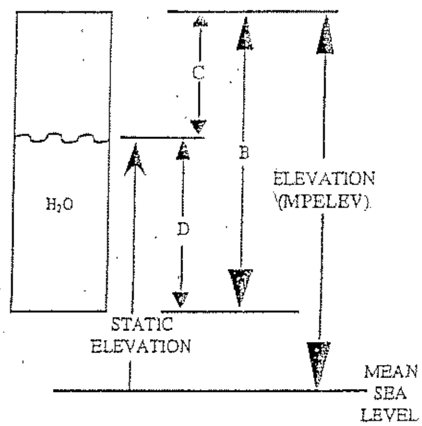
Measured Water Level Depth (C) (STATDEP) 21.17 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): 21.21



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Slightly Silty Brown - no odor

Dissolved Ferrous Iron (mg/L): 2.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1132	21.21	7.39	55	15.6	39	5.2	-38	200
1134		7.05	60	14.6	27	5.3	-71	
1136		6.77	63	14.0	37	6.8	-77	
1138		6.66	66	14.4	31	10.5	-79	
1140		6.58	67	15.2	34	4.5	-81	
1142		6.54	67	15.5	30	2.1	-82	
1144		6.54	67	15.9	25	1.9	-83	

Sample Time: 1145 Sample ID: 782M9335GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782UMW-96 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-1-04 Weather: 70° cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) [illegible] ft. (optional)

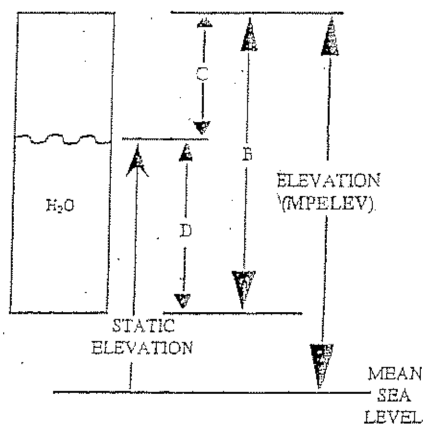
Measured Water Level Depth (C) (STATDEP) 21.46 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 37

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): .8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1413	21.55	7.2	68.8	18.1	25.4	2.59	-46	400
1414	↓	6.75	69.6	16.3	15.6	3.41	-49	400
1415		6.69	70.1	16.1	14.4	2.69	-51	400
1416		6.66	70.5	18.8	12.8	2.03	-56	400
1417		6.65	70.9	15.8	15.0	1.46	-59	400

Sample Time: 1430 Sample ID: 782M9637GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plome

Well No. (LOCID): WC-782VMW-97 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/1/04 Weather: 75

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

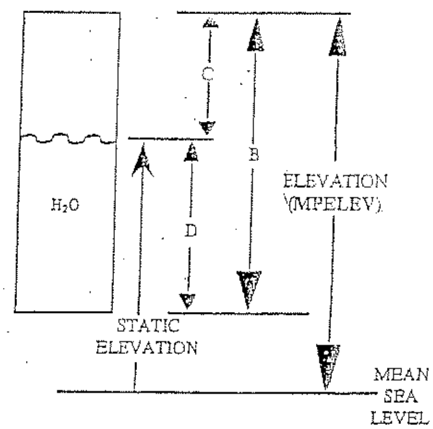
Measured Water Level Depth (C) (STATDEP) 18.99 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 18.99 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: slight silty Brown - no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
935	18.99	6.86	49	11.5	28	3.2	13	325
937		6.70	49	11.5	30	3.3	24	
939		6.59	50	11.3	33	2.8	31	
941		6.52	52	11.4	33	2.3	36	
943		6.52	53	11.3	34	1.8	39	
945		6.52	53	11.4	33	1.6	40	

Sample Time: 949 Sample ID: 782M97336A

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): ut-782Vmw-99 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/1/04 Weather: 80 sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

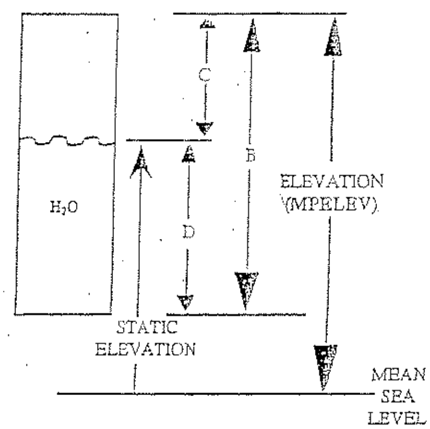
Measured Water Level Depth (C) (STATDEP) 21.90 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: 21.92 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear - no odor

Dissolved Ferrous Iron (mg/L): 1.6

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1207	21.92	7.73	0.12	18.5	14	6.8	-9	150
1211		8.44	0.11	17.1	25	4.8	-36	100
1214		8.34	0.11	16.2	28	5.1	-26	175
1217		7.78	0.11	17.6	26	2.1	-123	175
1219		7.77	0.11	16.2	29	2.4	-129	175
1222		7.74	0.11	15.5	30	2.5	-144	175
1225		7.62	0.11	15.1	30	0.7	-153	
1228		7.50	0.11	15.2	29	0.6	-151	
1231		7.48	0.11	15.3	29	0.6	-151	
1234		7.49	0.11	15.3	29	0.6	-150	

Sample Time: 1235 Sample ID: 782m9940GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC / AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WX-782UMW-104 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/1/04 Weather: 75 sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

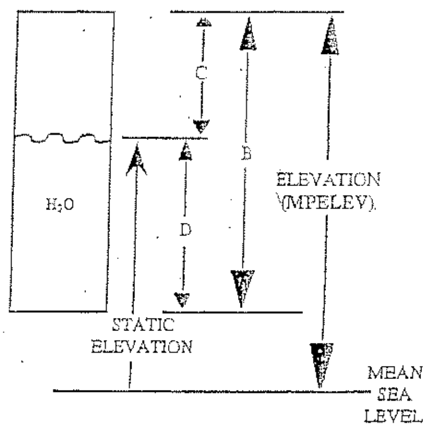
Measured Water Level Depth (C) (STATDEP) 17.93 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 26

Depth during Purging/Sampling: 18.19 - 18.25 ft (provide range)

Comments (re: Depth during purging/sampling): 18.29



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, petro odor

Dissolved Ferrous Iron (mg/L): 5.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
850	18.29	6.73	49	12.3	29	3.4	-79	400
852		6.67	48	11.8	28	3.3	-89	325
854		6.59	49	11.8	25	6.5	-92	400
855		6.55	48	11.9	23	8.4	-94	400
856		6.53	49	11.7	26	7.2	-96	400
857		6.52	48	11.7	27	3.7	-98	400
858		6.52	48	11.9	30	3.1	-100	400
859		6.52	48	11.7	32	2.9	-101	400
900		6.52	48	11.7	30	1.7	-102	400

Sample Time: 905 Sample ID: 782M10426GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782VMW-105B Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-1-04 Weather: 70° Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.5	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ ft. (optional)

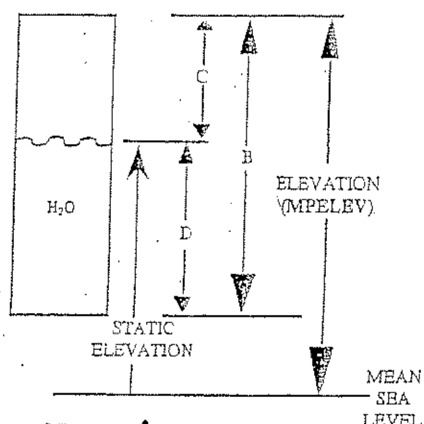
Measured Water Level Depth (C) (STATDEP) 19.32 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: 19.32 - 19.62 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 0.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0920	~~0920~~ 19.4	701	52.5	13.9	484.0	2.70	36	300
0922	19.50	6.84	52.0	13.5	877.0	1.42	26	300
0924	19.50	6.79	52.1	13.2	796.0	0.76	20	300
0926	19.50	6.79	52.1	13.4	539.0	0.41	19	300
0928	19.5	6.81	52.3	13.4	510.0	0.26	19	300
0930	19.5	6.83	52.3	13.3	~~[illegible]~~		18	300
					491.0	0.12		

Sample Time: 0930 Sample ID: 782M105B33GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB/JP

Location and Site Code (SITEID): Chlh. Plume

Well No. (LOCID): WL-782MW-6R2 Well Diameter (SDIAM): 2

Date (LOGDATE): 7-1-04 Weather: cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

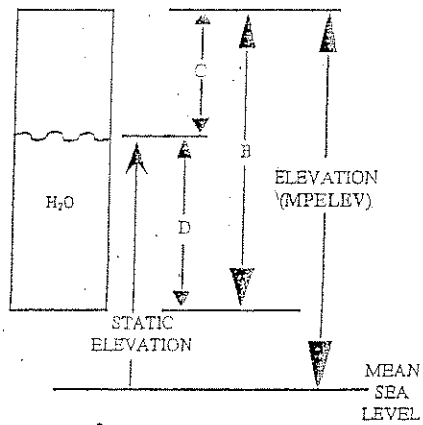
Measured Water Level Depth (C) (STATDEP) 23.82 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 30

Depth during Purging/Sampling: ________ (provide range) ft

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: silty brown / iron floc

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS: turb values jump around / iron floc ~~[illegible]~~

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1446	23.86	6.64	73.6	15.9	43.81	2.76	133	225
1448	23.86	6.24	67.8	14.0	48.0	1.12	144	300
1450	23.86	6.13	63.3	13.7	48.1	0.67	132	300
1452	23.86	6.11	60.8	13.9	60.5	0.42	86	300
1454	23.86	6.17	62.0	14.0	180.0	0.26	47	300
1456	23.86	6.28	62.5	14.2	190.0	0.20	39	300
1458	23.86	6.29	63.1	14.2	334.0	0.23	32	30

Sample Time: 1500 Sample ID: 782M6R230GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 39-04-02 Sampled by: DB / JP

Location and Site Code (SITEID): Chlorinated Plume

Well No. (LOCID): WL-782MW-10 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-1-04 Weather: 70 cloudy

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

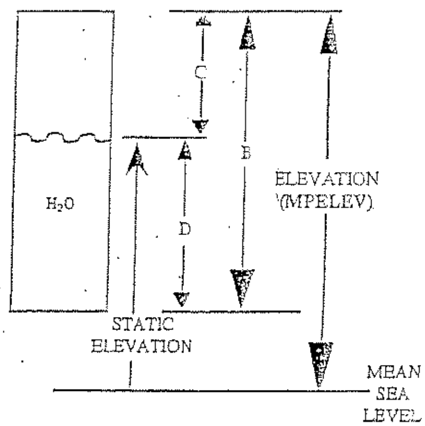
Measured Water Level Depth (C) (STATDEP) 21.90 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 5.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1155	21.9	6.85	71.8	15.9	32.7	1.32	-99	400
1156	21.9	6.84	72.2	14.2	31.0	0.38	-95	400
1157	21.9	6.68	72.2	13.9	33.7	0.08	-92	400
1158	21.9	6.60	71.5	13.9	41.9	0.00	-91	400
1159	21.9	6.58	71.5	13.6	35.9	0.00	-92	400
1200	21.9	6.57	71.6	13.6	34.0	0.00	-93	400
1201	21.9	6.57	71.6	13.6	27.0	0.00	-95	400
1202	21.9	6.59	71.5	13.5	28.0	0.00	-95	400
1203	21.9	6.60	71.6	13.6	27.5	0.00	-97	400

Sample Time: 1210 Sample ID: 782M1027GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (SITEID): Ch Plume

Well No. (LOCID): WL-786MW-30 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-1-04 Weather: 80 sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

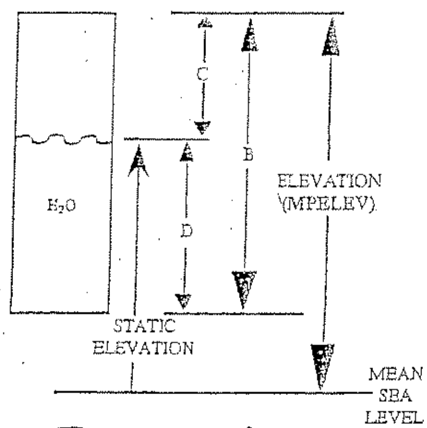
Measured Water Level Depth (C) (STATDEP) 15.39 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 22

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-1-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 0.2 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1621	15.5	7.35	33.7	16.5	58.8	10.37	96	~~125~~ 125
1624	15.5	6.93	32.8	14.0	160.0	8.01	124	125
16:27	15.5	6.88	31.5	13.2	203.0	7.22	130	150
1630	15.5	6.91	31.3	12.8	161.0	6.85	132	150
1633	15.5	6.93	31.2	12.6	134.0	6.80	133	150
1636	15.5	6.95	31.1	12.5	112.0	6.79	133	150
1639	15.5	6.99	30.6	12.7	95.1	6.75	130	150
1642	15.5	7.09	30.5	12.9	80.3	6.65	124	150
1645	15.5	7.31	31.2	12.9	66.8	6.48	108	150
1648	15.5	7.39	30.4	12.8	60.1	6.40	105	150
1651	15.5	7.45	30.6	12.7	59.0	6.35	98	150

Sample Time: 1700 Sample ID: 786MW3022GA

1654 - 15.5 - 7.48 - 30.8 - 12.8 - 59.2 - 6.30 - 96 - 150

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB/JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782OMW-78 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-2-04 Weather: 70° sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

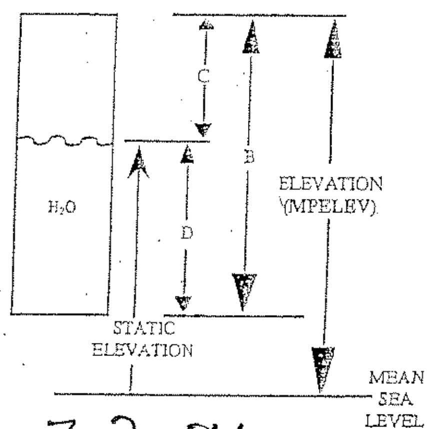
Measured Water Level Depth (C) (STATDEP) 23.99 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: ____________ (provide range) ft

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 7-2-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 1.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
11:35	23.99	7.44	74.5	13.8	486.0	7.81	20	450
1136	23.99	7.26	73.1	13.0	499.0	3.06	-38	450
1137	23.99	7.08	73.4	13.0	352.0	1.08	-64	450
1138	23.99	6.98	73.0	12.8	256.0	0.60	-67	450
1139	23.99	6.93	73.0	12.8	230.0	0.40	-70	450
1140	23.99	6.91	73.1	12.8	221.0	0.42	-72	450
1141	23.9	6.89	73.2	12.8	217.0	0.44	-73	450

Sample Time: ________ Sample ID: 782M7840GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB /JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782VMW-84 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-2 Weather: sun 65

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) __________ ft. (optional)

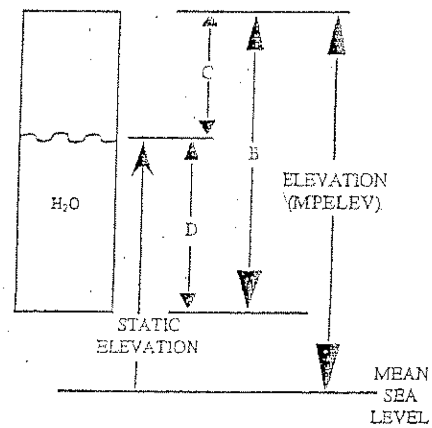
Measured Water Level Depth (C) (STATDEP) 23.24 ft.

Length of Static Water Column (D) = _____ (B) - _____ (C) = _____ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: __________ ft (provide range)

Comments (re: Depth during purging/sampling): __________



Purge Date and Method: BLADDER PUMP 7-2-04

Physical Appearance/Comments: clear / noodor

Dissolved Ferrous Iron (mg/L): 1.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
0936	28.31	7.8	74.6	16.5	765	7.09	44	200
0938	↓	7.25	76.8	15.5	100	5.68	-76	200
0940		6.88	77.6	15.0	95.5	3.44	-72	200
0942	↓	6.71	80.0	14.8	79.9	2.02	-72	200
0944		6.67	80.5	14.8	51.7	1.31	-76	200
0948	↓	6.67	80.7	14.8	40.1	0.89	-78	200

Sample Time: 0952 Sample ID: 782W8440GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782MW-87 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-2 Weather: sun 60

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

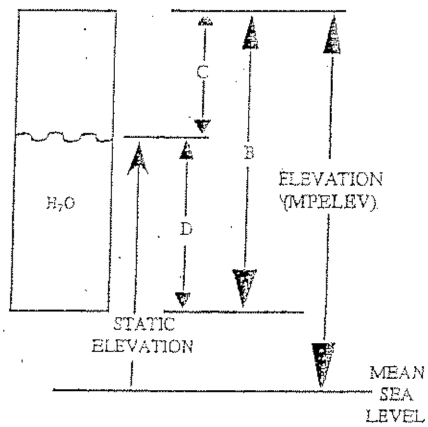
Measured Water Level Depth (C) (STATDEP) 23.82 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-2-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 4.6 mg/L

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0852	23.82	7.01	81.4	14.4	101.0	5.80	-68	300
0854	23.82	6.73	82.0	13.6	73.7	1.67	-80	300
0856	23.82	6.61	82.1	13.6	60.0	0.97	-83	300
0858	23.82	6.58	82.0	13.5	55.0	0.59	-85	300
0900	23.82	6.59	82.0	13.6	52.5	0.36	-89	300
0902	23.82	6.62	82.0	13.6	49.0	0.19	-95	300
0904	23.82	6.68	82.3	13.7	50.6	0.13	-100	300
0906	23.82	6.70	82.3	13.7	50.1	0.04	-103	300

Sample Time: 0910 Sample ID: 782M8735GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 34-04-02 Sampled by: DB/JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782dMW-88 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-2-04 Weather: 70 Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

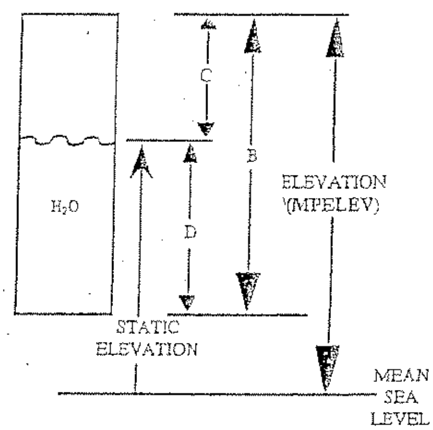
Measured Water Level Depth (C) (STATDEP) 26.98 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 37

Depth during Purging/Sampling: 27.04 (provide range) ft

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-2-04

Physical Appearance/Comments: ________

Dissolved Ferrous Iron (mg/L): 4.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1013	27.04	7.09	79.0	16.4	79.0	1.03	-84	250
1015	27.04	6.95	78.8	15.0	100.0	0.02	-92	250
1017	27.04	6.86	78.2	14.4	116.0	0.00	-95	250
1019	27.04	6.85	78.0	14.2	113.0	0.00	-98	250
1021	27.04	6.85	78.1	14.2	96.0	0.00	-102	250
1023	27.04	6.86	78.2	14.0	96.7	0.00	-104	250
1025	27.04	6.88	78.5	13.9	91.5	0.00	-105	250

Sample Time: 1030 Sample ID: 782M8837GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB /JP

Location and Site Code (SITEID): Chl. Plume

Well No. (LOCID): WL-782VMW-89 Well Diameter (SDIAM): 2"

Date (LOGDATE): 7-2-04 Weather: 65° sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

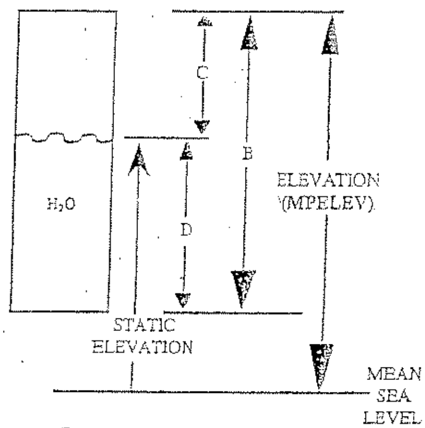
Measured Water Level Depth (C) (STATDEP) 24.47 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: 24.53 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 7-2-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 7.8 mg/L

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1053	24.53	7.09	87.6	14.7	291.0	7.03	-81	270
1055	24.53	6.75	82.6	13.5	211.0	1.95	-84	270
1057	24.53	6.64	80.3	13.2	107.0	0.86	-84	270
1059	24.53	6.67	79.8	13.2	109.0	0.65	-86	270
1101	24.53	6.72	79.5	13.1	73.0	0.55	-89	270
1103	24.53	6.77	79.4	13.1	67.5	0.47	-92	270
1105	24.53	6.86	79.5	12.9	66.5	0.22	-98	270
1107	24.53	6.88	79.4	12.9	65.8	0.10	-102	270
1109	24.53	6.95	79.3	13.1	66.7	0.06	-108	270

Sample Time: 1110 Sample ID: 782M8935GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC · AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782UMW-10 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/2/04 Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

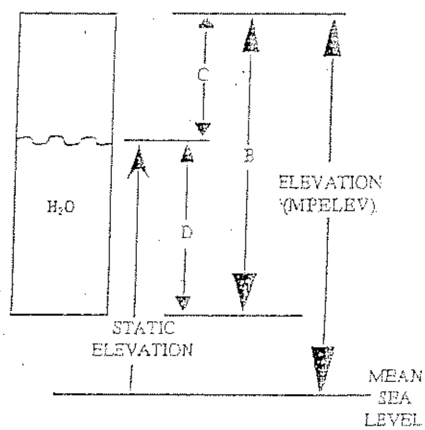
Measured Water Level Depth (C) (STATDEP) 10.03 ft.

Length of Static Water Column (D) = ______ - ______ = ______ ft. (optional)
(B) (C) (D)

Pump Intake Depth (ft): 18

Depth during Purging/Sampling: 10.07- ft
(provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear - no odor

Dissolved Ferrous Iron (mg/L): 3.8

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1040	10.07	7.00	50	13.1	70	4.2	-77	400
1041		6.97	47	12.8	61	1.4	-85	
1042		6.92	45	12.6	57	0.2	-89	
43		6.89	45	12.6	58	0.0	-92	
44		6.86	46	12.6	60	0.1	-94	
45		6.84	45	12.7	60	0.1	-95	
46		6.82	45	12.8	61	0.1	-97	

Sample Time: 1047 Sample ID: 782m1018GA GX GS GC GD

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782VMW-102 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/2/04 Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

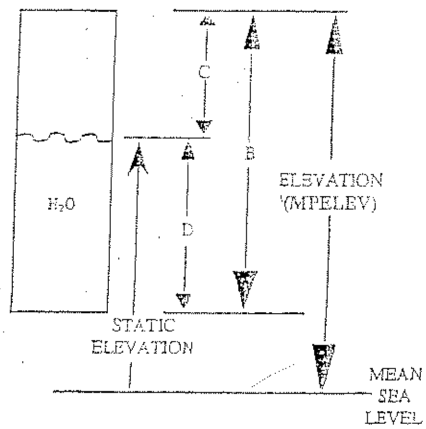
Measured Water Level Depth (C) (STATDEP) 8.99 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 19

Depth during Purging/Sampling: 7.0 ft (provide range)

Comments (re: Depth during purging/sampling): 9.0



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Cloudy - Lemon Lime odor

Dissolved Ferrous Iron (mg/L): 4.4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1138	9.00	6.94	71	14.0	320	0.1	-45	400
1139		6.73	65	12.3	190	1.9	-68	
1140		6.57	64	12.0	130	1.7	-69	
1141		6.54	63	11.9	130	0.0	-70	
1142		6.50	63	11.8	130	0.0	-71	

Sample Time: 1145 Sample ID: 782M10219GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: RL Am

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782MW-6D Well Diameter (SDIAM): 2

Date (LOGDATE): 7/2/04 Weather: 75 sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

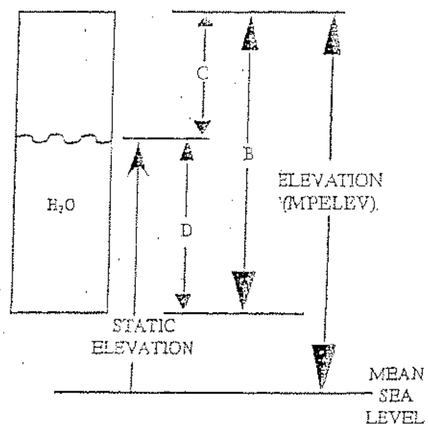
Measured Water Level Depth (C) (STATDEP) 24.01 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 43

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: water is slightly silty, slight organic odor

Dissolved Ferrous Iron (mg/L): ____________

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0839	24.03	6.17	.10	12.9	160	1.6	180	400
0840		6.17	.10	12.8	140	0.0	140	400
41		6.17	.10	12.5	150	0.0	108	
42		6.22	.10	12.6	180	0.0	66	
43		6.28	.10	12.8	280	0.0	52	
44		6.33	.10	12.7	270	0.0	39	
45		6.36	.10	12.7	230	0.1	30	
46		6.40	.10	12.6	180	0.2	18	
47		6.41	.10	12.7	160	0.2	11	
48		6.44	.10	12.8	150	0.2	-8	
49		6.46	.10	12.7	150	0.2	0	

Sample Time: 0851 Sample ID: 782M6D43GA
GC GS
GD GX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): AP2MW-3 Well Diameter (SDIAM): 2

Date (LOGDATE): 7/2/04 Weather: 80 Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

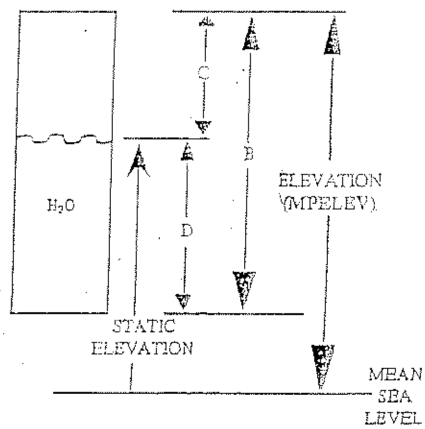
Measured Water Level Depth (C) (STATDEP) 20.02 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 20.02 ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear - Lemon-Lime Odor

Dissolved Ferrous Iron (mg/L): 5.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1013	20.02	6.68	71	13.6	88	0.4	-33	400
1014		6.72	71	13.2	70	2.5	-52	
1015		6.63	72	12.8	51	1.1	-67	
1016		6.59	72	12.3	52	0.0	-72	
1017		6.54	72	12.1	53	0.0	-75	
1018		6.51	72	12.1	51	0.0	-78	

Sample Time: 1023 Sample ID: AP2M0327GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-09-02　　Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): 782SW-11[illegible]5　　Well Diameter (SDIAM): Surface

Date (LOGDATE): 7/2/09　　Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

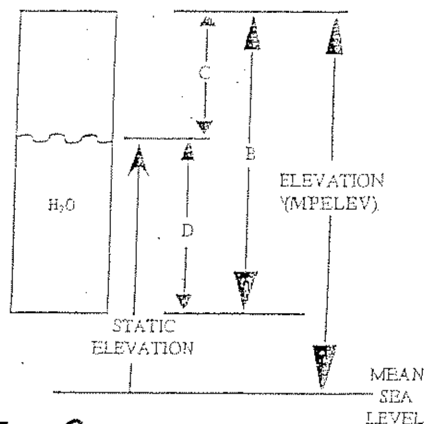
Measured Water Level Depth (C) (STATDEP) ______ ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): —

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: ~~BLADDER~~ PUMP Surface water

Physical Appearance/Comments: ______

Dissolved Ferrous Iron (mg/L): ______

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
		7.58	38	15.8	48	2.2	-15	

Sample Time: 1227　　Sample ID: ~~782SW[illegible]01GA~~ 782S11501GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC Am

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): 782 SW-118 Well Diameter (SDIAM): Surface water

Date (LOGDATE): ______ Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

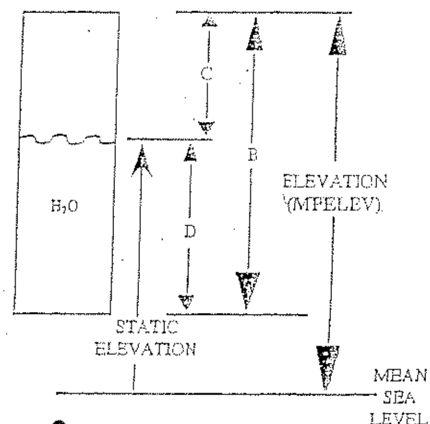
Measured Water Level Depth (C) (STATDEP) ______ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): ______

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: ~~BLADDER PUMP~~ Surface water

Physical Appearance/Comments: ______

Dissolved Ferrous Iron (mg/L): ______

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
12/1	0.1	7.49	40	16.0	46	2.6	-15	

Sample Time: 1213 Sample ID: 782511801GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): 782SW-119 Well Diameter (SDIAM): Surface water

Date (LOGDATE): 7/2/04 Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ______ ft. (optional)

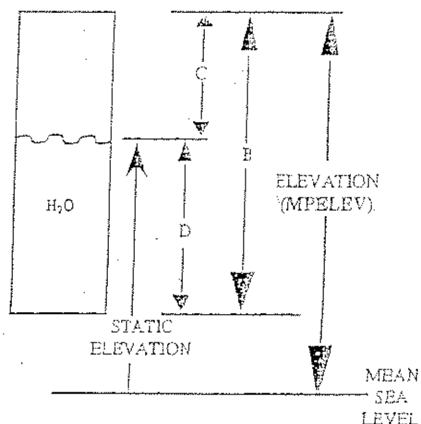
Measured Water Level Depth (C) (STATDEP) ______ ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): ______

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: ~~BLADDER PUMP~~ Surface water

Physical Appearance/Comments: ______

Dissolved Ferrous Iron (mg/L): ______

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1206	0.1	7.5	40	16.0	63	4.6	-15	

Sample Time: R01 Sample ID: 782S1190IGA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-09-02 Sampled by: PC AM

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): 782-SW-120 Well Diameter (SDIAM): — Surface water

Date (LOGDATE): 7/2/09 Weather: 80

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

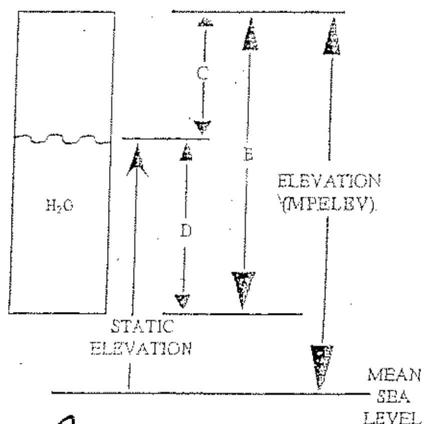
Measured Water Level Depth (C) (STATDEP) ____________ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): ____________

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: ~~BLADDER PUMP~~ Surface water

Physical Appearance/Comments: ____________

Dissolved Ferrous Iron (mg/L): ____________

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1150	01	7.26	91	16.4	64	3.1	-23	

Sample Time: 1153 Sample ID: 782S12001GA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): NA 32 Chl. Plume

Well No. (**LOCID**): WL-~~[illegible]~~ MW-10 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70° / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

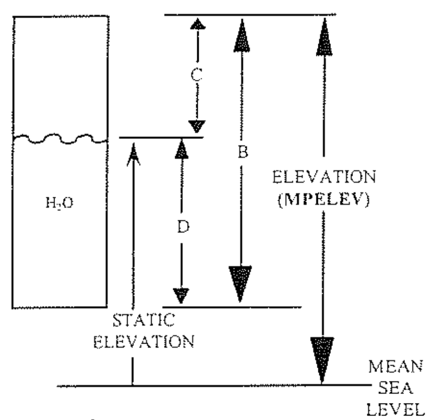
Measured Water Level Depth (C) (**STATDEP**) 21.65 ft.

Length of Static Water Column (D) = _____ (B) - _____ (C) = _____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 5.4

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 ± 3% ± 10% ± 10% ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1353	21.66	7.03	71.4	17.9	46.7	2.06	-115	420
1354	21.66	7.04	70.3	15.3	32.3	0.56	-121	420
1355	"	7.03	70.1	14.8	32.3	0.48	-121	420
1356	"	6.98	70.0	17.7	31.5	0.45	-120	420
1357	"	6.96	70.0	14.5	~~29~~ 30.0	0.40	-120	420
1358	"	6.95	69.7	14.5	30.1	0.38	-122	420
1359	"	6.97	69.6	14.6	24.8	0.33	-124	420
1400	"	6.98	69.6	14.5	24.6	0.31	-124	420
1401	"	6.99	69.6	14.9	24.6	0.30	-126	420

Sample Time: 1402 Sample ID: AP2MW027HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

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WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / PC

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782VMW-84 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	[illegible]	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2[illegible]	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

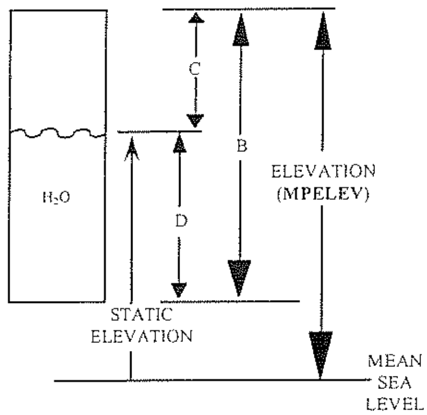
Measured Water Level Depth (C) (**STATDEP**) 23.08 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1018	23.15	8.17	69.6	16.7	91.8	8.73	39	320
1020	23.15	7.43	76.6	14.8	60.4	5.22	-104	320
1022	23.15	7.22	78.8	14.1	40.8	3.28	-107	320
1024	23.15	7.13	79.8	13.8	74.9	1.64	-112	320
1026	23.15	7.13	80.0	13.7	57.5	1.12	-116	320
1028	23.15	7.15	80.1	13.7	37.0	0.92	-119	320
1030	23.15	7.17	80.2	13.6	27.3	0.85	-121	320
1032	23.15	7.18	80.2	13.6	22.0	0.70	-123	320
1034	23.15	7.19	80.2	13.6	20.9	0.69	-124	320
1036	23.15	7.20	80.2	13.6	21.2	0.66	-124	320

Sample Time: 1040 Sample ID: 782M8440HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): chl. Plume

Well No. (**LOCID**): w-782vmw-85 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

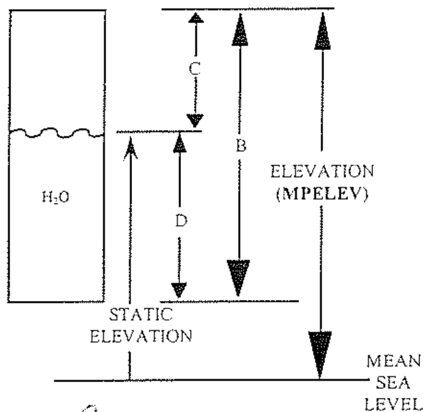
Measured Water Level Depth (C) (**STATDEP**) 23.78 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 36

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): ~~4.8~~ 5.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1138	23.93	7.13	0.121	14.1	242.0	3.51	-90	300
1140	23.92	7.05	0.126	13.0	179.0	1.75	-104	300
1142	23.92	7.04	0.128	12.6	141.0	1.00	-113	300
1144	23.92	7.09	0.128	12.6	103.0	0.80	-117	300
1146	23.92	7.04	0.126	12.6	85.0	0.73	-119	300
1148	23.92	7.10	0.127	12.6	66.0	0.65	-122	300
1150	23.92	7.12	0.127	12.5	65.1	0.62	-123	300
1152	23.92	7.13	0.127	12.6	64.0	0.64	-124	300

Sample Time: 1156 Sample ID: 782M8536HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-732VMW-86 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70° / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	[illegible]	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

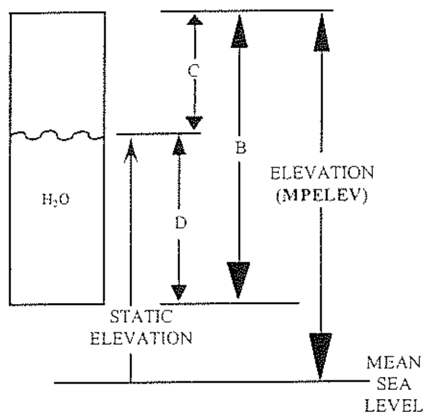
Measured Water Level Depth (C) (**STATDEP**) 2263 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 5.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1234	22.75	7.40	0.114	15.3	65.7	4.78	-105	250
1236	22.75	7.36	0.117	13.6	51.4	1.87	-115	250
1238	22.75	7.18	0.118	13.1	46.9	1.23	-116	250
1240	22.75	7.17	0.119	13.0	37.4	0.91	-118	250
1242	22.75	7.18	0.118	13.0	35.9	0.78	-120	250
1244	22.75	7.21	0.118	12.9	36.4	0.66	-122	250
1246	22.75	7.24	0.117	13.1	38.0	0.60	-124	250
1248	22.75	7.25	0.117	130	41.4	0.55	-125	250
1250	22.75	7.28	0.117	13.0	42.9	0.53	-126	250
1252	22.75	7.28	0.117	13.0	41.0	0.51	-127	250

Sample Time: 1300 Sample ID: 732M8633HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782VMW-87 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: cloudy / 70

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ft. (optional)

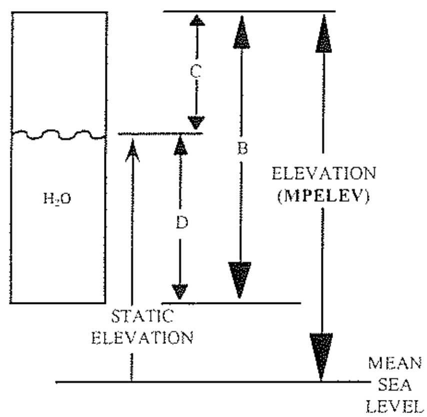
Measured Water Level Depth (C) (**STATDEP**) 23.64 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 5.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0928	23.64	6.90	79.4	13.7	92.6	4.61	-55	300
0930	23.64	6.84	82.5	12.7	45.1	2.46	-94	300
0932	23.64	6.87	82.9	12.5	30.0	1.35	-104	300
0934	23.64	6.91	83.2	12.4	24.5	0.95	-119	300
0936	23.64	6.94	83.3	12.4	25.0	0.75	-124	300
0938	23.64	6.99	83.4	12.3	24.9	0.73	-129	300
0940	23.64	7.02	83.3	12.3	18.8	0.60	-132	300
0942	23.64	7.05	83.3	12.3	17.6	0.56	-133	300
0944	23.64	7.07	83.3	12.3	17.7	0.55	-135	300

Sample Time: 0946 Sample ID: 782M8735HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02   Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782VMW-88   Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04   Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

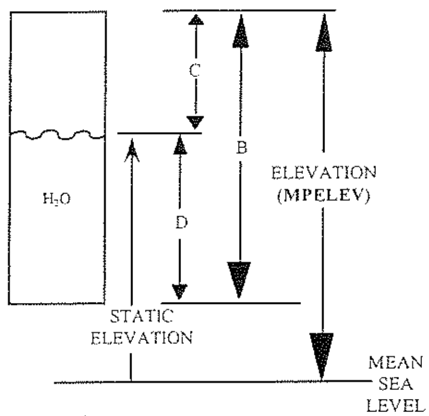
Measured Water Level Depth (C) (**STATDEP**) 26.82 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 37

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 5.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1059	26.87	7.29	76.7	16.5	33.1	4.14	-96	250
1101	26.87	7.25	77.9	15.4	30.8	1.51	-109	250
1103	26.87	7.25	79.2	14.8	21.8	0.90	-125	250
1105	26.87	7.26	79.6	14.6	21.3	0.63	-132	250
1107	26.87	7.28	79.1	14.6	19.2	0.55	-137	250
1109	26.87	7.29	78.4	14.6	18.8	0.47	-139	250
1111	26.87	7.31	77.8	14.6	19.0	0.44	-142	250
1113	26.87	7.29	77.5	14.5	19.0	0.46	-142	250

Sample Time: 1120   Sample ID: 782M88 37HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782VMW-89 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 78 / Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	[illegible]	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

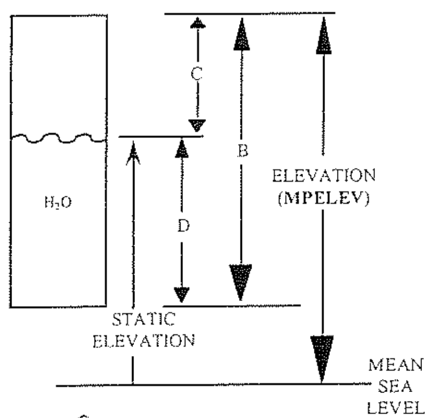
Measured Water Level Depth (C) (**STATDEP**) 24.30 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: Silty Brown / no odor

Dissolved Ferrous Iron (mg/L): 5

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1206	24.34	7.46	78.2	16.3	158.0	5.88	-77	220
1208	24.34	7.37	79.2	15.3	128.0	4.19	-103	220
1210	24.34	7.30	78.4	14.3	87.0	2.27	-116	250
1212	24.34	7.23	77.6	13.8	70.0	1.58	-120	250
1214	24.34	7.22	77.5	13.6	48.0	1.32	-123	250
1216	24.34	7.23	77.5	13.5	45.9	1.25	-124	250
1218	24.34	7.24	77.5	13.5	44.5	1.20	-126	250

Sample Time: ~~1220~~ 08 1220 Sample ID: 782M8935HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chi, Plume

Well No. (**LOCID**): WL-782MW-91 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70 / sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

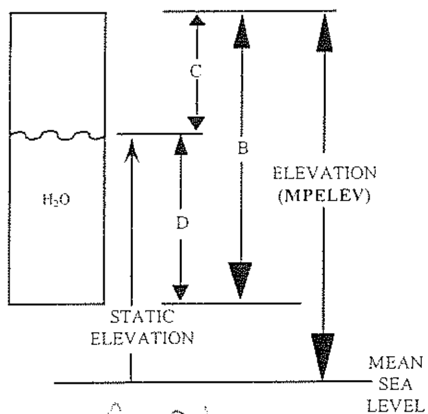
Measured Water Level Depth (C) (**STATDEP**) 19.22 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: clear / solvent odor

Dissolved Ferrous Iron (mg/L): 4.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1528	19.31	7.01	0.184	17.5	93.1	1.54	-117	300
1530	19.31	6.98	0.181	17.0	56.6	0.70	-124	250
1532	19.31	6.98	0.178	16.9	47.8	0.51	-128	300
1534	19.31	6.99	0.178	16.9	53.6	0.47	-131	300
1536	19.31	6.99	0.180	16.9	38.0	0.43	-134	300
1538	19.31	7.02	0.177	16.9	34.1	0.43	-136	300
1540	19.31	7.08	0.180	17.0	31.5	0.42	-138	300
1542	19.31	7.10	0.179	16.9	30.4	0.43	-139	300

Sample Time: 1550 Sample ID: 782MW91 27HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): chl. Plume

Well No. (**LOCID**): WL-782UMW-92 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

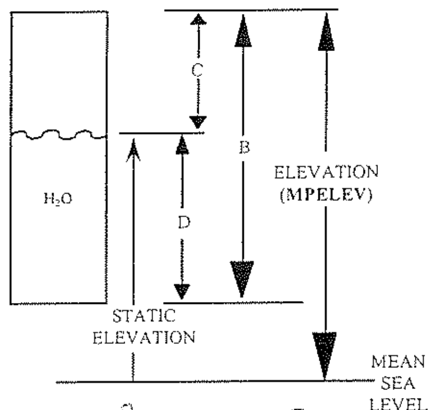
Measured Water Level Depth (C) (**STATDEP**) 21.70 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ~~35~~ DB ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 3.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1452	21.75	7.63	73.6	17.4	73.8	5.61	-60	300
1454	"	7.28	77.1	16.0	45.5	2.91	-114	300
1456	"	7.13	78.0	15.2	49.2	1.38	-117	300
1458	"	7.09	77.9	15.1	46.9	1.00	-119	300
1500	"	7.10	77.9	15.0	39.0	0.86	-121	300
1502	"	7.12	78.0	15.0	34.0	0.80	-123	300
1504	"	7.13	78.0	15.0	32.1	0.79	-124	300
1506	"	7.14	78.0	14.9	31.6	0.75	-125	300

Sample Time: 1510 Sample ID: 978MW9235HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-09-02 Sampled by: PC JD

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782UMW-94 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-21-04 Weather: 65

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

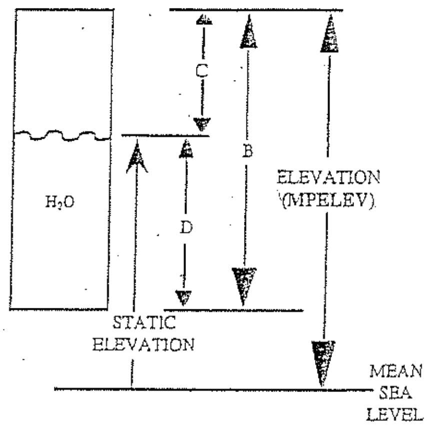
Measured Water Level Depth (C) (STATDEP) 21.74 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 1.3

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1535	21.85	7.84	89	19.0	10	5.10	72	100
1539	↓	7.71	94	16.7	8	2.73	60	↓
1543		7.61	95	16.0	11	2.00	-67	
1547		7.55	96	15.7	17	1.59	-108	
1551		7.50	96	15.5	19	1.20	-129	
1555		7.46	96	15.3	23	0.98	-140	
1559		7.43	96	15.2	22	0.83	-147	
1603		7.42	96	15.2	22	0.76	-149	
~~[illegible]~~								

Sample Time: 1609 Sample ID: 782m9440HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782VMW-96 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) __________ ft. (optional)

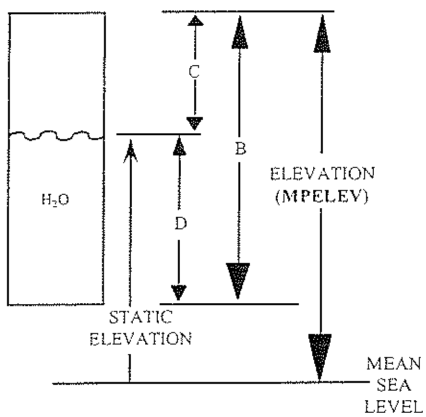
Measured Water Level Depth (C) (**STATDEP**) 21.23 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 37

Depth during Purging/Sampling: __________ (provide range) ft

Comments (re: Depth during purging/sampling): __________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 4

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1423	21.23	7.72	64.0	17.2	24.8	557	-44	225
1425	21.23	7.43	67.8	~~2~~ 16.0	20.8	2.81	-90	225
1427	21.23	7.33	69.4	16.0	21.5	1.78	-98	225
1429	21.23	7.30	69.3	15.7	21.5	1.33	-98	225
1431	21.23	7.31	69.5	15.6	23.0	0.99	-102	225
1433	21.23	7.32	69.4	15.4	21.8	0.95	-103	225
1435	21.23	7.33	69.2	15.5	23.4	0.94	-104	225

Sample Time: 1440 Sample ID: 782MW9637HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-78MW-97 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

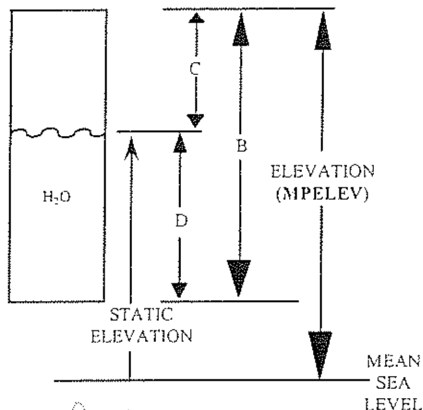
Measured Water Level Depth (C) (**STATDEP**) 18.69 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 31

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1604	18.70	7.51	52.0	14.0	85.7	6.73	-24	400
1605	"	7.36	50.6	13.6	77.4	5.29	-8	400
1606	"	7.10	49.6	12.9	72.0	3.10	15	400
1607	"	6.91	49.0	12.6	56.3	2.01	26	400
1608	"	6.86	49.3	12.3	49.4	1.40	36	400
1609	"	6.84	50.6	12.2	48.0	0.98	42	400
1610	"	6.84	51.0	12.3	49.7	0.89	44	400
1611	"	6.84	52.1	12.2	50.4	0.77	47	400
1612	"	6.84	52.1	12.2	48.9	0.75	48	400
1613	"	6.84	52.5	12.2	49.0	0.72	48	400

Sample Time: 1616 Sample ID: 78AM9731HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02　　Sampled by: PC JD

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782VMW-100　　Well Diameter (SDIAM): 2

Date (LOGDATE): 9-21-04　　Weather: 65

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

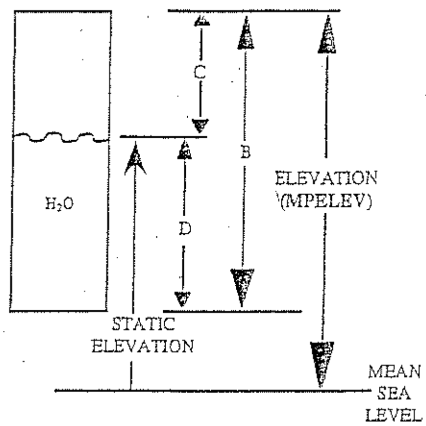
Measured Water Level Depth (C) (STATDEP) 15.64 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 25

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): Compromise draw down



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: organic matter - orange - no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1143	16.04	6.92	40	16.9	>999	2.98	120	100
1147		6.81	43	17.0	>999	2.85	122	
1151		6.85	45	16.7	>999	1.03	112	
1155		6.88	45	16.6	>999	0.79	100	
1159		6.90	45	16.6	>999	0.84	86	
1203		6.94	45	16.7	>999	0.80	69	
1207		6.97	45	16.8	>999	0.78	57	
1211		7.01	45	17.0	>999	0.74	41	
1215		7.04	49	17.1	>999	0.74	31	
1219		7.06	45	17.0	850	0.68	23	
1223		7.08	45	17.0	940	0.75	20	

Sample Time: 1223　　Sample ID: 782M10025HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC JD

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): WL-782VMW-101 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9/21/04 Weather: Sunny, 60's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) 9.79 ft. (optional)

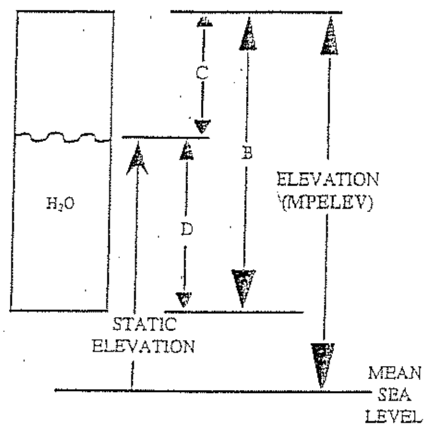
Measured Water Level Depth (C) (STATDEP) ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 18

Depth during Purging/Sampling: 9.79 - 9.88 ft (provide range)

Comments (re: Depth during purging/sampling): ____



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, Chlorine odor, No sheen

Dissolved Ferrous Iron (mg/L): 4.4

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1019	9.81	6.81	43	13.5	41	3.69	-62	400
1020	9.81	6.79	43	13.2	38	2.78	-75	400
1021		6.78	44	13.1	51	1.62	-93	
1022		6.74	45	12.9	23	1.16	-103	
1023		6.75	45	12.9	18	0.92	-109	
1024		6.76	46	13.0	13	0.80	-114	
1025		6.77	46	12.9	11	0.72	-118	
1026		6.78	46	13.0	12	0.68	-121	
1027		6.78	46	13.1	11	0.65	-124	
1028		6.79	46	12.9	11	0.63	-125	

Sample Time: 1031 Sample ID: 782M10118HA HD HC HX HS

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: JD PC

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782VMW-102 Well Diameter (SDIAM): 2"

Date (LOGDATE): 9/21/04 Weather: Sunny, Breezy, 60's

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

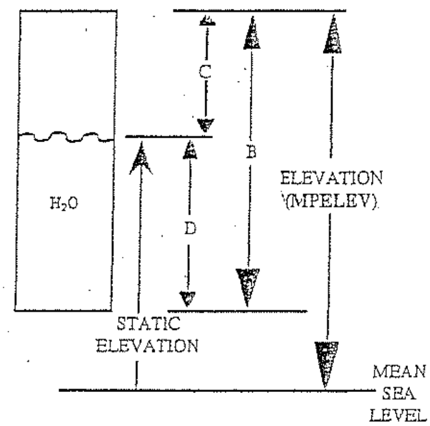
Measured Water Level Depth (C) (STATDEP) 8.75 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 19

Depth during Purging/Sampling: ________ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear, No odor.

Dissolved Ferrous Iron (mg/L): 4.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1359	8.75	6.86	66	12.7	120	1.88	-99	400
1400	↓	6.69	66	12.6	88	1.04	-106	↓
1401		6.63	66	12.5	63	0.77	-112	
1402		6.62	66	12.5	45	0.63	-116	
1403		6.62	.67	12.4	38	0.57	-119	
1404		6.61	66	12.4	35	0.54	-121	
1405		6.60	66	12.2	36	0.50	-122	
1406		6.59	66	12.2	33	0.49	-123	
1407		6.57	66	12.3	30	0.47	-124	

Sample Time: 1409 Sample ID: 782M10219HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-64-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782UMW-104 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-21-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) __________ ft. (optional)

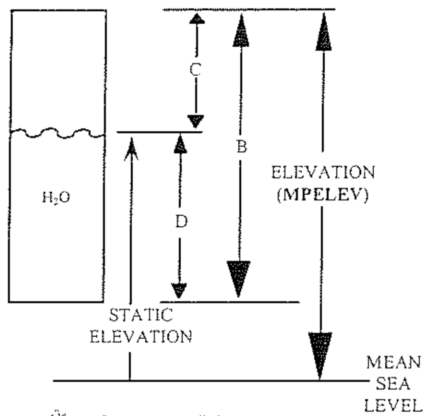
Measured Water Level Depth (C) (**STATDEP**) 17.60 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 28

Depth during Purging/Sampling: __________ ft (provide range)

Comments (re: Depth during purging/sampling): __________



Purge Date and Method: BLADDER PUMP 9-21-04

Physical Appearance/Comments: clear / solvent ~~no~~ odor

Dissolved Ferrous Iron (mg/L): 5.0

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1634	17.70	7.33	44.0	17.4	31.0	5.62	-96	150
1637	17.7	7.32	43.4	16.7	30.0	3.50	-106	150
1640		7.31	43.5	16.5	31.2	2.07	-118	150
1643	↓	7.31	43.9	16.4	30.4	1.78	-122	150
1646		7.33	44.0	16.4	30.5	1.52	-124	150
1649		7.36	44.4	16.5	31.4	1.28	-127	150
1652		7.42	44.0	16.8	31.1	1.15	-129	150
1655		7.43	44.7	17.4	29.4	1.04	-133	150
1658		7.43	44.5	17.6	28.2	.99	-134	150
1701		7.43	44.5	17.8	28.0	.96	-135	150

Sample Time: 1700 Sample ID: 782M10428HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: R JD

Location and Site Code (SITEID): AP2 Chlor Plume

Well No. (LOCID): AP2MW-3 Well Diameter (SDIAM): 2

Date (LOGDATE): 9/21/09 Weather: 63, Sunny

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

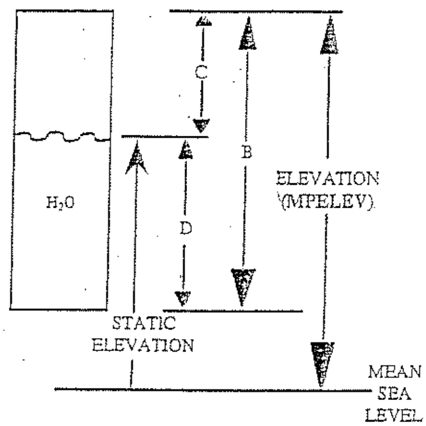
Measured Water Level Depth (C) (STATDEP) 19.78 ft.

Length of Static Water Column (D) = ____ - ____ = ____ ft. (optional)
(B) (C) (D)

Pump Intake Depth (ft): 27

Depth during Purging/Sampling: 19.78 – 19.83 ft
(provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 2.2

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
928	19.78	5.97	73	12.1	50	1.90	81	400
929		6.08	73	11.6	40	1.13	37	
930		6.14	73	11.5	32	0.87	19	
931		6.19	73	11.5	25	0.69	1	
932		6.21	74	11.4	24	0.62	-15	
933		6.23	74	11.4	14	0.53	-44	
0934		6.24	74	11.4	12	0.50	-56	
0935		6.26	74	11.4	12	0.50	-65	
0936		6.28	74	11.4	11	0.47	-76	
0937		6.30	74	11.4	11	0.45	-82	
0938		6.31	74	11.4	11	0.43	-87	
0939	19.78	6.33	74	11.4	11	0.41	-92	400

Sample Time: 0946 Sample ID: AP2MO327HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

Page __of__

WELL PURGING & SAMPLING FORM

Project: 32-04-02 Sampled by: JD JK

Location and Site Code (SITEID): Chlor. Plume

Well No. (LOCID): SL-782SW-1D Well Diameter (SDIAM): ——

Date (LOGDATE): 9/21/04 Weather: Overcast, Breezy, 78°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

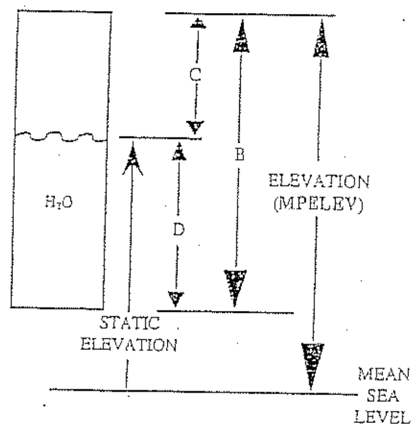
Measured Well Depth (B) (TOTDEPTH) ______ ft.

Measured Water Level Depth (C) (STATDEP) ______ ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Total Purge Volume = ______ gal (min. of 3 well volumes)



Purge Date and Method: Surface Water Grab Stainless Steel cup

Physical Appearance/Comments: Clear no odor

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 5%	±1°C			
Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
1455		7.76	32	15.2	17	9.38	71

Sample Time: 1457 Sample ID: 782S11501HA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-0402 Sampled by: JD PC

Location and Site Code (**SITEID**): Chlor. Plume

Well No. (**LOCID**): SL-782SW-118 Well Diameter (**SDIAM**): —

Date (**LOGDATE**): 9/21/04 Weather: Overcast, Breezy, 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

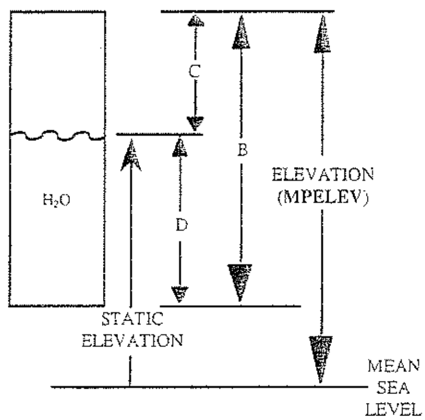
Measured Well Depth (B) (**TOTDEPTH**) — ft.

Measured Water Level Depth (C) (**STATDEP**) — ft.

Length of Static Water Column (D) = ________ (B) - ________ (C) = ________ (D) ft.

Casing Water Volume (E) = ________ (A) x ________ (D) = ________ gal

Minimum Purge Volume = — gal (3 well volumes)



Purge Date and Method: Surface Water Grab

Physical Appearance/Comments: Clear no odor.

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
Allowable Range:		± 0.1	± 5%	±1°C			
1443		7.57	33	15.3	20	9.61	88

Sample Time: 1445 Sample ID: 782S11801HA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-04-02 Sampled by: JD K

Location and Site Code (**SITEID**): Cinder Plume

Well No. (**LOCID**): SL-782SW-119 Well Diameter (**SDIAM**): —

Date (**LOGDATE**): 9/21/04 Weather: Sunny, Breezy, 70°

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

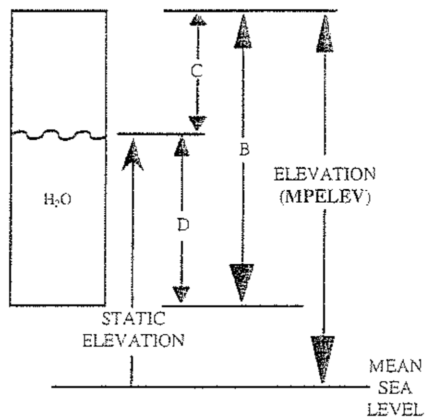
Measured Well Depth (B) (**TOTDEPTH**) — ft.

Measured Water Level Depth (C) (**STATDEP**) — ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Minimum Purge Volume = — gal (3 well volumes)



Purge Date and Method: Surface Water grab

Physical Appearance/Comments: Clear no odor

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
Allowable Range:		± 0.1	± 5%	±1°C			
1435		7.54	33	15.3	18	9.66	84

Sample Time: 1437 Sample ID: 782S11901HA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM

Project: 32-04-02 Sampled by: JD PC

Location and Site Code (**SITEID**): Chlor. Plume

Well No. (**LOCID**): SL-782SW-120 Well Diameter (**SDIAM**): ———

Date (**LOGDATE**): 9/21/04 Weather: Sunny, Breezy, 70

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

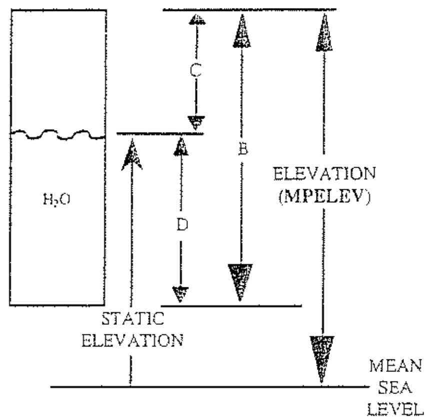
Measured Well Depth (B) (**TOTDEPTH**) ____________ ft.

Measured Water Level Depth (C) (**STATDEP**) ———— ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft.

Casing Water Volume (E) = ______ (A) x ______ (D) = ______ gal

Minimum Purge Volume = ______ gal (3 well volumes)



Purge Date and Method: Surface Water grab

Physical Appearance/Comments: Clear no odor

FIELD MEASUREMENTS:

Time	Volume Removed (gal)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)
Allowable Range:		± 0.1	± 5%	±1°C			
1423		7.41	34	15.7	20	9.61	64

Sample Time: 1425 Sample ID: 782S12001HA

Note: Attempt to get at least 5 sets of field measurements during purging. Sample may be collected after 3 to 5 well volumes have been removed and parameters have stabilized. Sample may be collected after 6 well volumes if parameters do not stabilize. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): UL-782MW-6D Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-22-04 Weather: 75 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

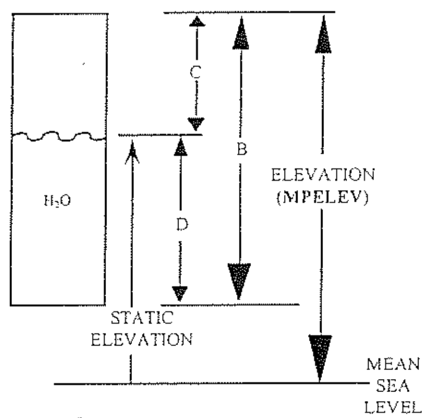
Measured Water Level Depth (C) (**STATDEP**) 23.80 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 43

Depth during Purging/Sampling: ____________ (provide range) ft

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9-22-04

Physical Appearance/Comments: silty Brown to clear / no odor

Dissolved Ferrous Iron (mg/L): 4.2

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1; EC ± 3%; Turbidity ± 10%; D.O. ± 10%; ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1439	23.8	7.41	89.8	15.4	33.7	3.26	-120	400
1440		7.33	91.5	14.6	28.8	1.40	-124	400
1441		7.30	91.8	14.0	19.3	.90	-128	
1442		7.28	91.9	14.0	20.3	.81	-128	
1443		7.25	92.1	13.8	17.0	.71	-129	
1444		7.24	91.7	13.8	18.6	.64	-130	
1445		7.23	91.4	13.7	22.1	.59	-131	
1446		7.23	91.0	13.7	22.8	.57	-131	
1447		7.23	91.1	13.7	22.7	.56	-132	

Sample Time: 1500 Sample ID: 782M6D43HA, HC, HK, HD, HS

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC JD

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): 782mw-6R2 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-22-04 Weather: 70

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

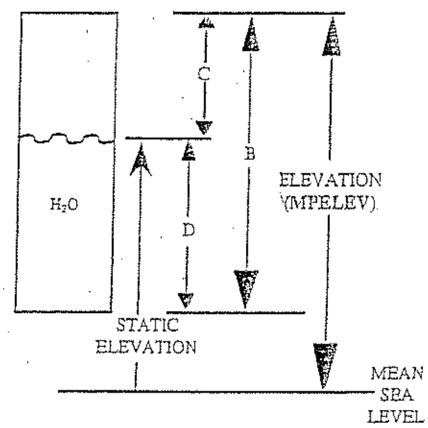
Measured Water Level Depth (C) (STATDEP) 23.68 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 30

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: cloudy no odor

Dissolved Ferrous Iron (mg/L): 2.5

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1203	23.68	6.69	70	15.5	310	3.57	86	400
1204		6.57	65	14.0	380	1.77	81	
1205		6.52	66	14.2	440	1.25	41	
1206		6.45	67	13.5	460	1.04	-3	
1207		6.42	68	13.6	490	0.90	-32	
1208		6.42	69	13.4	540	0.89	-39	
1209		6.40	69	13.3	530	0.80	-44	

Sample Time: 1211 Sample ID: 782M6R230HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC JD

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782UMW-76 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-22-04 Weather: 65

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

Measured Water Level Depth (C) (STATDEP) 20.05 ft.

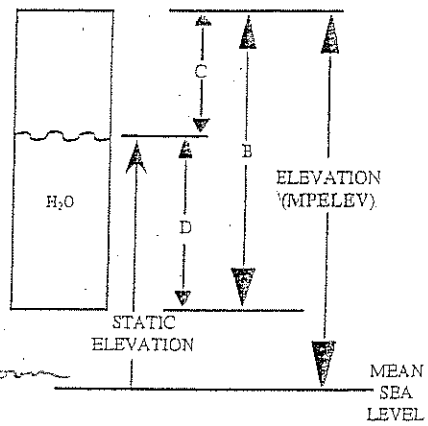
Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 38

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________

Sacrifice Draw down to establish flow rate



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear Chloride odor

Dissolved Ferrous Iron (mg/L): 2.6

FIELD MEASUREMENTS:

Allowable Range: ± 0.1 (pH), ± 3% (EC), ± 10% (Turbidity), ± 10% (D.O.), ± 10mV (ORP)

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
953	20.37	7.42	56	17.8	60	8.05	79	100
957		7.15	59	16.9	70	5.03	-53	200
959		6.97	62	15.8	52	4.02	-88	
1001		6.79	64	15.6	46	2.82	-104	
1003		6.76	64	15.4	33	2.13	-111	
1005		6.75	64	15.2	29	2.00	-114	
1002		6.75	64	15.1	27	1.91	-115	

Sample Time: 1011 Sample ID: 782M7638HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782VMW - 78 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-22-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

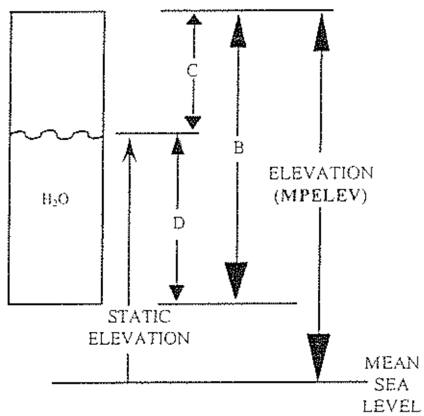
Measured Water Level Depth (C) (**STATDEP**) 23.78 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 40

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-22-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 3.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1335	23.78	7.93	75.5	14.3	186.0	3.53	-122	400
1336	23.78	7.74	75.3	14.4	183.0	2.71	-124	400
1337	23.78	7.62	76.0	14.3	163.0	1.88	-126	400
1338	23.78	7.54	76.3	14.4	150.0	1.33	-129	400
1339	"	7.51	76.5	14.3	124.0	1.12	-131	400
1340	"	7.51	76.8	14.1	111.0	1.00	-133	400
1341	"	7.52	76.5	13.9	121.0	1.05	-134	400
1342	"	7.52	76.7	14.0	120.0	1.10	-134	400

Sample Time: 1350 Sample ID: 782M7840HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC JD

Location and Site Code (SITEID): Chlor Plom

Well No. (LOCID): WL-782UMV-80 Well Diameter (SDIAM): 2

Date (LOGDATE): 9.22.04 Weather: 65

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____________ ft. (optional)

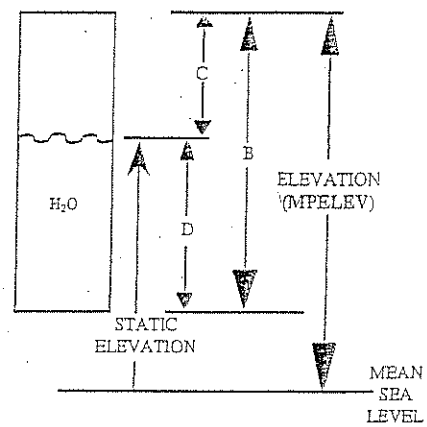
Measured Water Level Depth (C) (STATDEP) 18.65 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 3.2

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
910	18.74	6.02	71	14.2	110	5.49	173	400
911		6.09	72	13.6	100	3.65	129	
912		6.14	72	13.5	83	2.48	105	
913		6.20	72	13.4	68	1.89	80	
914		6.26	72	13.3	50	1.37	49	
915		6.30	72	13.3	43	1.15	32	
916		6.31	72	13.8	31	1.06	26	
917		6.31	72	13.2	20	1.01	24	
918		6.32	72	13.3	18	1.01	22	

Sample Time: 919 Sample ID: 782M8033HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-782UMW-81 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-22-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ____________ ft. (optional)

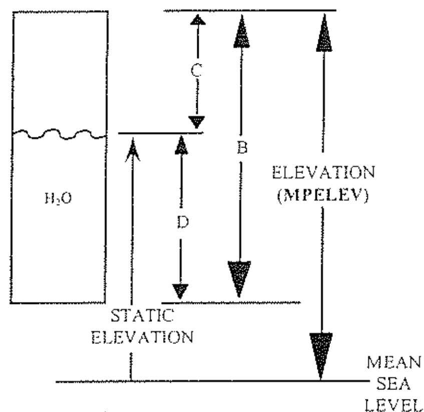
Measured Water Level Depth (C) (**STATDEP**) 20.90 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 46

Depth during Purging/Sampling: ____________ ft (provide range)

Comments (re: Depth during purging/sampling): ____________



Purge Date and Method: BLADDER PUMP 9-22-04

Physical Appearance/Comments: clear / no odor

Dissolved Ferrous Iron (mg/L): 1.6

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
0916	21.0	7.20	65.3	15.4	7.3	1.96	-73	100
0920	21.0	7.45	65.3	15.0	4.9	1.54	-101	100
0923	21.0	7.59	63.3	14.8	7.1	1.45	-114	150
0926	21.0	7.69	62.2	14.6	4.3	1.25	-112	150
0929	21.0	7.76	61.6	14.6	4.0	1.02	-130	150
0932	21.0	7.79	61.4	14.5	3.6	0.95	-135	150
0935	21.0	7.83	61.2	14.5	4.0	0.91	-140	150

Sample Time: 0940 Sample ID: 782MR146HA, HC, HX

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-82 Sampled by: PC JD

Location and Site Code (SITEID): Chlor Plome

Well No. (LOCID): WL-782Vmw-83 Well Diameter (SDIAM): 2

Date (LOGDATE): 7-22-04 Weather: 65

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ft. (optional)

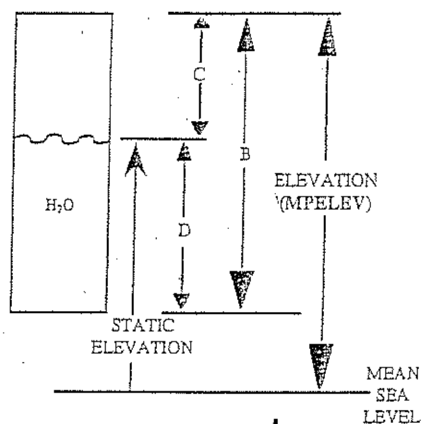
Measured Water Level Depth (C) (STATDEP) 18.11 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: ~~BLADDER~~ PUMP Peristaltic + Bailer

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range:		±0.1	±3%		±10%	±10%	±10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1333	18.19	7.47	52	15.5	130	3.39	129	400
1334		7.42	51	15.2	170	1.84	130	
1335		7.28	50	15.0	62	0.96	134	
1336		7.20	50	14.9	52	0.78	137	
1337		7.10	50	14.8	40	0.67	142	
1338		6.98	50	14.8	37	0.60	146	
1339		6.96	50	14.8	13	0.58	146	
1340		6.94	51	14.8	7	0.56	146	

Sample Time: 1341 Sample ID: 782m8333HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: PC JD

Location and Site Code (SITEID): Chlor Plume

Well No. (LOCID): WL-782 UMW-90 Well Diameter (SDIAM): 2

Date (LOGDATE): 7-22-04 Weather: 70

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ____ft. (optional)

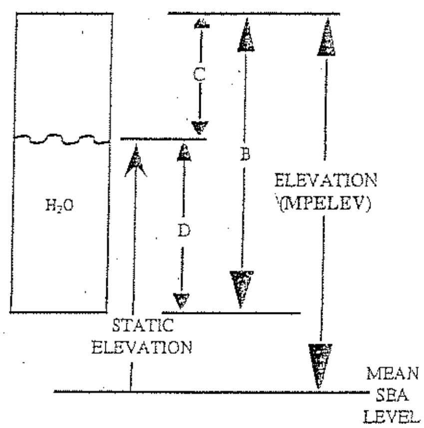
Measured Water Level Depth (C) (STATDEP) 24.66 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 29

Depth during Purging/Sampling: ____ ft (provide range)

Comments (re: Depth during purging/sampling): 24.66 - 24.70



24.50 top of Product

Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear petro odor

Dissolved Ferrous Iron (mg/L): 2.8

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1, EC ± 3%, Turbidity ± 10%, D.O. ± 10%, ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1420	24.66	6.50	42	15.0	11	1.44	-98	200
1422	24.70	6.32	38	14.9	3	1.02	-98	200
1424	24.70	6.23	37	14.9	0	0.84	-102	200
1426	24.70	6.23	38	14.7	0	0.77	-107	200
1428	24.70	6.22	38	14.9	0	0.72	-110	200
1430	24.70	6.22	39	14.9	0	0.70	-114	200

Sample Time: 1431 Sample ID: 782UM9029HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-64-62 Sampled by: PC JD

Location and Site Code (SITEID): Chlor plume

Well No. (LOCID): WL-782UMW-93 Well Diameter (SDIAM): 2

Date (LOGDATE): 9-22-04 Weather: 65

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (TOTDEPTH) ________ ft. (optional)

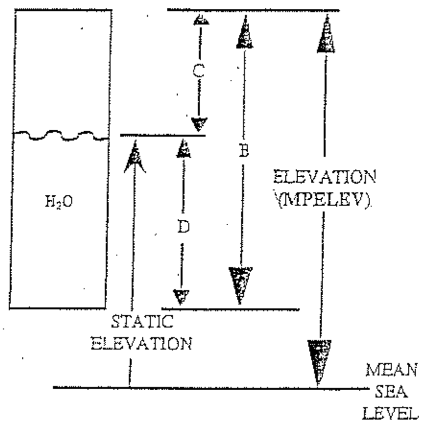
Measured Water Level Depth (C) (STATDEP) 21.03 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 35

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP

Physical Appearance/Comments: Clear no odor

Dissolved Ferrous Iron (mg/L): 3.8

FIELD MEASUREMENTS:

Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1125	21.08	7.27	59	18.7	22	8.14	129	100
1129	21.14	6.91	62	16.0	24	4.15	-60	200
1131		6.74	63	15.0	21	2.81	-85	
1133		6.69	64	14.5	16	1.99	-97	
1135		6.64	65	14.5	10	1.43	-103	
1137		6.61	65	14.4	9	1.30	-105	
1139		6.60	65	14.5	8	1.32	-106	

Sample Time: 1141 Sample ID: 782m9335HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB/JP

Location and Site Code (**SITEID**): CW. Plume

Well No. (**LOCID**): WL-782VMW-105B Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-22-04 Weather: 70 / sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

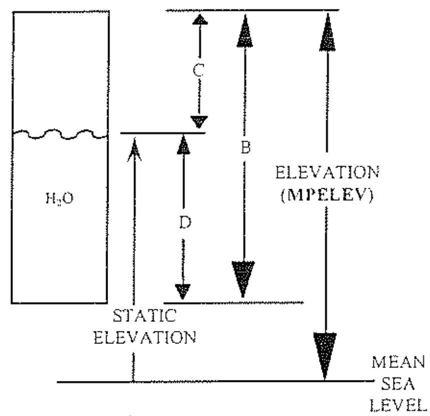
Measured Water Level Depth (C) (**STATDEP**) 19.06 ft.

Length of Static Water Column (D) = ____ (B) - ____ (C) = ____ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ________ ft (provide range)

Comments (re: Depth during purging/sampling): ________



Purge Date and Method: BLADDER PUMP 9-22-04

Physical Appearance/Comments: silty brown to clear / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Allowable Range: pH ± 0.1; EC ± 3%; Turbidity ± 10%; D.O. ± 10%; ORP ± 10mV

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
1020	19.16	7.84	53.4	16.4	60.4	4.78	54	200
1022	19.13	7.64	51.6	15.0	84.8	2.35	-14	200
1024	19.13	7.60	50.5	14.8	100	1.66	-38	200
1026	19.13	7.58	50.4	14.6	112.0	1.20	-56	200
1028	19.13	7.60	50.4	14.6	120.0	1.06	-63	200
1030	19.13	7.64	50.6	14.6	117.0	1.04	-67	200
switch battery								
~~1036~~	~~19.13~~	~~7.74~~	~~49.3~~		~~124.0~~	DB		
1040	19.16	7.75	50.6	16.0	112.0	2.24	-70	200
1042	19.16	7.77	51.2	15.5	108.0	1.30	-71	200
1044	19.16	7.75	51.4	14.9	110.0	0.95	-71	200

Sample Time: ________ Sample ID: 782VM105B33HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / TP

Location and Site Code (**SITEID**): LHL Plume

Well No. (**LOCID**): WL-782UMW-1036 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-22-04 Weather: 70 / Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ______ ft. (optional)

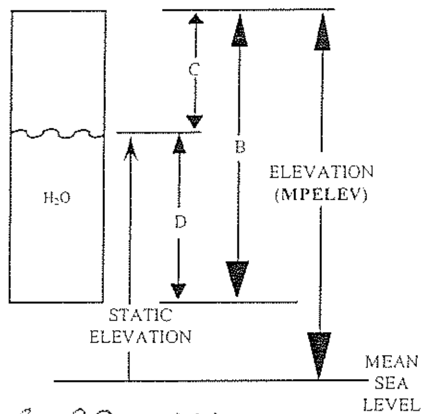
Measured Water Level Depth (C) (**STATDEP**) 19.06 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 33

Depth during Purging/Sampling: ______ ft (provide range)

Comments (re: Depth during purging/sampling): ______



Purge Date and Method: BLADDER PUMP 9-22-04

Physical Appearance/Comments: ~~Dr~~ clear to silty / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1046	19.66	7.75	51.3	14.8	109.0	0.79	-72	200
1048	19.16	7.75	51.3	14.7	104.0	0.76	-72	200
1050	19.16	7.75	51.2	14.7	98.4	0.73	-72	200
1052	19.16	7.76	51.4	14.6	81.4	0.68	-72	200
1054	19.16	7.76	51.4	14.6	85.2	0.66	-73	200
1056	19.16	7.78	51.6	14.6	82.5	0.63	-74	200

Sample Time: 1058 Sample ID: 782M10533HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

WELL PURGING & SAMPLING FORM
(LOW FLOW)

Project: 32-04-02 Sampled by: DB / JP

Location and Site Code (**SITEID**): Chl. Plume

Well No. (**LOCID**): WL-786MW-30 Well Diameter (**SDIAM**): 2"

Date (**LOGDATE**): 9-22-04 Weather: 800 70° / Sun

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

Measured Well Depth (B) (**TOTDEPTH**) ________ ft. (optional)

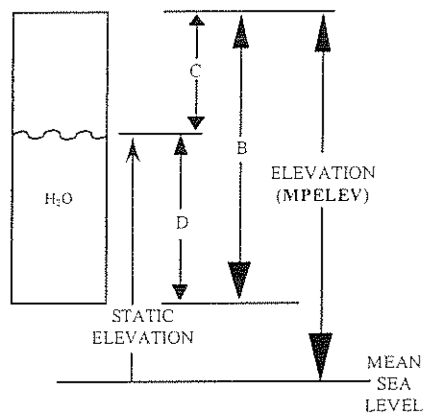
Measured Water Level Depth (C) (**STATDEP**) ~~14~~ 15.02 ft.

Length of Static Water Column (D) = ______ (B) - ______ (C) = ______ (D) ft. (optional)

Pump Intake Depth (ft): 22

Depth during Purging/Sampling: ________________ ft (provide range)

Comments (re: Depth during purging/sampling): ________________



Purge Date and Method: BLADDER PUMP 9-22-04

Physical Appearance/Comments: silty brown / no odor

Dissolved Ferrous Iron (mg/L): 0.0

FIELD MEASUREMENTS:

Time	Depth to Water (ft BTOC)	pH	EC (mS/cm)	Temp. (F or C)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	Flow Rate (mL/min)
Allowable Range:		± 0.1	± 3%		± 10%	± 10%	± 10mV	
1259	15.18	7.67	32.7	15.0	201.0	8.23	151	200
1301	"	7.63	32.6	14.3	161.0	7.39	150	200
1303	"	7.57	32.4	14.1	141.0	7.24	154	200
1305	"	7.55	32.3	13.9	97.0	7.18	154	200
1307	"	7.56	32.3	13.8	80.0	7.14	152	200
1309	"	7.56	32.3	13.8	79.1	7.09	151	200
1311	"	7.55	32.2	13.8	75.4	7.10	149	200

Sample Time: 1312 Sample ID: 786M3022HA

Note: Maintain a flow rate of 200-500 mL/min during purging. Purge a minimum of 1L between readings. Collect samples at a flow rate between 100-250 mL/min. VOC and gas sensitive (e.g. alkalinity, Fe^{2+}, CH_4, H_2S) parameters should be sampled first.

APPENDIX C

ESTIMATED PORE VOLUMES NEEDED FOR GROUNDWATER TREATMENT USING MODIFIED BATCH FLUSH MODEL

APPENDIX C

ESTIMATED PORE VOLUMES NEEDED FOR GROUNDWATER TREATMENT USING MODIFIED BATCH FLUSH MODEL

The approach used for estimating the duration of treatment operations associated with the groundwater at Griffiss AFB Aprons Site involved the application of "Batch Flush" model described in US. EPA's "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites, December 1998." However, the original model was modified and extended for this report to give both a closed-form solution as well as to include source biodegradation, which was not present in the EPA model.

The groundwater contained in a given volume of saturated aquifer is considered to constitute one "batch". The "Batch Flush" model assumes that equilibrium conditions are attained (for the partition of a chemical between the soil and water) prior to the "flushing" of every batch of water. This equilibrium model is assumed to be adequate for the level of alternatives analysis (-30% to +50% cost range) required by the FS.

The EPA Batch Flush model can be expressed as:

$$Cs_i = Cs_{i-1} - Cw_i E/d, \qquad \text{---- Eq (1)}$$

where:

- Cs_i = soil concentration after i flushes, [ug contaminant/kg soil];
- Cs_{i-1} = soil concentration after previous ($i\text{-}l^{th}$) flush, [µg contaminant/kg soil];
- Cw_i = equilibrium concentration in groundwater from i^{th} flush, [µg contaminant/l water];
- E = effective porosity (assumed to be 0.25), [l voids/l total volume]; and
- d = soil bulk density (assumed to be 2.0), [kg soil/l total volume].

To account for source biodegradation, assuming first-order degradation kinetics for contaminant in adsorbed (soil) phase only (dissolved contamination will be transported away undegraded) and applying mass balance (and ignoring potential daughter products), Eq (1) will be modified as follows:

$$Cs_i = Cs_{i-1}\,[\exp(-kT)] - Cw_i E/d, \qquad \text{---- Eq (2)}$$

where:

- k = biodegradation rate constant, [per year]
  - = 0 (zero) for no biodegradation
  - = [ln (2)]/[half-life in years] ≈ 0.693/(half-life in years) for biodegradation; and
- T = time for one (1) flush, [year].

Substituting the equilibrium equation:

$$Cw_i = Cs_i/K_d, \qquad \text{---- Eq (3)}$$

<u>where:</u>

K_d = soil-water partition coefficient of chemical, [l water/kg soil]
= Koc X foc;

Koc = organic carbon-water partition coefficient of chemical, [(ug adsorbed/kg organic carbon)/(ug dissolved/ l water)]; and
foc = organic carbon content of soil, [kg organic carbon/kg soil]

into Eq (2), the following equation is obtained:

$$Cs_i = Cs_{(i-1)} [\exp(-kT)] (1+E/K_d d)^{-1}, \qquad \text{---- Eq (4)}$$

The expression for the number of pore volumes or "flushes" of water (n) which must be circulated through the contaminated zone to achieve clean-up standards (ARARs) can be derived as follows:

For 1 flush:

$$Cs_1 = Cs_0 [\exp(-kT)] (1+E/K_d d)^{-1}, \qquad \text{---- Eq (5)}$$

<u>where:</u>

Cs_1 = soil concentration after 1 flush, and
Cs_0 = initial soil concentration.

For 2 flushes:

$$Cs_2 = Cs_1 [\exp(-kT)] (1+E/K_d d)^{-1}$$
$$= \{Cs_0 [\exp(-kT)] (1+E/K_d d)^{-1}\} [\exp(-kT)] (1+E/K_d d)^{-1}, \text{ or}$$

$$Cs_2 = Cs_0 [\exp(-2kT)] (1+E/K_d d)^{-2}$$

For n flushes,

$$Cs_n = Cs_0 [\exp(-nkT)] [1+E/K_d d]^{-n}$$

Solving for "n" and using Eq (3):

$$n = \frac{\ln(Cs_n / Cs_0)}{\ln[(1 + E / K_d d)^{-1}] - kT} = \frac{\ln(Cw_n / Cw_0)}{\ln[(1 + E / K_d d)^{-1}] - kT} \qquad \text{---- Eq (6)}$$

From Eq (6), the expression for "n" can be written in terms of both soil concentrations [middle term in Eq (6)] and groundwater concentrations [last term in Eq (6)]. For projects involving remediation of contaminated soil by flushing/washing, clean-up standards (ARARs) are usually specified for soils (i.e., Cs_n's are known) and the middle term of Eq (6) can be used for determining "n". On the other hand, for projects involving groundwater remediation, clean-up standards (ARARs) are usually specified for groundwater (i.e., Cw_n's are known) and the last term of Eq (6) can be used for determining "n". In this FS, Eq (6) will be applied to groundwater remediation.

APPENDIX D

ESTIMATES OF DISSOLVED MASS USING MAROS AND CALCULATION OF EFFECTIVE CONCENTRATIONS FOR TCE, CIS-DCE AND VC PLUMES

APPENDIX D
NOSEDOCKS / APRON 2 CHLORINATED PLUME

ESTIMATES OF DISSOLVED MASS USING MAROS AND CALCULATION OF EFFECTIVE CONCENTRATIONS FOR TCE, cis-DCE, and VC PLUMES

	TCE PLUME			DCE PLUME			VC PLUME				
	Thickness (Ft.) = 14			Thickness (Ft.) = 23			Thickness (Ft.) = 23				
Date	Dissolved Mass (Kg)	Area (Sq. Ft.)	Effective Conc.* (ug/l)	Dissolved Mass (Kg)	Area (Sq. Ft.)	Effective Conc.* (ug/l)	Dissolved Mass (Kg)	Area (Sq. Ft.)	Effective Conc.* (ug/l)	Total Dissolved Mass (Kg)	Total Area of Plumes (Sq. Ft.)
Feb-02	0.21	288,419	7	0.65	530,362	8	0.83	986,039	5	1.69	1,804,820
Feb-03	0.16	282,671	6	0.33	453,031	4	1.26	1,055,959	7	1.75	1,791,662
Jun-03	0.39	276,811	14	0.51	446,508	7	1.63	1,090,252	9	2.53	1,813,571
Sep-03	0.33	265,528	13	0.50	444,383	7	1.81	1,101,865	10	2.64	1,811,776
Dec-03	0.06	297,920	2	0.07	421,026	1	0.88	1,097,080	5	1.01	1,816,026
Mar-04	0.20	278,070	7	0.33	410,341	5	1.53	1,074,024	9	2.06	1,762,435
Jul-04	0.19	264,884	7	0.34	420,628	5	1.34	1,057,780	8	1.86	1,743,292
Sep-04	0.20	255,316	8	0.33	429,895	5	1.39	1,088,091	8	1.92	1,773,302

Porosity = 0.25

* Reverse calculations for effective concentration were performed using the following formula:
Effective concentration (ug/l) = [Dissolved Mass (Kg) * 10^9] / [Area (Sq. Ft.) * Thickness (Ft.) * Porosity * 28.32]

MAROS Site Results

Project: fs

User Name: Niels

Location: Griffiss AFB

State: New York

User Defined Site and Data Assumptions:

Hydrogeology and Plume Information:

Groundwater Seepage Velocity: 105.3 ft/yr

Current Plume Length: 2500 ft

Current Plume Widt 700 ft

Number of Tail Wells: 30

Number of Source Wells: 3

Source Information:

Source Treatment: In-situ Biodegradation

NAPL is not observed at this site.

Down-gradient Information:

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 100 ft

Down-gradient property: 100 ft

Distance from Source to Nearest:

Down-gradient receptor: 2600 ft

Down-gradient property: 2600 ft

Data Consolidation Assumptions:

Time Period: 2/1/2002 **to** 12/28/2004

Consolidation Period: No Time Consolidation

Consolidation Type: Median

Duplicate Consolidation: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value

Plume Information Weighting Assumptions:

Consolidation Step 1. Weight Plume Information by Chemical

Summary Weighting: Weighting Applied to All Chemicals Equally

Consolidation Step 2. Weight Well Information by Chemical

Well Weighting: No Weighting of Wells was Applied.

Chemical Weighting: No Weighting of Chemicals was Applied.

Note: These assumptions were made when consolidating the historical montoring data and lumping the Wells and COCs.

1. Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling before reassessment, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Level of Effort	Sampling Duration	Sampling Frequency	Sampling Density
cis-1,2-DICHLOROETHYLENE	S	PD	M	Remove treatment system if previously reducing concentatior	No Recommendation	37
TRICHLOROETHYLENE (TCE)	NT	PD	M	Remove treatment system if previously reducing concentatior	No Recommendation	37
VINYL CHLORIDE	NT	S	M	Remove treatment system if previously reducing concentatior	No Recommendation	37

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Level of Monitoring Effort Indicated by Analysi Moderate

2. Spatial Moment Analysis Results:

Moment Type	Consituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	cis-1,2-DICHLOROETHYLENE	0.63	-11	81.0%	S
	TRICHLOROETHYLENE (TCE)	0.67	-5	63.6%	S
	VINYL CHLORIDE	0.24	2	54.0%	NT
1st Moment: Distance to Source					
	cis-1,2-DICHLOROETHYLENE	0.21	4	61.9%	NT
	TRICHLOROETHYLENE (TCE)	0.32	12	87.0%	NT
	VINYL CHLORIDE	0.05	8	76.2%	NT
2nd Moment: Sigma XX					
	cis-1,2-DICHLOROETHYLENE	0.41	-2	54.0%	S
	TRICHLOROETHYLENE (TCE)	0.44	-2	54.0%	S
	VINYL CHLORIDE	0.17	-8	76.2%	S
2nd Moment: Sigma YY					
	cis-1,2-DICHLOROETHYLENE	0.31	-22	98.8%	D
	TRICHLOROETHYLENE (TCE)	0.36	-14	91.0%	PD
	VINYL CHLORIDE	0.37	-20	97.8%	D

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.25 **Saturated Thickness:** Variable

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

MAROS Spatial Moment Analysis Summary

Project: fs

Location: Griffiss AFB

User Name: Niels

State: New York

Effective Date	0th Moment Estimated Mass (Kg)	1st Moment (Center of Mass) Xc (ft)	Yc (ft)	Source Distance (ft)	2nd Moment (Spread) Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
cis-1,2-DICHLOROETHYLENE							
2/1/2002	6.5E-01	1,137,129	1,174,576	874	145,214	78,034	32
2/1/2003	3.3E-01	1,137,294	1,174,540	990	301,421	53,246	33
4/1/2003	0.0E+00						1
7/1/2003	5.1E-01	1,137,620	1,174,428	1,240	476,953	57,884	33
9/20/2003	5.0E-01	1,137,562	1,174,504	1,213	421,478	60,890	33
12/10/2003	6.8E-02	1,138,033	1,174,572	1,677	244,860	25,191	14
4/1/2004	3.3E-01	1,137,501	1,174,549	1,176	448,700	50,945	33
7/1/2004	3.4E-01	1,137,540	1,174,589	1,229	388,001	48,216	25
10/1/2004	3.3E-01	1,137,545	1,174,569	1,224	419,413	47,566	29
12/28/2004	1.7E-01	1,137,207	1,174,508	898	114,853	31,902	19
TRICHLOROETHYLENE (TCE)							
2/1/2002	2.1E-01	1,136,928	1,174,331	568	262,311	60,574	32
2/1/2003	1.6E-01	1,137,471	1,174,451	1,108	651,308	91,143	33
4/1/2003	0.0E+00						2
7/1/2003	3.9E-01	1,137,725	1,174,300	1,308	663,105	47,501	33
9/20/2003	3.3E-01	1,137,692	1,174,351	1,287	667,095	67,396	33
12/10/2003	6.0E-02	1,138,191	1,174,575	1,828	185,768	21,047	14
4/1/2004	2.0E-01	1,137,756	1,174,419	1,367	800,141	64,601	33
7/1/2004	1.9E-01	1,137,863	1,174,456	1,480	566,924	49,000	25
10/1/2004	2.0E-01	1,137,812	1,174,425	1,422	601,556	47,841	29
12/28/2004	6.4E-02	1,137,046	1,174,332	672	240,479	40,371	19
VINYL CHLORIDE							
2/1/2002	8.3E-01	1,137,611	1,174,649	1,319	196,279	35,926	32
2/1/2003	1.3E+00	1,137,748	1,174,638	1,437	235,344	23,315	33
7/1/2003	1.6E+00	1,137,822	1,174,583	1,483	275,389	37,570	33
9/20/2003	1.8E+00	1,137,806	1,174,623	1,484	256,477	30,096	33
12/10/2003	8.8E-01	1,137,911	1,174,636	1,585	159,439	11,656	14
4/1/2004	1.5E+00	1,137,803	1,174,647	1,491	225,992	23,723	33
7/1/2004	1.3E+00	1,137,830	1,174,657	1,519	239,655	22,404	25
10/1/2004	1.4E+00	1,137,765	1,174,647	1,456	224,166	21,070	29
12/28/2004	1.2E+00	1,137,733	1,174,646	1,427	170,191	13,573	19

Project: fs

Location: Griffiss AFB

User Name: Niels

State: New York

Moment Type	Consituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	cis-1,2-DICHLOROETHYLENE	0.63	-11	81.0%	S
	TRICHLOROETHYLENE (TCE)	0.67	-5	63.6%	S
	VINYL CHLORIDE	0.24	2	54.0%	NT
1st Moment: Distance to Source					
	cis-1,2-DICHLOROETHYLENE	0.21	4	61.9%	NT
	TRICHLOROETHYLENE (TCE)	0.32	12	87.0%	NT
	VINYL CHLORIDE	0.05	8	76.2%	NT
2nd Moment: Sigma XX					
	cis-1,2-DICHLOROETHYLENE	0.41	-2	54.0%	S
	TRICHLOROETHYLENE (TCE)	0.44	-2	54.0%	S
	VINYL CHLORIDE	0.17	-8	76.2%	S
2nd Moment: Sigma YY					
	cis-1,2-DICHLOROETHYLENE	0.31	-22	98.8%	D
	TRICHLOROETHYLENE (TCE)	0.36	-14	91.0%	PD
	VINYL CHLORIDE	0.37	-20	97.8%	D

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.25 **Saturated Thickness:** Variable

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

APPENDIX E

SITE-SPECIFIC RATE CONSTANT ESTIMATIONS FOR BIODEGRADATION OF TCE, DCE, AND VC

APPENDIX E
SITE-SPECIFIC RATE CONSTANT ESTIMATIONS
FOR BIODEGRADATION OF TCE, DCE, AND VC

Griffiss AFB Site - Nosedocks / Apron 2 Chlorinated Plume
Rate Constant and Half-life Summary
(Detailed calculations for TCE, DCE, and VC follow this summary data.)

TCE Attenuation

For Natural Attenuation of Downgradient Areas

For modeling purposes, assume TCE apparent Half-life away from hot-spot = **5** years
and back-calculate TCE apparent rate constant k for locations away from hot-spot = 0.00038 /day
However, the pore volume and cleanup time calculations were performed in Tables 4-3 and 4-4, respectively, for maximum concentration wells since they provide limiting conditions for remediation. Therefore, use the biodegradation rate constant for source areas, which is discussed below, for calculations in Tables 4-2 and 4-3.

For Natural Attenuation of Source Areas

Based on plume drawings, Well 782VMW-105B is the hot-spot.
As such, this well is most likely to represent true natural attenuation.
Locations farther away receive migrating TCE from hot-spot
even while they themselves undergo natural attenuation, leading to longer apparent half-lives.
For modeling purposes, assume true TCE natural attenuation Half-life = **3** years
and back-calculate true TCE rate constant k for natural attenuation = 0.000633 /day
(0.231/year)

DCE Attenuation

For Natural Attenuation of Downgradient Areas

For modeling purposes, assume DCE apparent Half-life away from hot-spot = **5** years
and back-calculate TCE apparent rate constant k for locations away from hot-spot = 0.00038 /day
(0.139/year)

For Natural Attenuation of Source Areas

No clear distinction between rate constants for source (hot-spot) and downgradient areas.
Use same for both. (However, calculations in Tables 4-2 and 4-3 are for high concentration areas only.)

VC Attenuation

For Natural Attenuation of Downgradient Areas

For modeling purposes, assume VC apparent Half-life away from hot-spot = **9** years
and back-calculate VC apparent rate constant k for locations away from hot-spot = 0.000211 /day
(0.077/year)

For Natural Attenuation of Source Areas

No clear distinction between rate constants for source (hot-spot) and downgradient areas.
Use same for both. (However, calculations in Tables 4-2 and 4-3 are for high concentration areas only.)

Griffiss AFB Site - Nosedocks / Apron 2 Chlorinated Plume

SITE-SPECIFIC RATE CONSTANT ESTIMATIONS FOR TCE

782VMW-97

Date	t (days)	C (ppb)
2/1/2002	0	31
1/1/2003	334	38
6/1/2003	485	32
9/1/2003	577	18
12/1/2003	668	42
3/1/2004	759	32
7/1/2004	881	21
9/1/2004	943	22

Coefficients (best fit for for y=b*m^x)

m	b
0.99961067	35.5887613

Converting to $C=C_0*e^{(-k*t)}$,

k [= - ln (m)]	C_0
0.00038941	35.5887613

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 1780.0 days

4.9 years

782VMW-105B

Date	t (days)	C (ppb)
2/1/2002	0	50
1/1/2003	334	39
6/1/2003	485	29
9/1/2003	577	26
12/1/2003	668	21
3/1/2004	759	28
7/1/2004	881	25
9/1/2004	943	29

Coefficients (best fit for for y=b*m^x)

m	b
0.99929967	44.8099573

Converting to $C=C_0*e^{(-k*t)}$,

k [= - ln (m)]	C_0
0.00070057	44.8099573

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 989.4 days

2.7 years

MW-30

Date	t (days)	C (ppb)
2/1/2002	0	0.88
6/1/2003	485	3.3
9/1/2003	577	3.6
12/1/2003	668	4.4
3/1/2004	759	1.8
7/1/2004	881	2.3
9/1/2004	943	4

Coefficients (best fit for for y=b*m^x)

m	b
1.00118138	1.24667052

Converting to $C=C_0*e^{(-k*t)}$,

k [= - ln (m)]	C_0
-0.0011807	1.24667052

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -587.1 days

-1.6 years

IGNORE THIS DATA
INCREASING CONCENTRATIONS

782VMW-81

Date	t (days)	C (ppb)
2/1/2002	0	21
1/1/2003	334	11
6/1/2003	485	14
9/1/2003	577	15
12/1/2003	668	17
3/1/2004	759	14
7/1/2004	881	12
9/1/2004	943	13

Coefficients (best fit for for y=b*m^x)

m	b
0.99965215	17.5674929

Converting to $C=C_0*e^{(-k*t)}$,

k [= - ln (m)]	C_0
0.00034791	17.5674929

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 1992.3 days

5.5 years

782VMW-83

Date	t (days)	C (ppb)
2/1/2002	0	6
1/1/2003	334	7
6/1/2003	485	7
9/1/2003	577	5
12/1/2003	668	2
3/1/2004	759	7
7/1/2004	881	6
9/1/2004	943	5

Coefficients (best fit for for y=b*m^x)

m	b
0.99972102	6.22599041

Converting to $C=C_0*e^{(-k*t)}$,

k [= - ln (m)]	C_0
0.00027902	6.22599041

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 2484.3 days

6.8 years

SUMMARY (manually enter from above)

n (# data)	k (/day)	$t_{1/2}$ (day)
1	0.00038941	1780
2	0.00070057	989.4
3	0.00034791	1992.3
4	0.00027902	2484.3

Average Half-life (Simple Method) (n = number of data points)

Arithmetic Mean [(Sum of $t_{1/2}$)/n] = 4.96 years

Geometric Mean [(Product of $t_{1/2}$)^(1/n)] = 4.71 years

Half-life Based On Avg. Rate Constant (More Fundamental Method) (n = number of data points)

Half-life Based on Arithmetic Mean of Rate Constant k = 4.42 years

Half-life Based on Geometric Mean of Rate Constant k = 4.71 years

For Natural Attenuation of Downgradient Areas

For modeling purposes, assume TCE apparent Half-life away from hot-spot = **5** years

and back-calculate TCE apparent rate constant k for locations away from hot-spot = 0.00037981 /day

For Natural Attenuation of Source Areas

Based on plume drawings, Well 782VMW-105B is the hot-spot.
As such, this well is most likely to represent true natural attenuation.
Locations farther away receive migrating TCE from hot-spot
even while they themselves undergo natural attenuation, leading to longer apparent half-lives.
For modeling purposes, assume true TCE natural attenuation Half-life = **3** years
and back-calculate true TCE rate constant k for natural attenuation = 0.00063301 /year

Griffiss AFB Site - Nosedocks / Apron 2 Chlorinated Plume

SITE-SPECIFIC RATE CONSTANT ESTIMATIONS FOR DCE

VMW-76

Date	t (days)	C (ppb)
2/1/2002	0	2
2/1/2003	365	1.6
6/1/2003	485	2
9/1/2003	577	3
12/1/2003	668	2
4/1/2004	790	2
7/1/2004	881	2
9/1/2004	943	2

Coefficients (best fit for for y=b*m^x)

m	b
1.00006792	1.96591314

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
-6.792E-05	1.96591314

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -10205.1 days

-28.0 years

IGNORE THIS DATA.
NO ATTENUATION - STEADY-STATE DUE TO MIGRATING PLUME

VMW-78

Date	t (days)	C (ppb)
2/1/2002	0	41
2/1/2003	365	68
6/1/2003	485	50
9/1/2003	577	65
12/1/2003	668	59
4/1/2004	790	72
7/1/2004	881	64
9/1/2004	943	52

Coefficients (best fit for for y=b*m^x)

m	b
1.0003272	47.8422992

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
-0.0003271	47.8422992

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -2118.8 days

-5.8 years

IGNORE THIS DATA.
THIS WELL IS A DCE HOT-SPOT.
EVIDENCE OF ATTENUATION - BUT NON-MONOTONIC, LIKELY DUE TO ADDL. DCE FROM TCE ATTENUATION AND/OR FROM CHANGING WATER LEVELS.

VMW-80

Date	t (days)	C (ppb)
2/1/2002	0	3
2/1/2003	365	2
6/1/2003	485	1
9/1/2003	577	2
12/1/2003	668	2
4/1/2004	790	0.4
7/1/2004	881	1.2
9/1/2004	943	1.3

Coefficients (best fit for for y=b*m^x)

m	b
0.9988088	2.8289177

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
0.00119191	2.8289177

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 581.5 days

1.6 years

UPGRADIENT OFF-CENTER WELL.
POTENTIAL ATTENUATION AS UPGRADIENT TCE PLUME EDGE ATTENUATES.

VMW-81

Date	t (days)	C (ppb)
2/1/2002	0	20
2/1/2003	365	27
6/1/2003	485	30
9/1/2003	577	24
12/1/2003	668	27
4/1/2004	790	23
7/1/2004	881	19
9/1/2004	943	23

Coefficients (best fit for for y=b*m^x)

m	b
0.9999628	24.4018504

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
3.7203E-05	24.4018504

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 18631.7 days

51.0 years

IGNORE THIS DATA.
EVIDENCE OF ATTENUATION - BUT NON-MONOTONIC, LIKELY DUE TO ADDL. DCE FROM TCE ATTENUATION AND/OR FROM CHANGING WATER LEVELS.

VMW-83

Date	t (days)	C (ppb)
2/1/2003	0	0.45
6/1/2003	120	0.48
9/1/2003	212	0.4
12/1/2003	303	0.3
4/1/2004	425	0.55
7/1/2004	516	0.47
9/1/2004	578	0.26

Coefficients (best fit for for y=b*m^x)

m	b
0.99957452	0.45998045

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
0.00042557	0.45998045

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 1628.8 days

4.5 years

<u>SUMMARY</u> (manually enter from above)

n (# data)	k (/day)	$t_{1/2}$ (day)
1	0.00119191	581.5
2	0.00042557	1628.8
3	0.00014716	4710

<u>Average Half-life (Simple Method)</u> (n = number of data points)

Arithmetic Mean [(Sum of $t_{1/2}$)/n] = 6.32 years

Geometric Mean [(Product of $t_{1/2}$)^(1/n)] = 4.51 years

<u>Half-life Based On Avg. Rate Constant (More Fundamental Method)</u> (n = number of data points)

Half-life Based on Arithmetic Mean of Rate Constant k = 3.23 years

Half-life Based on Geometric Mean of Rate Constant k = 4.51 years

<u>For Natural Attenuation of Downgradient Areas</u>

For modeling purposes, assume DCE apparent Half-life away from hot-spot = **5** years

and back-calculate TCE apparent rate constant k for locations away from hot-spot = 0.00037981 /day

<u>For Natural Attenuation of Source Areas</u>

No clear distinction between rate constants for source (hot-spot) and downgradient areas.
Use same for both.

VMW-90

Date	t (days)	C (ppb)
2/1/2002	0	19
2/1/2003	365	15
6/1/2003	485	9
9/1/2003	577	4
12/1/2003	668	3
4/1/2004	790	0.1

Coefficients (best fit for for y=b*m^x)

m	b
0.99457068	52.2679818

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
0.00544411	52.2679818

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 127.3 days

0.3 years

IGNORE THIS DATA.

EVIDENCE OF RAPID ATTENUATION - BUT ADVECTION MAY HAVE BEEN THE CAUSE

VMW-105B

Date	t (days)	C (ppb)
2/1/2002	0	5
2/1/2003	365	3
6/1/2003	485	2
9/1/2003	577	4
12/1/2003	668	3
4/1/2004	790	6
7/1/2004	881	3
9/1/2004	943	3

Coefficients (best fit for for y=b*m^x)

m	b
0.99981599	3.82940671

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
0.00018403	3.82940671

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 3766.5 days

10.3 years

IGNORE THIS DATA.
THIS WELL IS TCE HOT-SPOT. NON-MONOTONIC, LIKELY DUE TO ADDL. DCE FROM TCE ATTENUA-TION AND/OR FROM CHANGING WATER LEVELS.

782MW-6R2

Date	t (days)	C (ppb)
2/1/2002	0	14
2/1/2003	365	0.8
6/1/2003	485	1.6
9/1/2003	577	0.8
12/1/2003	668	2
4/1/2004	790	1
7/1/2004	881	12
9/1/2004	943	11

Coefficients (best fit for for y=b*m^x)

m	b
1.00012277	2.6053788

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
-0.0001228	2.6053788

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -5646.2 days

-15.5 years

IGNORE THIS DATA.
THIS WELL IS DOWNGRADIENT OF HOT-SPOT WELL 782MW-10, AND IS LIKELY RECEIVING MIGRATION DCE PLUME EVEN WHILE NATURAL ATTENUATION IS OCCURRING.

782MW-10

Date	t (days)	C (ppb)
2/1/2002	0	69
2/1/2003	365	57
6/1/2003	485	71
9/1/2003	577	72
12/1/2003	668	55
4/1/2004	790	78
7/1/2004	881	51
9/1/2004	943	59

Coefficients (best fit for for y=b*m^x)

m	b
0.99985285	69.0867912

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
0.00014716	69.0867912

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 4710.0 days

12.9 years

TREAT THIS DATA WITH CAUTION
THIS WELL IS A DCE HOT-SPOT. EVIDENCE OF ATTENUATION - BUT NON-MONOTONIC, LIKELY DUE TO ADDL. DCE FROM TCE ATTENUA-TION AND/OR FROM CHANGING WATER LEVELS.

Griffiss AFB Site - Nosedocks / Apron 2 Chlorinated Plume

SITE-SPECIFIC RATE CONSTANT ESTIMATIONS FOR VC

VMW-76

Date	t (days)	C (ppb)
2/1/2002	0	16
2/1/2003	365	13
6/1/2003	485	19
9/1/2003	577	18
12/1/2003	668	23
4/1/2003	424	16
7/1/2004	881	16
9/1/2004	943	16

Coefficients (best fit for for y=b*m^x)

m	b
1.00012033	15.8454134

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
-0.0001203	15.8454134

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -5760.7 days

-15.8 years

IGNORE THIS DATA.
EVIDENCE OF ATTENUATION - BUT NON-MONOTONIC, LIKELY DUE TO ADDL. VC FROM DCE ATTENUATION AND/OR FROM CHANGING WATER LEVELS.

VMW-78

Date	t (days)	C (ppb)
2/1/2003	0	15
6/1/2003	120	22
9/1/2003	212	28
12/1/2003	303	20
4/1/2003	59	17
7/1/2004	516	12
9/1/2004	578	21

Coefficients (best fit for for y=b*m^x)

m	b
0.99986763	19.315504

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
0.00013237	19.315504

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 5236.3 days

14.3 years

DO NOT USE 2/1/2002 DATA.
USE THESE RESULTS W/ CAUTION.
EVIDENCE OF ATTENUATION - BUT NON-MONOTONIC, LIKELY DUE TO ADDL. VC FROM DCE ATTENUATION AND/OR FROM CHANGING WATER LEVELS.

VMW-81

Date	t (days)	C (ppb)
2/1/2003	0	10
6/1/2003	120	15
9/1/2003	212	14
12/1/2003	303	16
4/1/2003	59	9
7/1/2004	516	7
9/1/2004	578	12

Coefficients (best fit for for y=b*m^x)

m	b
0.99979686	12.0330151

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
0.00020316	12.0330151

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 3411.8 days

9.3 years

USE THESE RESULTS W/ CAUTION.
EVIDENCE OF ATTENUATION - BUT ADDL. VC FROM DCE ATTENUATION AND/OR FROM CHANGING WATER LEVELS.

VMW-84

Date	t (days)	C (ppb)
2/1/2002	0	57
2/1/2003	365	55
6/1/2003	485	37
9/1/2003	577	57
12/1/2003	668	58
4/1/2004	790	64
7/1/2004	881	40
9/1/2004	943	44

Coefficients (best fit for for y=b*m^x)

m	b
0.99982293	56.1951871

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
0.00017709	56.1951871

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 3914.2 days

10.7 years

VMW-87

Date	t (days)	C (ppb)
2/1/2002	0	24
2/1/2003	365	26
6/1/2003	485	30
9/1/2003	577	33
12/1/2003	668	35
4/1/2004	790	34
7/1/2004	881	23
9/1/2004	943	25

Coefficients (best fit for for y=b*m^x)

m	b
1.00008626	26.9900327

Converting to $C=C_0*e^(-k*t)$,

k [= - ln (m)]	C_0
-8.626E-05	26.9900327

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -8035.7 days

-22.0 years

IGNORE THIS DATA.
NO EVIDENCE OF CONSISTENT ATTENUATION. HIGH CONC. PLUME MAY BE PASSING THROUGH.

SUMMARY (manually enter from above)

n (# data)	k (/day)	$t_{1/2}$ (day)
1	0.00013237	5236.3
2	0.00020316	3411.8
3	0.00017709	3914.2
4	0.00054514	1271.5
5	0.00021627	3205.1
6	0.00016322	4246.7

Average Half-life (Simple Method) (n = number of data points)

Arithmetic Mean [(Sum of $t_{1/2}$)/n] = 9.72 years

Geometric Mean [(Product of $t_{1/2}$)^(1/n)] = 8.94 years

Half-life Based On Avg. Rate Constant (More Fundamental Method) (n = number of data points)

Half-life Based on Arithmetic Mean of Rate Constant k = 7.93 years

Half-life Based on Geometric Mean of Rate Constant k = 8.94 years

For Natural Attenuation of Downgradient Areas

For modeling purposes, assume VC apparent Half-life away from hot-spot = **9** years

and back-calculate VC apparent rate constant k for locations away from hot-spot = 0.000211 /day

For Natural Attenuation of Source Areas

No clear distinction between rate constants for source (hot-spot) and downgradient areas.
Use same for both.

VMW-88

Date	t (days)	C (ppb)
2/1/2002	0	43
2/1/2003	365	35
6/1/2003	485	34
9/1/2003	577	40
12/1/2003	668	31
4/1/2004	790	30
7/1/2004	881	24
9/1/2004	943	27

Coefficients (best fit for for y=b*m^x)

m	b
0.99945501	44.7454777

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
0.00054514	44.7454777

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 1271.5 days

3.5 years

VMW-93

Date	t (days)	C (ppb)
2/1/2002	0	76
2/1/2003	365	88
6/1/2003	485	110
9/1/2003	577	100
12/1/2003	668	97
4/1/2004	790	60
7/1/2004	881	62
9/1/2004	943	80

Coefficients (best fit for for y=b*m^x)

m	b
0.99978376	93.5776508

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
0.00021627	93.5776508

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 3205.1 days

8.8 years

VMW-96

Date	t (days)	C (ppb)
2/1/2002	0	78
2/1/2003	365	96
6/1/2003	485	130
9/1/2003	577	120
12/1/2003	668	72
4/1/2004	790	130
7/1/2004	881	95
9/1/2004	943	96

Coefficients (best fit for for y=b*m^x)

m	b
1.00018546	89.6273163

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
-0.0001854	89.6273163

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -3737.9 days

-10.2 years

IGNORE THIS DATA.
EVIDENCE OF ATTENUATION - BUT NON-MONOTONIC, LIKELY DUE TO ADDL. VC FROM DCE ATTENUA-TION AND/OR FROM CHANGING WATER LEVELS.

782MW-6R2

Date	t (days)	C (ppb)
2/1/2002	0	14
2/1/2003	365	4
6/1/2003	485	5
9/1/2003	577	6
12/1/2003	668	5
4/1/2004	790	3
7/1/2004	881	16
9/1/2004	943	21

Coefficients (best fit for for y=b*m^x)

m	b
1.00028186	6.22191668

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
-0.0002818	6.22191668

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = -2459.5 days

-6.7 years

IGNORE THIS DATA.
NO EVIDENCE OF CONSISTENT ATTENUATION. HIGH CONC. PLUME MAY BE PASSING THROUGH.

782MW-10

Date	t (days)	C (ppb)
2/1/2002	0	25
2/1/2003	365	19
6/1/2003	485	26
9/1/2003	577	30
12/1/2003	668	21
4/1/2004	790	26
7/1/2004	881	18
9/1/2004	943	21

Coefficients (best fit for for y=b*m^x)

m	b
0.99983679	25.2440582

Converting to $C=C_0*e^\wedge(-k*t)$,

k [= - ln (m)]	C_0
0.00016322	25.2440582

1st Order Half-life [$t_{1/2}$=(ln 2)/k]

$t_{1/2}$ = 4246.7 days

11.6 years

APPENDIX F

PROJECT AND PHASE ELEMENT TECHNOLOGY COSTS DETAIL REPORT

Project Cost Over Time Report
(with Markups)

Folder: GAFB APRONS FS

Project

Name:	Apron 2 Chlorinated FS
ID:	Apron 2 Chlorinated FS
Location:	GRIFFISS HOUSING, NEW YORK
Modifiers:	Material 1.006
	Labor 1.18 (Modified)
	Equipment 1.057
Category:	None
Report Option:	Fiscal Year
Description:	This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.

Site Name	Site ID	2006	2007	2008	2009	2010	2011
Apron 2: Air Sparging & SVE	Apron 2: Air Sparging & SVE	$28,420,698	$1,278,969	$1,186,832	$151,913	$49,453	$0
Apron 2: Chemical Oxidation an	Apron 2: Chemical Oxidation an	$2,528,897	$44,036	$44,036	$44,036	$44,036	$44,036
Apron 2: IC and LTM	Apron 2: IC and LTM	$102,327	$47,507	$47,507	$47,507	$47,507	$47,507
Apron 2: Natural Attenuation	Apron 2: Natural Attenuation	$191,743	$47,367	$47,367	$47,367	$47,367	$47,367
Apron 2: PRB, ORC and	Apron 2: PRB, ORC	$4,319,564	$42,865	$42,865	$42,865	$42,865	$42,865

Project Cost Over Time Report
(with Markups)

Site Name	Site ID	2006	2007	2008	2009	2010	2011
LTM	and LTM						
Apron 2: Six Mile Creek Barrie	Apron 2: Six Mile Creek Barrie	$431,100	$82,019	$81,831	$82,019	$82,581	$81,831
Total Project Cost		$35,994,329	$1,542,763	$1,450,438	$415,707	$313,809	$263,606

Cost Database Date: 2004

Cost Type: User-Defined

Print Date: 5/25/2005 3:33:51 PM

Project Cost Over Time Report
(with Markups)

Site Name	Site ID	2012	2013	2014	2015	2016	2017
Apron 2: Air Sparging & SVE	Apron 2: Air Sparging & SVE	$0	$0	$0	$0	$0	$0
Apron 2: Chemical Oxidation an	Apron 2: Chemical Oxidation an	$44,036	$44,036	$44,036	$44,036	$0	$0
Apron 2: IC and LTM	Apron 2: IC and LTM	$47,507	$47,507	$47,507	$47,507	$47,507	$47,507
Apron 2: Natural Attenuation	Apron 2: Natural Attenuation	$47,367	$47,367	$47,367	$47,367	$47,367	$47,367
Apron 2: PRB, ORC and LTM	Apron 2: PRB, ORC and LTM	$42,865	$42,865	$42,865	$42,865	$42,865	$42,865
Apron 2: Six Mile Creek Barrie	Apron 2: Six Mile Creek Barrie	$82,019	$81,831	$82,019	$83,519	$81,831	$82,019
Total Project Cost		$263,794	$263,606	$263,794	$265,294	$219,570	$219,758

Project Cost Over Time Report
(with Markups)

Site Name	Site ID	2018	2019	2020	2021	2022	2023
Apron 2: Air Sparging & SVE	Apron 2: Air Sparging & SVE	$0	$0	$0	$0	$0	$0
Apron 2: Chemical Oxidation an	Apron 2: Chemical Oxidation an	$0	$0	$0	$0	$0	$0
Apron 2: IC and LTM	Apron 2: IC and LTM	$47,507	$47,507	$47,507	$47,507	$47,507	$47,507
Apron 2: Natural Attenuation	Apron 2: Natural Attenuation	$47,367	$47,367	$47,367	$47,367	$47,367	$47,367
Apron 2: PRB, ORC and LTM	Apron 2: PRB, ORC and LTM	$42,865	$42,865	$42,865	$0	$0	$0
Apron 2: Six Mile Creek Barrie	Apron 2: Six Mile Creek Barrie	$81,831	$82,019	$82,581	$81,831	$82,019	$81,831
Total Project Cost		$219,570	$219,758	$220,320	$176,705	$176,893	$176,705

Cost Database Date: 2004

Cost Type: User-Defined

Print Date: 5/25/2005 3:33:51 PM

Project Cost Over Time Report
(with Markups)

Site Name	Site ID	2024	2025	2026	2027	2028	2029
Apron 2: Air Sparging & SVE	Apron 2: Air Sparging & SVE	$0	$0	$0	$0	$0	$0
Apron 2: Chemical Oxidation an	Apron 2: Chemical Oxidation an	$0	$0	$0	$0	$0	$0
Apron 2: IC and LTM	Apron 2: IC and LTM	$47,507	$47,507	$47,507	$47,507	$47,507	$47,507
Apron 2: Natural Attenuation	Apron 2: Natural Attenuation	$47,367	$47,367	$47,367	$47,367	$47,367	$47,367
Apron 2: PRB, ORC and LTM	Apron 2: PRB, ORC and LTM	$0	$0	$0	$0	$0	$0
Apron 2: Six Mile Creek Barrie	Apron 2: Six Mile Creek Barrie	$82,019	$83,519	$81,831	$82,019	$81,831	$82,019
Total Project Cost		$176,893	$178,393	$176,705	$176,893	$176,705	$176,893

Cost Database Date: 2004

Cost Type: User-Defined

Print Date: 5/25/2005 3:33:51 PM

Project Cost Over Time Report
(with Markups)

Site Name	Site ID	2030	2031	2032	2033	2034	2035
Apron 2: Air Sparging & SVE	Apron 2: Air Sparging & SVE	$0	$0	$0	$0	$0	$0
Apron 2: Chemical Oxidation an	Apron 2: Chemical Oxidation an	$0	$0	$0	$0	$0	$0
Apron 2: IC and LTM	Apron 2: IC and LTM	$47,507	$47,507	$47,507	$47,507	$47,507	$47,507
Apron 2: Natural Attenuation	Apron 2: Natural Attenuation	$47,367	$47,367	$47,367	$47,367	$47,367	$47,367
Apron 2: PRB, ORC and LTM	Apron 2: PRB, ORC and LTM	$0	$0	$0	$0	$0	$0
Apron 2: Six Mile Creek Barrie	Apron 2: Six Mile Creek Barrie	$82,581	$81,831	$82,019	$81,831	$82,019	$55,243
Total Project Cost		$177,455	$176,705	$176,893	$176,705	$176,893	$150,117

Project Cost Over Time Report
(with Markups)

Site Name	Site ID	Total
Apron 2: Air Sparging & SVE	Apron 2: Air Sparging & SVE	$31,087,865
Apron 2: Chemical Oxidation an	Apron 2: Chemical Oxidation an	$2,925,221
Apron 2: IC and LTM	Apron 2: IC and LTM	$1,480,030
Apron 2: Natural Attenuation	Apron 2: Natural Attenuation	$1,565,386
Apron 2: PRB, ORC and LTM	Apron 2: PRB, ORC and LTM	$4,919,674
Apron 2: Six Mile Creek Barrie	Apron 2: Six Mile Creek Barrie	$2,785,493
Total Project Cost		$44,763,657

Phase Element Technology Cost Detail Report
(with Markups)

Folder: GAFB APRONS FS

Project

Name: Apron 2 Chlorinated FS
ID: Apron 2 Chlorinated FS
Location: GRIFFISS HOUSING, NEW YORK
Modifiers: Material 1.006
Labor 1.18 (Modified)
Equipment 1.057
Category: None
Report Option: Fiscal Year
Description: This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.

Site

Name: Apron 2: IC and LTM
ID: Apron 2: IC and LTM
Type: None
Description: This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.
Program: N/A

Estimator Information:
Name: Upgraded from prior version of RACER
Title: Upgraded from prior version of RACER
Agency/Org./Office: Upgraded from prior version of RACER
Business Address: Upgraded from prior version of RACER
Phone: Upgraded from prior version of RACER

Email:	Upgraded from prior version of RACER
Prepared Date:	Upgraded from prior version of RACER

Reviewer Information:

Name:	Upgraded from prior version of RACER
Title:	Upgraded from prior version of RACER
Agency/Org./Office:	Upgraded from prior version of RACER
Business Address:	Upgraded from prior version of RACER
Phone:	Upgraded from prior version of RACER
Email:	Upgraded from prior version of RACER
Date Reviewed:	Upgraded from prior version of RACER

Phase Element

Name:	IC and LTM	Media/Waste Type:	Groundwater
Type:	Remedial Action	Secondary Media/Waste Type:	N/A
Labor Rate Group:	System Labor Rate	Contaminant:	Volatile Organic Compounds (VOCs)
Analysis Rate Group:	System Analysis Rate	Secondary Contaminant:	None
Approach:	Natural Attenuation	Markup Template:	System Defaults
Start Date:	10/1/2005	O&M Markup Template:	N/A
Description:	IC and LTM		

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	49.00	EA	11.27	0.00	0.00	$551.99	☐
33020402	Decontamination Materials per Sample	49.00	EA	10.03	0.00	0.00	$491.70	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	2.00	WK	315.43	0.00	0.00	$630.86	☐
33021720	Testing, purgeable organics (624, 8260)	49.00	EA	188.13	0.00	0.00	$9,218.36	☐
33231186	Well Development Equipment Rental (weekly)	2.00	WK	584.16	92.84	0.00	$1,354.00	☐
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	44.00	EA	8.13	0.00	0.00	$357.63	☐

Total Element Cost $12,604.54

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020520	Hip Waders	1.00	EA	140.33	0.00	0.00	$140.33	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020524	Field sampling equipment, coliwasas, glass, disposable, 200 mL, case of 12, 7/8" x 42"	2.00	EA	140.42	0.00	0.00	$280.84	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	315.43	0.00	0.00	$315.43	☐
33021720	Testing, purgeable organics (624, 8260)	14.00	EA	188.13	0.00	0.00	$2,633.82	☐
				Total Element Cost			$3,370.41	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Sample collection, vehicle mileage charge, car or van	810.00	MI	0.16	0.00	0.00	$130.41	☐
33220102	Project Manager	4.00	HR	0.00	165.70	0.00	$662.79	☐
33220105	Project Engineer	30.00	HR	0.00	160.68	0.00	$4,820.41	☐
33220108	Project Scientist	245.00	HR	0.00	185.99	0.00	$45,568.55	☐
33220109	Staff Scientist	80.00	HR	0.00	137.85	0.00	$11,028.03	☐
33220112	Field Technician	168.00	HR	0.00	102.70	0.00	$17,253.30	☐
33220114	Word Processing/Clerical	44.00	HR	0.00	71.54	0.00	$3,147.82	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220115	Draftsman/CADD	40.00	HR	0.00	93.53	0.00	$3,741.08	☐

Total Element Cost	$86,352.39
Total 1st Year Technology Cost	$102,327.33
Total Phase Element Cost	$102,327.33

Phase Element Technology Cost Detail Report
(with Markups)

Folder: GAFB APRONS FS

Project

Name:	Apron 2 Chlorinated FS
ID:	Apron 2 Chlorinated FS
Location:	GRIFFISS HOUSING, NEW YORK
Modifiers:	Material 1.006
	Labor 1.18 (Modified)
	Equipment 1.057
Category:	None
Report Option:	Fiscal Year
Description:	This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.

Site

Name:	Apron 2: Natural Attenuation
ID:	Apron 2: Natural Attenuation
Type:	None
Description:	This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.
Program:	N/A

Estimator Information:

Name:	Upgraded from prior version of RACER
Title:	Upgraded from prior version of RACER
Agency/Org./Office:	Upgraded from prior version of RACER
Business Address:	Upgraded from prior version of RACER
Phone:	Upgraded from prior version of RACER

Email: Upgraded from prior version of RACER
Prepared Date: Upgraded from prior version of RACER

Reviewer Information:

Name: Upgraded from prior version of RACER
Title: Upgraded from prior version of RACER
Agency/Org./Office: Upgraded from prior version of RACER
Business Address: Upgraded from prior version of RACER
Phone: Upgraded from prior version of RACER
Email: Upgraded from prior version of RACER
Date Reviewed: Upgraded from prior version of RACER

Phase Element

Name:	Natural Attenuation	Media/Waste Type:	Groundwater
Type:	Remedial Action	Secondary Media/Waste Type:	N/A
Labor Rate Group:	System Labor Rate	Contaminant:	Volatile Organic Compounds (VOCs)
Analysis Rate Group:	System Analysis Rate	Secondary Contaminant:	None
Approach:	Natural Attenuation	Markup Template:	System Defaults
Start Date:	10/1/2005	O&M Markup Template:	N/A
Description:	Natural Attenuation		

Phase Element Technology Cost Detail Report (with Markups)

Technology: Natural Attenuation

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	49.00	EA	11.07	0.00	0.00	$542.64	☐
33020402	Decontamination Materials per Sample	49.00	EA	9.86	0.00	0.00	$483.37	☐
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	1,345.00	LF	0.66	0.00	0.00	$894.02	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	2.00	WK	310.08	0.00	0.00	$620.17	☐
33021602	Testing, soil & sediment analysis, pH, electrometric (9045)	49.00	EA	8.89	0.00	0.00	$435.81	☐
33021603	Testing, dissolved solids	49.00	EA	15.69	0.00	0.00	$768.69	☐
33021608	Testing, nitrogen, nitrate/nitrite	49.00	EA	29.58	0.00	0.00	$1,449.44	☐
33021618	Testing, purgeable organics (624, 8260)	49.00	EA	184.94	0.00	0.00	$9,062.11	☐
33021653	Testing, chloride	49.00	EA	21.60	0.00	0.00	$1,058.58	☐
33021663	Testing, dissolved oxygen (DO)	49.00	EA	17.47	0.00	0.00	$855.98	☐
33021667	Testing, soil & sediment analysis, sulfates (375.3m)	49.00	EA	23.13	0.00	0.00	$1,133.50	☐
33021668	Testing, sulfur: sulfate, sulfide, sulfite	49.00	EA	37.12	0.00	0.00	$1,818.81	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33021673	Testing, total organic carbons	49.00	EA	31.80	0.00	0.00	$1,558.23	☐
33021678	Ferrous Iron (S.M. 3500 Fe - D)	49.00	EA	118.97	0.00	0.00	$5,829.46	☐
33021679	Dissolved Iron (II)	49.00	EA	37.00	0.00	0.00	$1,812.86	☐
33230510	4" Submersible Pump Rental, Week	2.00	WK	302.22	0.00	0.00	$604.45	☐
33231186	Well Development Equipment Rental (weekly)	2.00	WK	574.26	91.27	0.00	$1,331.05	☐

Total Element Cost $30,259.17

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020521	PPE, disposable clothing, hip waders, rental	1.00	WK	106.21	0.00	0.00	$106.21	☐
33020524	Field sampling equipment, coliwasas, glass, disposable, 200 mL, case of 12, 7/8" x 42"	2.00	EA	138.04	0.00	0.00	$276.08	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	310.08	0.00	0.00	$310.08	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33021602	Testing, soil & sediment analysis, pH, electrometric (9045)	14.00	EA	8.89	0.00	0.00	$124.52	☐
33021603	Testing, dissolved solids	14.00	EA	15.69	0.00	0.00	$219.63	☐
33021608	Testing, nitrogen, nitrate/nitrite	14.00	EA	29.58	0.00	0.00	$414.13	☐
33021618	Testing, purgeable organics (624, 8260)	14.00	EA	184.94	0.00	0.00	$2,589.18	☐
33021653	Testing, chloride	14.00	EA	21.60	0.00	0.00	$302.45	☐
33021663	Testing, dissolved oxygen (DO)	14.00	EA	17.47	0.00	0.00	$244.57	☐
33021667	Testing, soil & sediment analysis, sulfates (375.3m)	14.00	EA	23.13	0.00	0.00	$323.86	☐
33021668	Testing, sulfur: sulfate, sulfide, sulfite	14.00	EA	37.12	0.00	0.00	$519.66	☐
33021673	Testing, total organic carbons	14.00	EA	31.80	0.00	0.00	$445.21	☐
33021678	Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	118.97	0.00	0.00	$1,665.56	☐
33021679	Dissolved Iron (II)	14.00	EA	37.00	0.00	0.00	$517.96	☐
				Total Element Cost			$8,059.08	

Phase Element Technology Cost Detail Report
(with Markups)

Element: General

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Sample collection, vehicle mileage charge, car or van	3,470.00	MI	0.16	0.00	0.00	$558.67	☐
33010202	Sample collection, sampling personnel travel, per diem	18.00	DAY	86.00	0.00	0.00	$1,548.00	☑
33020577	Oxygen/reduction potential meter rental	9.00	DAY	77.18	0.00	0.00	$694.58	☐
33220108	Project Scientist	205.00	HR	0.00	184.27	0.00	$37,775.74	☐
33220112	Field Technician	176.00	HR	0.00	101.75	0.00	$17,907.52	☐
33220114	Word Processing/Clerical	32.00	HR	0.00	70.88	0.00	$2,268.12	☐
33220115	Draftsman/CADD	32.00	HR	0.00	92.66	0.00	$2,965.15	☐

Total Element Cost $63,717.78

Total 1st Year Technology Cost $102,036.03

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Professional Labor Management

Element: Professional Labor Percentage

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	1.00	LS	0.00	23,607.13	0.00	$23,607.13	☑
33220139	Planning Documents Labor Cost	1.00	LS	0.00	18,885.70	0.00	$18,885.70	☑
33220140	Construction Oversight Labor Cost	1.00	LS	0.00	15,344.63	0.00	$15,344.63	☑
33220141	Reporting Labor Cost	1.00	LS	0.00	3,541.07	0.00	$3,541.07	☑
33220142	As-Built Drawings Labor Cost	1.00	LS	0.00	3,541.07	0.00	$3,541.07	☑
33220143	Public Notice Labor Cost	1.00	LS	0.00	1,180.36	0.00	$1,180.36	☑
33220144	Site Closure Activities Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220145	Permitting Labor Cost	1.00	LS	0.00	23,607.13	0.00	$23,607.13	☑
33220146	Responsible Party Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220147	Reimbursement Claims Preparation Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220148	Other Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐

Total Element Cost	$89,707.09
Total 1st Year Technology Cost	$89,707.09
Total Phase Element Cost	$191,743.12

Phase Element Technology Cost Detail Report
(with Markups)

Folder: GAFB APRONS FS

Project

Name:	Apron 2 Chlorinated FS		
ID:	Apron 2 Chlorinated FS		
Location:	GRIFFISS HOUSING, NEW YORK		
Modifiers:	Material	1.006	
	Labor	1.18	(Modified)
	Equipment	1.057	

Category: None

Report Option: Fiscal Year

Description: This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.

Site

Name: Apron 2: Air Sparging & SVE

ID: Apron 2: Air Sparging & SVE

Type: None

Description: This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.

Program: N/A

Estimator Information:

Name: Upgraded from prior version of RACER

Title: Upgraded from prior version of RACER

Agency/Org./Office: Upgraded from prior version of RACER

Business Address: Upgraded from prior version of RACER

Phone: Upgraded from prior version of RACER

Cost Database Date: 2004

Cost Type: User-Defined

Print Date: 5/25/2005 3:53:20 PM

Email: Upgraded from prior version of RACER
Prepared Date: Upgraded from prior version of RACER

Reviewer Information:
Name: Upgraded from prior version of RACER
Title: Upgraded from prior version of RACER
Agency/Org./Office: Upgraded from prior version of RACER
Business Address: Upgraded from prior version of RACER
Phone: Upgraded from prior version of RACER
Email: Upgraded from prior version of RACER
Date Reviewed: Upgraded from prior version of RACER

Phase Element

Name: Air Sparging & SVE
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: In Situ
Start Date: 10/1/2005

Media/Waste Type: Groundwater
Secondary Media/Waste Type: N/A
Contaminant: Volatile Organic Compounds (VOCs)
Secondary Contaminant: None
Markup Template: System Defaults
O&M Markup Template: System Defaults

Description: This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Air Sparging

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010101	Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	1,534.12	2,787.69	$4,321.80	☐
33020303	Organic Vapor Analyzer Rental, per Day	1,593.00	DAY	148.46	0.00	0.00	$236,491.52	☐
33021720	Testing, purgeable organics (624, 8260)	6,370.00	EA	265.53	0.00	0.00	$1,691,441.39	☐
33132377	Equipment Enclosure, 8' x 15', Portable Building/Shed; lined, insulated, skid mounted, w/exhaust fan	1.00	EA	3,220.07	0.00	0.00	$3,220.07	☐
33139006	Air Sparge System, Blower 163 SCFM, 15 HP, 15 PSI, base, intake filter, silencer, pulleys, belt, belt guard.	98.00	EA	15,469.05	0.00	0.00	$1,515,967.11	☐
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	1,593.00	DAY	146.12	0.00	0.00	$232,761.99	☐
33220112	Field Technician	25,488.00	HR	0.00	80.82	0.00	$2,059,812.72	☐
33230101	2" PVC, Schedule 40, Well Casing	117,845.00	LF	1.46	5.11	9.29	$1,869,693.42	☐
33230201	2" PVC, Schedule 40, Well Screen	6,370.00	LF	3.37	6.60	11.99	$139,841.88	☐
33230301	2" PVC, Well Plug	3,185.00	EA	7.10	7.67	13.94	$91,434.34	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	127,400.00	LF	0.00	14.02	25.48	$5,032,898.78	☐
33231173	Split Spoon Sampling	25,480.00	LF	0.00	21.92	39.82	$1,573,137.75	☐
33231182	DOT steel drums, 55 gal., open, 17C	6,549.00	EA	102.05	0.00	0.00	$668,299.25	☐
33231401	2" Screen, Filter Pack	12,740.00	LF	3.79	4.35	7.90	$204,255.32	☐
33231811	2" Well, Portland Cement Grout	108,290.00	LF	1.41	0.00	0.00	$152,753.87	☐
33232101	2" Well, Bentonite Seal	3,185.00	EA	11.26	17.26	31.36	$190,707.93	☐
33260428	2" PVC, Schedule 80, Connection Piping	47,775.00	LF	1.08	5.56	0.00	$317,120.90	☐
33260460	4" PVC, Schedule 80, Manifold Piping	31,850.00	LF	3.23	11.97	0.00	$484,059.49	☐
33270124	2" PVC, Schedule 80, Tee	3,185.00	EA	15.50	0.00	0.00	$49,379.28	☐
33270134	2" PVC, Schedule 80, 90 Degree, Elbow	3,185.00	EA	4.22	0.00	0.00	$13,428.28	☐
33270167	4" x 2" Reducer, PVC Schedule 80	3,185.00	EA	45.43	0.00	0.00	$144,687.54	☐
33270440	2" PVC, Sch 80, Ball Valve	3,185.00	EA	108.39	0.00	0.00	$345,217.05	☐
33310209	Pressure Gauge	3,185.00	EA	85.55	81.19	0.00	$531,095.88	☐

Total Element Cost $17,552,027.58

Total 1st Year Technology Cost $17,552,027.58

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Soil Vapor Extraction

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010101	Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	1,822.15	1,263.05	$3,085.20	☐
33020303	Organic Vapor Analyzer Rental, per Day	273.00	DAY	148.49	0.00	0.00	$40,536.76	☐
33132361	1000 SCFM, Vapor Recovery System	32.00	EA	32,522.12	0.00	0.00	$1,040,707.90	☐
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	273.00	DAY	21.63	711.07	0.00	$200,026.91	☐
33220112	Field Technician	4,368.00	HR	0.00	100.80	0.00	$440,278.68	☐
33230101	2" PVC, Schedule 40, Well Casing	10,400.00	LF	1.46	5.11	9.29	$165,025.12	☐
33230201	2" PVC, Schedule 40, Well Screen	10,400.00	LF	3.37	6.60	11.99	$228,345.52	☐
33230301	2" PVC, Well Plug	1,040.00	EA	7.10	7.67	13.94	$29,860.27	☐
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	21,840.00	LF	0.00	14.02	25.49	$862,887.48	☐
33231182	DOT steel drums, 55 gal., open, 17C	1,097.00	EA	106.22	0.00	0.00	$116,525.75	☐
33231401	2" Screen, Filter Pack	12,480.00	LF	3.79	4.35	7.90	$200,115.55	☐
33231811	2" Well, Portland Cement Grout	7,280.00	LF	1.41	0.00	0.00	$10,270.62	☐
33232101	2" Well, Bentonite Seal	1,040.00	EA	11.26	17.26	31.37	$62,280.50	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33260428	2" PVC, Schedule 80, Connection Piping	27,300.00	LF	1.08	5.56	0.00	$181,220.13	☐
33260460	4" PVC, Schedule 80, Manifold Piping	18,200.00	LF	3.23	11.97	0.00	$276,616.34	☐
33270124	2" PVC, Schedule 80, Tee	1,040.00	EA	15.51	0.00	0.00	$16,127.07	☐
33270134	2" PVC, Schedule 80, 90 Degree, Elbow	1,040.00	EA	4.22	0.00	0.00	$4,385.68	☐
33270136	4" PVC, Schedule 80, 90 Degree, Elbow	1,040.00	EA	17.43	0.00	0.00	$18,129.59	☐
33270167	4" x 2" Reducer, PVC Schedule 80	1,040.00	EA	45.44	0.00	0.00	$47,254.27	☐
33270440	2" PVC, Sch 80, Ball Valve	1,040.00	EA	108.41	0.00	0.00	$112,746.40	☐
33310209	Pressure Gauge	1,040.00	EA	79.74	88.49	0.00	$174,955.56	☐

Total Element Cost $4,231,381.32

Total 1st Year Technology Cost $4,231,381.32

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Overhead Electrical Distribution

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
20020301	1/0 ACSR Conductor	3,180.00	LF	0.28	1.05	0.07	$4,454.86	☐
20020310	1/C #2 Aluminum, Bare, Wire	1,260.00	LF	0.21	1.02	0.07	$1,631.83	☐
20020403	40' Class 3 Treated Power Pole	5.00	EA	410.12	594.80	59.58	$5,322.53	☐
20020420	Straight-line Structure, 5 KV Pole Top	3.00	EA	140.11	536.00	53.69	$2,189.40	☐
20020430	Terminal Structure, 5 KV Pole Top	2.00	EA	1,583.62	2,033.87	203.72	$7,642.42	☐
20020511	5 KV, 3/0, Shielded Cable, Copper	120.00	LF	3.44	2.62	0.26	$758.29	☐
20020545	5 KV, 1/0 to 4/0 Conductor, Terminations & Splicing	6.00	EA	611.25	405.98	0.00	$6,103.37	☐
20039902	4" Rigid Steel Conduit	40.00	LF	12.11	16.36	0.00	$1,138.72	☐

Total Element Cost $29,241.41

Total 1st Year Technology Cost $29,241.41

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Professional Labor Management

Element: Professional Labor Percentage

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	1.00	LS	0.00	569,694.36	0.00	$569,694.36	☑
33220139	Planning Documents Labor Cost	1.00	LS	0.00	546,906.57	0.00	$546,906.57	☑
33220140	Construction Oversight Labor Cost	1.00	LS	0.00	957,086.50	0.00	$957,086.50	☑
33220141	Reporting Labor Cost	1.00	LS	0.00	113,938.87	0.00	$113,938.87	☑
33220142	As-Built Drawings Labor Cost	1.00	LS	0.00	113,938.87	0.00	$113,938.87	☑
33220143	Public Notice Labor Cost	1.00	LS	0.00	6,836.33	0.00	$6,836.33	☑
33220144	Site Closure Activities Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220145	Permitting Labor Cost	1.00	LS	0.00	227,877.73	0.00	$227,877.73	☑
33220146	Responsible Party Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220147	Reimbursement Claims Preparation Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220148	Other Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐

Total Element Cost $2,536,279.23

Total 1st Year Technology Cost $2,536,279.23

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Operations and Maintenance

Element: Miscellaneous

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010423	Disposable Gloves (Latex)	447.00	PR	0.26	0.00	0.00	$116.58	☐
33010425	Disposable Coveralls (Tyvek)	447.00	EA	5.88	0.00	0.00	$2,629.16	☐
33190340	Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	12.00	EA	270.36	0.00	0.00	$3,244.28	☐
33199921	DOT steel drums, 55 gal., open, 17C	12.00	EA	106.22	0.00	0.00	$1,274.67	☐
33240104	Startup Costs	1.00	LS	1,072,526.44	1,309,811.06	541,008.91	$2,923,346.40	☑
33420101	Electrical Charge	6,465.00	KWH	0.09	0.00	0.00	$561.81	☐
99020110	Annual Maintenance Materials and Labor	1.00	LS	34,857.11	42,568.86	17,582.79	$95,008.76	☑

Total Element Cost $3,026,181.66

Element: Air Sparging

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220106	Staff Engineer	114.00	HR	0.00	138.01	0.00	$15,732.86	☐
33220112	Field Technician	570.00	HR	0.00	100.80	0.00	$57,453.95	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Air Sparging

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33420101	Electrical Charge	6,975,150.00	KWH	0.09	0.00	0.00	$606,140.54	☐

Total Element Cost $679,327.34

Element: Soil Vapor Extraction

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33021832	Testing, non-rad lab tests, hydrocarbon speciation C1-C22 to-12/14	416.00	EA	368.13	0.00	0.00	$153,140.21	☐
33220106	Staff Engineer	184.00	HR	0.00	138.01	0.00	$25,393.38	☐
33220112	Field Technician	917.00	HR	0.00	100.80	0.00	$92,430.30	☐
33420101	Electrical Charge	1,366,560.00	KWH	0.09	0.00	0.00	$118,754.06	☐

Total Element Cost $389,717.95

Total 1st Year Technology Cost	$4,095,226.95
Runtime Percent Cost Adjustment	97%
O & M Total Cost	$3,972,370.14

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	49.00	EA	10.79	0.00	0.00	$528.61	☐
33020402	Decontamination Materials per Sample	49.00	EA	9.61	0.00	0.00	$470.86	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	2.00	WK	302.06	0.00	0.00	$604.13	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	49.00	EA	157.57	0.00	0.00	$7,721.02	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	49.00	EA	125.20	0.00	0.00	$6,134.56	☐
33231186	Well Development Equipment Rental (weekly)	2.00	WK	559.40	86.86	0.00	$1,292.54	☐
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	44.00	EA	7.78	0.00	0.00	$342.47	☐
			Total Element Cost				$17,094.18	

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020520	Hip Waders	1.00	EA	134.38	0.00	0.00	$134.38	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020524	Field sampling equipment, coliwasas, glass, disposable, 200 mL, case of 12, 7/8" x 42"	2.00	EA	134.47	0.00	0.00	$268.94	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	302.06	0.00	0.00	$302.06	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	14.00	EA	157.57	0.00	0.00	$2,206.01	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	14.00	EA	125.20	0.00	0.00	$1,752.73	☐
			Total Element Cost				$4,664.12	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Sample collection, vehicle mileage charge, car or van	810.00	MI	0.16	0.00	0.00	$130.41	☐
33220102	Project Manager	4.00	HR	0.00	162.63	0.00	$650.52	☐
33220105	Project Engineer	30.00	HR	0.00	157.70	0.00	$4,731.14	☐
33220108	Project Scientist	245.00	HR	0.00	182.55	0.00	$44,724.68	☐
33220109	Staff Scientist	80.00	HR	0.00	135.30	0.00	$10,823.82	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220112	Field Technician	168.00	HR	0.00	100.80	0.00	$16,933.80	☐
33220114	Word Processing/Clerical	44.00	HR	0.00	70.22	0.00	$3,089.53	☐
33220115	Draftsman/CADD	40.00	HR	0.00	91.79	0.00	$3,671.80	☐

Total Element Cost	$84,755.68
Total 1st Year Technology Cost	$106,513.98
Total Phase Element Cost	$28,427,813.66

Phase Element Technology Cost Detail Report
(with Markups)

Folder: GAFB APRONS FS

Project

Name:	Apron 2 Chlorinated FS
ID:	Apron 2 Chlorinated FS
Location:	GRIFFISS HOUSING, NEW YORK
Modifiers:	Material 1.006
	Labor 1.18 (Modified)
	Equipment 1.057
Category:	None
Report Option:	Fiscal Year
Description:	This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.

Site

Name:	Apron 2: PRB, ORC and LTM
ID:	Apron 2: PRB, ORC and LTM
Type:	None
Description:	PRB, ORC & LTM
Program:	N/A

Estimator Information:

Name:	Upgraded from prior version of RACER
Title:	Upgraded from prior version of RACER
Agency/Org./Office:	Upgraded from prior version of RACER
Business Address:	Upgraded from prior version of RACER
Phone:	Upgraded from prior version of RACER

Phase Element Technology Cost Detail Report
(with Markups)

Email:	Upgraded from prior version of RACER
Prepared Date:	Upgraded from prior version of RACER

Reviewer Information:

Name:	Upgraded from prior version of RACER
Title:	Upgraded from prior version of RACER
Agency/Org./Office:	Upgraded from prior version of RACER
Business Address:	Upgraded from prior version of RACER
Phone:	Upgraded from prior version of RACER
Email:	Upgraded from prior version of RACER
Date Reviewed:	Upgraded from prior version of RACER

Phase Element

Name:	PRB / Oxidation Injection	Media/Waste Type:	Groundwater
Type:	Remedial Action	Secondary Media/Waste Type:	N/A
Labor Rate Group:	System Labor Rate	Contaminant:	Volatile Organic Compounds (VOCs)
Analysis Rate Group:	System Analysis Rate	Secondary Contaminant:	None
Approach:	In Situ	Markup Template:	System Defaults
Start Date:	10/1/2005	O&M Markup Template:	N/A
Description:	PRB / Oxidation Injection		

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Permeable Barriers

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030415	Backfill with Excavated Material	462.22	CY	0.42	5.28	1.09	$3,141.11	☐
18050301	Loam or topsoil, imported topsoil, 6" deep, furnish and place	31.98	LCY	25.13	8.93	4.94	$1,246.98	☐
18050402	Seeding, Vegetative Cover	0.04	ACR	3,094.99	170.02	81.03	$133.84	☐
18050413	Watering with 3,000-Gallon Tank Truck, per Pass	0.20	ACR	5.19	56.40	46.34	$21.59	☐
33061011	Temporary Medium Wall Sheet Piling	13,860.00	SF	11.37	9.15	6.91	$380,232.47	☐
33061023	Slurry wall installation, normal soil, 26' - 75' excavation	1,000.00	CY	0.00	3.77	5.06	$8,827.50	☐
33061027	Key-in Treatment Wall	62.22	CY	40.11	84.57	30.08	$9,629.32	☐
33061028	Slurry wall installation, level and compact working surface	22.22	CY	0.00	3.81	6.38	$226.43	☐
33061031	Iron Filings	500.00	CY	514.17	50.83	39.20	$302,098.45	☐
33061042	Pea Gravel	100.00	CY	29.19	8.70	3.73	$4,161.75	☐
33230101	2" PVC, Schedule 40, Well Casing	405.00	LF	1.46	5.11	9.29	$6,425.61	☐
33230201	2" PVC, Schedule 40, Well Screen	45.00	LF	3.37	6.60	11.99	$987.89	☐
33230301	2" PVC, Well Plug	9.00	EA	7.10	7.67	13.94	$258.37	☐

Total Element Cost $717,391.30

Cost Database Date: 2004

Cost Type: User-Defined

Print Date: 5/25/2005 3:49:37 PM

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
		Total 1st Year Technology Cost					$717,391.30	

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Professional Labor Management

Element: Professional Labor Percentage

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	1.00	LS	0.00	265,033.52	0.00	$265,033.52	☑
33220139	Planning Documents Labor Cost	1.00	LS	0.00	265,033.52	0.00	$265,033.52	☑
33220140	Construction Oversight Labor Cost	1.00	LS	0.00	331,291.91	0.00	$331,291.91	☑
33220141	Reporting Labor Cost	1.00	LS	0.00	33,129.19	0.00	$33,129.19	☑
33220142	As-Built Drawings Labor Cost	1.00	LS	0.00	33,129.19	0.00	$33,129.19	☑
33220143	Public Notice Labor Cost	1.00	LS	0.00	4,638.09	0.00	$4,638.09	☑
33220144	Site Closure Activities Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220145	Permitting Labor Cost	1.00	LS	0.00	331,291.91	0.00	$331,291.91	☑
33220146	Responsible Party Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220147	Reimbursement Claims Preparation Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220148	Other Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐

Total Element Cost $1,263,547.32

Total 1st Year Technology Cost $1,263,547.32

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	141.00	EA	10.79	0.00	0.00	$1,521.09	☐
33020402	Decontamination Materials per Sample	141.00	EA	9.61	0.00	0.00	$1,354.93	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	5.00	WK	302.06	0.00	0.00	$1,510.32	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	141.00	EA	157.57	0.00	0.00	$22,217.64	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	141.00	EA	125.20	0.00	0.00	$17,652.50	☐
33231186	Well Development Equipment Rental (weekly)	5.00	WK	559.40	86.86	0.00	$3,231.34	☐
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	128.00	EA	7.78	0.00	0.00	$996.29	☐
			Total Element Cost				$48,484.10	

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020520	Hip Waders	1.00	EA	134.38	0.00	0.00	$134.38	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020524	Field sampling equipment, coliwasas, glass, disposable, 200 mL, case of 12, 7/8" x 42"	2.00	EA	134.47	0.00	0.00	$268.94	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	302.06	0.00	0.00	$302.06	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	14.00	EA	157.57	0.00	0.00	$2,206.01	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	14.00	EA	125.20	0.00	0.00	$1,752.73	☐

Total Element Cost $4,664.12

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Sample collection, vehicle mileage charge, car or van	2,250.00	MI	0.16	0.00	0.00	$362.25	☐
33220102	Project Manager	4.00	HR	0.00	162.63	0.00	$650.52	☐
33220105	Project Engineer	30.00	HR	0.00	157.70	0.00	$4,731.14	☐
33220108	Project Scientist	544.00	HR	0.00	182.55	0.00	$99,307.04	☐
33220109	Staff Scientist	80.00	HR	0.00	135.30	0.00	$10,823.82	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220112	Field Technician	470.00	HR	0.00	100.80	0.00	$47,374.31	☐
33220114	Word Processing/Clerical	90.00	HR	0.00	70.22	0.00	$6,319.49	☐
33220115	Draftsman/CADD	86.00	HR	0.00	91.79	0.00	$7,894.36	☐

Total Element Cost $177,462.92

Total 1st Year Technology Cost $230,611.13

Phase Element Technology Cost Detail Report
(with Markups)

Technology: In Situ Biodegradation (Saturated Zone)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
19040631	20,000 Gallon Horizontal Plastic Sump with 6" NPT Connection	1.00	EA	18,581.07	2,872.66	299.16	$21,752.89	☐
33020537	Water level indicators, water level chart recorder, battery operated	60.00	EA	1,170.22	0.00	0.00	$70,213.10	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	302.06	0.00	0.00	$302.06	☐
33021511	Aqueous organic & highly toxic wastes, reverse osmosis, optional equipment, recycle system, 3/4 HP unit only	60.00	EA	102.44	0.00	0.00	$6,146.44	☐
33021913	Testing, biomonitoring & bioassay, laboratory bench-scale studies	3.00	EA	956.17	0.00	0.00	$2,868.50	☐
33230101	2" PVC, Schedule 40, Well Casing	1,200.00	LF	1.46	5.11	9.29	$19,041.36	☐
33230201	2" PVC, Schedule 40, Well Screen	2,700.00	LF	3.37	6.60	11.99	$59,282.01	☐
33230301	2" PVC, Well Plug	60.00	EA	7.10	7.67	13.94	$1,722.71	☐
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	3,900.00	LF	0.00	14.02	25.49	$154,087.05	☐
33231172	Split Spoon Sample, 2" x 24", During Drilling	780.00	EA	53.00	0.00	0.00	$41,339.84	☐
33231178	Move Rig/Equipment Around Site	59.00	EA	72.05	261.93	181.56	$30,417.57	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33231180	Mobilization/Demobilization, Drill Equipment or Trencher, Crew	1.00	EA	313.28	1,138.85	789.41	$2,241.53	☐
33231182	DOT steel drums, 55 gal., open, 17C	204.00	EA	106.22	0.00	0.00	$21,669.33	☐
33231187	Load Supplies/Equipment	1.00	LS	187.97	683.31	473.64	$1,344.92	☐
33231401	2" Screen, Filter Pack	2,880.00	LF	3.79	4.35	7.90	$46,180.51	☐
33231502	Surface Pad, Concrete, 4' x 4' x 4"	60.00	EA	73.13	37.29	3.57	$6,839.38	☐
33231811	2" Well, Portland Cement Grout	1,020.00	LF	1.41	0.00	0.00	$1,439.02	☐
33232101	2" Well, Bentonite Seal	60.00	EA	11.26	17.26	31.37	$3,593.11	☐
33260428	2" PVC, Schedule 80, Connection Piping	6,000.00	LF	1.08	5.56	0.00	$39,828.60	☐
33270114	2" PVC, Schedule 40, 90 Degree, Elbow	60.00	EA	1.99	0.00	0.00	$119.38	☐
33270402	Valves, iron body, silent check, bronze trim, compact wafer type, for 125 or 150 lb. flanges, 2"	60.00	EA	181.31	93.85	0.00	$16,509.47	☐
33290102	10 GPM, 1/2 HP, Centrifugal Pump	60.00	EA	893.02	483.38	0.00	$82,584.03	☐
33330192	Oxygen Release Compound (ORC), More than 40,000 lb.	4,500.00	LB	9.71	0.00	0.00	$43,708.95	☐

Total Element Cost $673,231.77

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
		Total 1st Year Technology Cost					$673,231.77	

Phase Element Technology Cost Detail Report (with Markups)

Technology: Permeable Barriers

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030415	Backfill with Excavated Material	462.22	CY	0.42	5.28	1.09	$3,141.11	☐
18050301	Loam or topsoil, imported topsoil, 6" deep, furnish and place	31.98	LCY	25.13	8.93	4.94	$1,246.98	☐
18050402	Seeding, Vegetative Cover	0.04	ACR	3,094.99	170.02	81.03	$133.84	☐
18050413	Watering with 3,000-Gallon Tank Truck, per Pass	0.20	ACR	5.19	56.40	46.34	$21.59	☐
33061011	Temporary Medium Wall Sheet Piling	13,860.00	SF	11.37	9.15	6.91	$380,232.47	☐
33061023	Slurry wall installation, normal soil, 26' - 75' excavation	1,000.00	CY	0.00	3.77	5.06	$8,827.50	☐
33061027	Key-in Treatment Wall	62.22	CY	40.11	84.57	30.08	$9,629.32	☐
33061028	Slurry wall installation, level and compact working surface	22.22	CY	0.00	3.81	6.38	$226.43	☐
33061031	Iron Filings	500.00	CY	514.17	50.83	39.20	$302,098.45	☐
33061042	Pea Gravel	100.00	CY	29.19	8.70	3.73	$4,161.75	☐
33230101	2" PVC, Schedule 40, Well Casing	405.00	LF	1.46	5.11	9.29	$6,425.61	☐
33230201	2" PVC, Schedule 40, Well Screen	45.00	LF	3.37	6.60	11.99	$987.89	☐
33230301	2" PVC, Well Plug	9.00	EA	7.10	7.67	13.94	$258.37	☐

Total Element Cost $717,391.30

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
		Total 1st Year Technology Cost					$717,391.30	

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Permeable Barriers

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030415	Backfill with Excavated Material	462.22	CY	0.42	5.28	1.09	$3,141.11	☐
18050301	Loam or topsoil, imported topsoil, 6" deep, furnish and place	31.98	LCY	25.13	8.93	4.94	$1,246.98	☐
18050402	Seeding, Vegetative Cover	0.04	ACR	3,094.99	170.02	81.03	$133.84	☐
18050413	Watering with 3,000-Gallon Tank Truck, per Pass	0.20	ACR	5.19	56.40	46.34	$21.59	☐
33061011	Temporary Medium Wall Sheet Piling	13,860.00	SF	11.37	9.15	6.91	$380,232.47	☐
33061023	Slurry wall installation, normal soil, 26' - 75' excavation	1,000.00	CY	0.00	3.77	5.06	$8,827.50	☐
33061027	Key-in Treatment Wall	62.22	CY	40.11	84.57	30.08	$9,629.32	☐
33061028	Slurry wall installation, level and compact working surface	22.22	CY	0.00	3.81	6.38	$226.43	☐
33061031	Iron Filings	500.00	CY	514.17	50.83	39.20	$302,098.45	☐
33061042	Pea Gravel	100.00	CY	29.19	8.70	3.73	$4,161.75	☐
33230101	2" PVC, Schedule 40, Well Casing	405.00	LF	1.46	5.11	9.29	$6,425.61	☐
33230201	2" PVC, Schedule 40, Well Screen	45.00	LF	3.37	6.60	11.99	$987.89	☐
33230301	2" PVC, Well Plug	9.00	EA	7.10	7.67	13.94	$258.37	☐
				Total Element Cost			$717,391.30	

Cost Database Date: 2004

Cost Type: User-Defined

Print Date: 5/25/2005 3:49:37 PM

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
		Total 1st Year Technology Cost					$717,391.30	
		Total Phase Element Cost					$4,319,564.12	

Phase Element Technology Cost Detail Report
(with Markups)

Folder: GAFB APRONS FS

Project

Name:	Apron 2 Chlorinated FS		
ID:	Apron 2 Chlorinated FS		
Location:	GRIFFISS HOUSING, NEW YORK		
Modifiers:	Material	1.006	
	Labor	1.18	(Modified)
	Equipment	1.057	
Category:	None		
Report Option:	Fiscal Year		
Description:	This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.		

Site

Name:	Apron 2: Chemical Oxidation and LTM
ID:	Apron 2: Chemical Oxidation and LTM
Type:	None
Description:	Chemical Oxidation & LTM
Program:	N/A

Estimator Information:

Name:	Upgraded from prior version of RACER
Title:	Upgraded from prior version of RACER
Agency/Org./Office:	Upgraded from prior version of RACER
Business Address:	Upgraded from prior version of RACER
Phone:	Upgraded from prior version of RACER

Phase Element Technology Cost Detail Report
(with Markups)

Email:	Upgraded from prior version of RACER
Prepared Date:	Upgraded from prior version of RACER

Reviewer Information:

Name:	Upgraded from prior version of RACER
Title:	Upgraded from prior version of RACER
Agency/Org./Office:	Upgraded from prior version of RACER
Business Address:	Upgraded from prior version of RACER
Phone:	Upgraded from prior version of RACER
Email:	Upgraded from prior version of RACER
Date Reviewed:	Upgraded from prior version of RACER

Phase Element

Name:	Chemical Oxidation Injection	Media/Waste Type:	Groundwater
Type:	Remedial Action	Secondary Media/Waste Type:	N/A
Labor Rate Group:	System Labor Rate	Contaminant:	Volatile Organic Compounds (VOCs)
Analysis Rate Group:	System Analysis Rate	Secondary Contaminant:	None
Approach:	In Situ	Markup Template:	System Defaults
Start Date:	10/1/2005	O&M Markup Template:	N/A
Description:	Chemical Oxidation Injection		

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Professional Labor Management

Element: Professional Labor Percentage

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	1.00	LS	0.00	154,002.95	0.00	$154,002.95	☑
33220139	Planning Documents Labor Cost	1.00	LS	0.00	154,002.95	0.00	$154,002.95	☑
33220140	Construction Oversight Labor Cost	1.00	LS	0.00	192,503.69	0.00	$192,503.69	☑
33220141	Reporting Labor Cost	1.00	LS	0.00	19,250.37	0.00	$19,250.37	☑
33220142	As-Built Drawings Labor Cost	1.00	LS	0.00	19,250.37	0.00	$19,250.37	☑
33220143	Public Notice Labor Cost	1.00	LS	0.00	2,695.05	0.00	$2,695.05	☑
33220144	Site Closure Activities Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220145	Permitting Labor Cost	1.00	LS	0.00	192,503.69	0.00	$192,503.69	☑
33220146	Responsible Party Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220147	Reimbursement Claims Preparation Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220148	Other Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐

Total Element Cost $734,209.08

Total 1st Year Technology Cost $734,209.08

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	102.00	EA	10.79	0.00	0.00	$1,100.37	☐
33020402	Decontamination Materials per Sample	102.00	EA	9.61	0.00	0.00	$980.16	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	4.00	WK	302.06	0.00	0.00	$1,208.25	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	102.00	EA	157.57	0.00	0.00	$16,072.33	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	102.00	EA	125.20	0.00	0.00	$12,769.89	☐
33231186	Well Development Equipment Rental (weekly)	4.00	WK	559.40	86.86	0.00	$2,585.07	☐
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	92.00	EA	7.78	0.00	0.00	$716.08	☐
				Total Element Cost			$35,432.16	

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020520	Hip Waders	1.00	EA	134.38	0.00	0.00	$134.38	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020524	Field sampling equipment, coliwasas, glass, disposable, 200 mL, case of 12, 7/8" x 42"	2.00	EA	134.47	0.00	0.00	$268.94	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	302.06	0.00	0.00	$302.06	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	14.00	EA	157.57	0.00	0.00	$2,206.01	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	14.00	EA	125.20	0.00	0.00	$1,752.73	☐
				Total Element Cost			$4,664.12	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Sample collection, vehicle mileage charge, car or van	1,530.00	MI	0.16	0.00	0.00	$246.33	☐
33220102	Project Manager	4.00	HR	0.00	162.63	0.00	$650.52	☐
33220105	Project Engineer	30.00	HR	0.00	157.70	0.00	$4,731.14	☐
33220108	Project Scientist	417.00	HR	0.00	182.55	0.00	$76,123.22	☐
33220109	Staff Scientist	80.00	HR	0.00	135.30	0.00	$10,823.82	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220112	Field Technician	322.00	HR	0.00	100.80	0.00	$32,456.44	☐
33220114	Word Processing/Clerical	70.00	HR	0.00	70.22	0.00	$4,915.16	☐
33220115	Draftsman/CADD	66.00	HR	0.00	91.79	0.00	$6,058.46	☐

Total Element Cost $136,005.09

Total 1st Year Technology Cost $176,101.37

Phase Element Technology Cost Detail Report
(with Markups)

Technology: In Situ Biodegradation (Saturated Zone)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
19010310	Storage Tanks, steel, ground level, horizontal , for water, 5,000 gallons	1.00	EA	6,639.86	863.61	0.00	$7,503.47	☐
19040631	20,000 Gallon Horizontal Plastic Sump with 6" NPT Connection	1.00	EA	18,581.07	2,872.66	299.16	$21,752.89	☐
33020537	Water level indicators, water level chart recorder, battery operated	80.00	EA	1,170.22	0.00	0.00	$93,617.47	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	302.06	0.00	0.00	$302.06	☐
33021511	Aqueous organic & highly toxic wastes, reverse osmosis, optional equipment, recycle system, 3/4 HP unit only	80.00	EA	102.44	0.00	0.00	$8,195.25	☐
33021913	Testing, biomonitoring & bioassay, laboratory bench-scale studies	3.00	EA	956.17	0.00	0.00	$2,868.50	☐
33230101	2" PVC, Schedule 40, Well Casing	1,600.00	LF	1.46	5.11	9.29	$25,388.48	☐
33230201	2" PVC, Schedule 40, Well Screen	1,840.00	LF	3.37	6.60	11.99	$40,399.59	☐
33230301	2" PVC, Well Plug	80.00	EA	7.10	7.67	13.94	$2,296.94	☐
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	3,440.00	LF	0.00	14.02	25.49	$135,912.68	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33231172	Split Spoon Sample, 2" x 24", During Drilling	720.00	EA	53.00	0.00	0.00	$38,159.86	☐
33231178	Move Rig/Equipment Around Site	79.00	EA	72.05	261.93	181.56	$40,728.61	☐
33231180	Mobilization/Demobilization, Drill Equipment or Trencher, Crew	1.00	EA	313.28	1,138.85	789.41	$2,241.53	☐
33231182	DOT steel drums, 55 gal., open, 17C	180.00	EA	106.22	0.00	0.00	$19,120.00	☐
33231187	Load Supplies/Equipment	1.00	LS	187.97	683.31	473.64	$1,344.92	☐
33231401	2" Screen, Filter Pack	2,080.00	LF	3.79	4.35	7.90	$33,352.59	☐
33231502	Surface Pad, Concrete, 4' x 4' x 4"	80.00	EA	73.13	37.29	3.57	$9,119.18	☐
33231811	2" Well, Portland Cement Grout	1,360.00	LF	1.41	0.00	0.00	$1,918.69	☐
33232101	2" Well, Bentonite Seal	80.00	EA	11.26	17.26	31.37	$4,790.81	☐
33240102	Bench Scale Test	3.00	LS	6,436.76	0.00	0.00	$19,310.29	☑
33240103	Pilot Scale Test	1.00	LS	128,735.25	0.00	0.00	$128,735.25	☑
33260428	2" PVC, Schedule 80, Connection Piping	8,000.00	LF	1.08	5.56	0.00	$53,104.80	☐
33270114	2" PVC, Schedule 40, 90 Degree, Elbow	80.00	EA	1.99	0.00	0.00	$159.18	☐
33270402	Valves, iron body, silent check, bronze trim, compact wafer type, for 125 or 150 lb. flanges, 2"	80.00	EA	181.31	93.85	0.00	$22,012.63	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33290102	10 GPM, 1/2 HP, Centrifugal Pump	80.00	EA	893.02	483.38	0.00	$110,112.04	☐
33330171	Hydrogen Peroxide, 50% Solution, 500 Lb Drums	50.00	EA	1,217.37	0.00	0.00	$60,868.60	☐

Total Element Cost $883,316.30

Total 1st Year Technology Cost $883,316.30

Phase Element Technology Cost Detail Report
(with Markups)

Technology: In Situ Biodegradation (Saturated Zone)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
19010310	Storage Tanks, steel, ground level, horizontal , for water, 5,000 gallons	1.00	EA	6,639.86	863.61	0.00	$7,503.47	☐
19040631	20,000 Gallon Horizontal Plastic Sump with 6" NPT Connection	1.00	EA	18,581.07	2,872.66	299.16	$21,752.89	☐
33020537	Water level indicators, water level chart recorder, battery operated	80.00	EA	1,170.22	0.00	0.00	$93,617.47	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	302.06	0.00	0.00	$302.06	☐
33021511	Aqueous organic & highly toxic wastes, reverse osmosis, optional equipment, recycle system, 3/4 HP unit only	80.00	EA	102.44	0.00	0.00	$8,195.25	☐
33021913	Testing, biomonitoring & bioassay, laboratory bench-scale studies	3.00	EA	956.17	0.00	0.00	$2,868.50	☐
33230101	2" PVC, Schedule 40, Well Casing	1,600.00	LF	1.46	5.11	9.29	$25,388.48	☐
33230201	2" PVC, Schedule 40, Well Screen	1,840.00	LF	3.37	6.60	11.99	$40,399.59	☐
33230301	2" PVC, Well Plug	80.00	EA	7.10	7.67	13.94	$2,296.94	☐
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	3,440.00	LF	0.00	14.02	25.49	$135,912.68	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33231172	Split Spoon Sample, 2" x 24", During Drilling	720.00	EA	53.00	0.00	0.00	$38,159.86	☐
33231178	Move Rig/Equipment Around Site	79.00	EA	72.05	261.93	181.56	$40,728.61	☐
33231180	Mobilization/Demobilization, Drill Equipment or Trencher, Crew	1.00	EA	313.28	1,138.85	789.41	$2,241.53	☐
33231182	DOT steel drums, 55 gal., open, 17C	180.00	EA	106.22	0.00	0.00	$19,120.00	☐
33231187	Load Supplies/Equipment	1.00	LS	187.97	683.31	473.64	$1,344.92	☐
33231401	2" Screen, Filter Pack	2,080.00	LF	3.79	4.35	7.90	$33,352.59	☐
33231502	Surface Pad, Concrete, 4' x 4' x 4"	80.00	EA	73.13	37.29	3.57	$9,119.18	☐
33231811	2" Well, Portland Cement Grout	1,360.00	LF	1.41	0.00	0.00	$1,918.69	☐
33232101	2" Well, Bentonite Seal	80.00	EA	11.26	17.26	31.37	$4,790.81	☐
33260428	2" PVC, Schedule 80, Connection Piping	8,000.00	LF	1.08	5.56	0.00	$53,104.80	☐
33270114	2" PVC, Schedule 40, 90 Degree, Elbow	80.00	EA	1.99	0.00	0.00	$159.18	☐
33270402	Valves, iron body, silent check, bronze trim, compact wafer type, for 125 or 150 lb. flanges, 2"	80.00	EA	181.31	93.85	0.00	$22,012.63	☐
33290102	10 GPM, 1/2 HP, Centrifugal Pump	80.00	EA	893.02	483.38	0.00	$110,112.04	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33330171	Hydrogen Peroxide, 50% Solution, 500 Lb Drums	50.00	EA	1,217.37	0.00	0.00	$60,868.60	☐

Total Element Cost	$735,270.77
Total 1st Year Technology Cost	$735,270.77
Total Phase Element Cost	$2,528,897.52

Phase Element Technology Cost Detail Report
(with Markups)

Folder: GAFB APRONS FS

Project

Name:	Apron 2 Chlorinated FS		
ID:	Apron 2 Chlorinated FS		
Location:	GRIFFISS HOUSING, NEW YORK		
Modifiers:	Material	1.006	
	Labor	1.18	(Modified)
	Equipment	1.057	
Category:	None		
Report Option:	Fiscal Year		
Description:	This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.		

Site

Name: Apron 2: Six Mile Creek Barrier & LTM
ID: Apron 2: Six Mile Creek Barrier & LTM
Type: None
Description: This estimate was imported or upgraded from a previous version of RACER and contained no information in this Description field.
Program: N/A

Estimator Information:

Name: Upgraded from prior version of RACER
Title: Upgraded from prior version of RACER
Agency/Org./Office: Upgraded from prior version of RACER
Business Address: Upgraded from prior version of RACER
Phone: Upgraded from prior version of RACER

Phase Element Technology Cost Detail Report
(with Markups)

Email: Upgraded from prior version of RACER
Prepared Date: Upgraded from prior version of RACER

Reviewer Information:

Name: Upgraded from prior version of RACER
Title: Upgraded from prior version of RACER
Agency/Org./Office: Upgraded from prior version of RACER
Business Address: Upgraded from prior version of RACER
Phone: Upgraded from prior version of RACER
Email: Upgraded from prior version of RACER
Date Reviewed: Upgraded from prior version of RACER

Phase Element

Name:	Six-Mile Creek Barrier Trench	Media/Waste Type:	Groundwater
Type:	Remedial Action	Secondary Media/Waste Type:	N/A
Labor Rate Group:	System Labor Rate	Contaminant:	Volatile Organic Compounds (VOCs)
Analysis Rate Group:	System Analysis Rate	Secondary Contaminant:	None
Approach:	In Situ	Markup Template:	System Defaults
Start Date:	10/1/2005	O&M Markup Template:	System Defaults
Description:	Air Sparge Horizontal Well & LTM		

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Professional Labor Management

Element: Professional Labor Percentage

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	1.00	LS	0.00	20,814.14	0.00	$20,814.14	☑
33220139	Planning Documents Labor Cost	1.00	LS	0.00	19,426.53	0.00	$19,426.53	☑
33220140	Construction Oversight Labor Cost	1.00	LS	0.00	16,651.31	0.00	$16,651.31	☑
33220141	Reporting Labor Cost	1.00	LS	0.00	2,775.22	0.00	$2,775.22	☑
33220142	As-Built Drawings Labor Cost	1.00	LS	0.00	2,775.22	0.00	$2,775.22	☑
33220143	Public Notice Labor Cost	1.00	LS	0.00	832.57	0.00	$832.57	☑
33220144	Site Closure Activities Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220145	Permitting Labor Cost	1.00	LS	0.00	27,752.19	0.00	$27,752.19	☑
33220146	Responsible Party Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220147	Reimbursement Claims Preparation Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐
33220148	Other Labor Cost	1.00	LS	0.00	0.00	0.00	$0.00	☐

Total Element Cost $91,027.18

Total 1st Year Technology Cost $91,027.18

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Special Well Drilling & Installation

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	4.00	DAY	21.91	731.68	0.00	$3,014.39	☐
33230136	4" PVC, Schedule 40, Horizontal Well Casing, Material Only	173.10	LF	3.47	0.00	0.00	$601.11	☐
33230238	4" PVC, Schedule 40, Horizontal Well Screen, Material Only	450.00	LF	5.81	0.00	0.00	$2,613.78	☐
33230327	4" PVC Plug for Horizontal Well, Material Only	1.00	EA	45.67	0.00	0.00	$45.67	☐
33231182	DOT steel drums, 55 gal., open, 17C	43.00	EA	107.63	0.00	0.00	$4,628.18	☐
33231186	Well Development Equipment Rental (weekly)	1.00	WK	566.83	89.38	0.00	$656.21	☐
33231201	Mobilize/Demobilize Directional Drill Rig	1.00	EA	317.44	1,171.86	817.10	$2,306.40	☐
33231210	Mud Drilling, 400 - 1,200' Length, Unconsolidated, Continuous	788.19	LF	141.21	0.00	0.00	$111,297.32	☐
33231812	4" Well, Portland Cement Grout	168.10	LF	2.14	0.00	0.00	$360.47	☐
33232102	4" Well, Bentonite Seal	2.00	EA	28.53	44.41	81.18	$308.23	☐
				Total Element Cost			$125,831.76	

Phase Element Technology Cost Detail Report
(with Markups)

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
			Total 1st Year Technology Cost				$125,831.76	

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Air Sparging

Element: N/A

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020303	Organic Vapor Analyzer Rental, per Day	10.00	DAY	150.43	0.00	0.00	$1,504.27	☐
33132377	Equipment Enclosure, 8' x 15', Portable Building/Shed; lined, insulated, skid mounted, w/exhaust fan	2.00	EA	3,262.82	0.00	0.00	$6,525.63	☐
33139006	Air Sparge System, Blower 163 SCFM, 15 HP, 15 PSI, base, intake filter, silencer, pulleys, belt, belt guard.	2.00	EA	15,674.39	0.00	0.00	$31,348.79	☐
33220112	Field Technician	320.00	HR	0.00	80.82	0.00	$25,860.80	☐
33260460	4" PVC, Schedule 80, Manifold Piping	300.00	LF	3.27	12.32	0.00	$4,676.37	☐
33270440	2" PVC, Sch 80, Ball Valve	6.00	EA	109.83	0.00	0.00	$658.96	☐
33310209	Pressure Gauge	6.00	EA	86.69	83.55	0.00	$1,021.43	☐

Total Element Cost $71,596.26

Total 1st Year Technology Cost $71,596.26

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Operations and Maintenance

Element: Miscellaneous

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010423	Disposable Gloves (Latex)	57.00	PR	0.28	0.00	0.00	$15.79	☐
33010425	Disposable Coveralls (Tyvek)	57.00	EA	6.25	0.00	0.00	$356.03	☐
33190340	Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	2.00	EA	287.10	0.00	0.00	$574.21	☐
33199921	DOT steel drums, 55 gal., open, 17C	2.00	EA	112.80	0.00	0.00	$225.60	☐
33220104	Senior Staff Engineer	4.00	HR	0.00	239.87	0.00	$959.46	☐
33240104	Startup Costs	1.00	LS	3,094.04	3,867.55	1,779.07	$8,740.67	☑
33420101	Electrical Charge	3,502.00	KWH	0.09	0.00	0.00	$323.23	☐
99020110	Annual Maintenance Materials and Labor	1.00	LS	66.70	83.38	38.35	$188.44	☑

Total Element Cost $11,383.43

Phase Element Technology Cost Detail Report
(with Markups)

Element: Air Sparging

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33021803	Testing, non-rad lab tests, tentative id of compounds GC/MS 30/5040/8240	3.00	EA	155.29	0.00	0.00	$465.86	☐
33220106	Staff Engineer	38.00	HR	0.00	143.22	0.00	$5,442.18	☐
33220112	Field Technician	188.00	HR	0.00	104.60	0.00	$19,664.80	☐
33420101	Electrical Charge	56,940.00	KWH	0.09	0.00	0.00	$5,255.56	☐

Total Element Cost	$30,828.40
Total 1st Year Technology Cost	$42,211.83
Runtime Percent Cost Adjustment	97%
O & M Total Cost	$40,945.48

Cost Database Date: 2004

Cost Type: User-Defined

Print Date: 5/25/2005 3:55:27 PM

Phase Element Technology Cost Detail Report
(with Markups)

Technology: Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	49.00	EA	10.93	0.00	0.00	$535.62	☐
33020402	Decontamination Materials per Sample	49.00	EA	9.74	0.00	0.00	$477.11	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	2.00	WK	306.07	0.00	0.00	$612.15	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	49.00	EA	159.66	0.00	0.00	$7,823.52	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	49.00	EA	126.86	0.00	0.00	$6,215.99	☐
33231186	Well Development Equipment Rental (weekly)	2.00	WK	566.83	89.38	0.00	$1,312.42	☐
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	44.00	EA	7.89	0.00	0.00	$347.02	☐

Total Element Cost $17,323.83

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020520	Hip Waders	1.00	EA	136.16	0.00	0.00	$136.16	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: Surface Water

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020524	Field sampling equipment, coliwasas, glass, disposable, 200 mL, case of 12, 7/8" x 42"	2.00	EA	136.25	0.00	0.00	$272.51	☐
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1.00	WK	306.07	0.00	0.00	$306.07	☐
33022131	Testing, purgeable halocarbons (SW5030/8010)	14.00	EA	159.66	0.00	0.00	$2,235.29	☐
33022132	Testing, purgeable aromatics (SW5030/8020)	14.00	EA	126.86	0.00	0.00	$1,776.00	☐
			Total Element Cost				$4,726.03	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Sample collection, vehicle mileage charge, car or van	810.00	MI	0.16	0.00	0.00	$130.41	☐
33220102	Project Manager	4.00	HR	0.00	162.63	0.00	$650.52	☐
33220105	Project Engineer	30.00	HR	0.00	157.70	0.00	$4,731.14	☐
33220108	Project Scientist	245.00	HR	0.00	182.55	0.00	$44,724.68	☐
33220109	Staff Scientist	80.00	HR	0.00	135.30	0.00	$10,823.82	☐

Phase Element Technology Cost Detail Report
(with Markups)

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220112	Field Technician	168.00	HR	0.00	100.80	0.00	$16,933.80	☐
33220114	Word Processing/Clerical	44.00	HR	0.00	70.22	0.00	$3,089.53	☐
33220115	Draftsman/CADD	40.00	HR	0.00	91.79	0.00	$3,671.80	☐

Total Element Cost	$84,755.68
Total 1st Year Technology Cost	$106,805.54
Total Phase Element Cost	$436,206.22