FINAL

Corrective Action Plan for the Risk-Based Remediation of the Seventh Street Service Station



Eglin Air Force Base
Florida

Prepared For

Air Force Center for Environmental Excellence
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Brooks Air Force Base, Texas

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ACRONYMS AND ABBREVIATIONS

°C	degrees centigrade
°F	degrees Fahrenheit
AAS	air sparge
AETC	Air Education and Training Command
AFB	Air Force Base
AFCEE/ERT	Air Force Center for Environmental Excellence, Technology Transfer Division
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
CAR	Contamination Assessment Report
CH_4	methane
CO_2	carbon dioxide
COPC	chemicals of potential concern
CSM	conceptual site model
DO	dissolved oxygen
EDB	ethylene dibromide
ES	Engineering-Science, Inc.
FAC	Florida Administrative Code
Fe2+	ferrous iron
Fe3+	ferric iron
FDEP	Florida Department of Environmental Protection
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet per year
gpd/ft	gallons per day per foot
H^+	hydrogen ion
HDPE	high-density polyethylene
LCS	laboratory control samples
LTM	long-term monitoring
LNAPL	light, non-aqueous phase liquid
MDL	method detection limit
mg/L	milligrams per liter
MNA	monitored natural attenuation
msl	mean sea level
MS/MSD	matrix spike / matrix spike duplicate
MTBE	methyl tert-butyl ether
mV	millivolt
MW	monitoring well
N	nitrogen
NFA	No-Further-Action

O_2	oxygen
ORP	oxidation/reduction potential
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
OVM	organic vapor meter
PAH	polynuclear aromatic hydrocarbon
Parsons ES	Parsons Engineering Science, Inc.
PEL	permissible exposure limits
POC	point of compliance
POL	petroleum, oils, and lubricants
ppmv	parts per million, volume per volume
PQL	practical quantitation limit
QA	quality assurance
QC	quality control
RAP	Remedial Action Plan
RNA	remediation by natural attenuation
SAP	sampling and analysis plan
SB	soil boring
SQL	sample quantitation limit
SVE	soil vapor extraction
Tbsp	tablespoon
TCLs	target cleanup levels
TDS	total dissolved solids
TLV	threshold limit value
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
UST	underground storage tank

SECTION 1

INTRODUCTION

Parsons Engineering Science, Inc. (Parsons ES) was retained by the Air Force Center for Environmental Excellence, Technology Transfer Division (AFCEE/ERT) under Air Education and Training Command (AETC) Contract No. F41689-96-D-0710, Order No. 5015 to prepare a corrective action plan (CAP) to support a risk-based remediation decision for contaminated soil and groundwater at the Seventh Street Service Station at Eglin Air Force Base (AFB) in Florida.

1.1 DESCRIPTION OF THE RISK-BASED APPROACH

The objective of risk-based remediation is to reduce the risk of specific chemicals to human health and/or ecological receptors such as animals or plant life. For any chemical to pose a risk, four elements must exist at the site:

- A source of chemical contamination that exceeds or could generate chemical contamination above health-protective or aesthetic standards;
- A mechanism of contaminant release;
- A human or ecological receptor available for chemical contact; and
- A completed pathway through which that receptor will contact the chemical.

If any one of these four elements is absent at a site, there is no current risk. The reduction or elimination of risk can be accomplished by limiting or removing any one of these four elements from the site.

The goal of this risk-based remediation approach is to find the most cost-effective method of reducing present and future risk by combining three risk reduction techniques:

- Chemical Source Reduction - Achieved by natural attenuation processes over time or by engineered removals such as free product recovery, soil vapor extraction (SVE), or *in situ* bioventing.
- Chemical Migration Control - Examples include natural attenuation of a groundwater plume, and SVE to prevent migration of hazardous vapors to a receptor exposure point.

- Receptor Restriction - Examples include land use controls and site fencing to eliminate chemical exposure until natural attenuation and/or engineered remediation reduce the chemical source and/or eliminate the potential for chemical migration to an exposure point.

1.2 RISK-BASED APPROACH TASKS

The major tasks of this risk-based project are:

- Assessing available data and collecting any supplemental site characterization data necessary to define the nature, magnitude, and extent of soil and groundwater contamination and to document to what degree natural attenuation processes are operating at the selected sites;

- Determining whether an unacceptable risk to human health or the environment currently exists or may exist in the foreseeable future using applicable Florida Department of Environmental Protection (FDEP) guidance and regulations, contaminant fate and transport predictions, and exposure concentration estimates;

- Evaluating and recommending a remedial alternative that both reduces the source of contamination and minimizes or eliminates risks to potential receptors; and

- Documenting the remedial action selection process in a report that satisfies FDEP requirements.

1.3 REGULATORY REQUIREMENTS

This section describes Florida's tiered approach for risk-based remedial action at sites contaminated with petroleum products. The *Petroleum Contamination Site Cleanup Criteria* rule [Chapter 62.770 of the Florida Administrative Code (FAC)] (FDEP, 1997) presents guidance for determination of remedial requirements for closure of petroleum-contaminated sites, including several mechanisms for determining matrix-specific cleanup criteria. The regulations allow closure of petroleum release sites under several different scenarios, including:

- No-Further-Action (NFA) Proposal Without Conditions,

- NFA Proposal With Conditions, or

- Monitoring-Only Proposal for Natural Attenuation.

A Remedial Action Plan (RAP) must be prepared for sites that do not meet the requirements for NFA or Natural Attenuation. Closure of a site under the NFA-Without-Conditions alternative would allow unrestricted future use of the site (e.g., residential land use), and therefore the requirements and allowable contaminant levels under this alternative are the most restrictive. The NFA-With-Conditions alternative requires that appropriate institutional or engineering controls be implemented to limit receptor exposure; sites seeking closure under this alternative are subject to potentially less stringent cleanup levels. A Natural Attenuation Monitoring Program is a

recognized means of remediating a site, with the goal of achieving the NFA cleanup target levels.

The actual or potential beneficial use of the groundwater and susceptibility of the aquifer to contamination are considered in the risk-based corrective action program to determine site-specific remediation target levels. All groundwater of the State of Florida is classified according to the following uses:

Class F-I: Potable water use: groundwater in a single source aquifer described in Rule 62-520.460, FAC that has a total dissolved solids (TDS) content of less than 3,000 milligrams per liter (mg/L) and was specifically reclassified as Class F-I by the Commission.

Class G-I: Potable water use: groundwater in a single-source aquifer that has a TDS content of less than 3,000 mg/L.

Class G-II: Potable water use: groundwater in an aquifer that has a TDS content of less than 10,000 mg/L, unless otherwise classified by the Commission.

Class G-III: Non-potable water use: groundwater in an unconfined aquifer that has a TDS content of 10,000 mg/L or greater; or that has a TDS content of 3,000-10,000 mg/L and either has been reclassified by the Commission as having no reasonable potential as a future source of drinking water, or has been designated by the FDEP as an exempted aquifer pursuant to Rule 62-28.130(3), FAC.

Class G-IV: Non-potable water use: groundwater in a confined aquifer that has a TDS content of 10,000 mg/L or greater.

The classification of the groundwater beneath the Seventh Street Service Station is G-II (Williams, 1997).

1.3.1 No Further Action

Closure of a petroleum release site under a NFA Proposal (without or with conditions) requires that a site meet the following criteria:

- No free product is present (as specified in 62-770.680 (1)(a), FAC);
- No fire or explosion hazard is present due to release of petroleum or petroleum products;
- No "excessively contaminated soil" (as defined in 62-770.200, FAC) is present; and
- Matrix-specific target cleanup levels are met.

The *Petroleum Contamination Site Cleanup Criteria* rule (FDEP, 1997) incorporates matrix-specific Target Cleanup Levels (TCLs) for petroleum constituents in the form of "look-up" tables or through reference to other applicable regulations (i.e., state groundwater or surface water regulations). Contaminant concentrations in all affected media at a site must be below all applicable TCLs for the site to qualify for a NFA (with or without conditions) proposal. However, the rule also allows for the development of alternative cleanup standards based on a site-specific risk assessment for use in a NFA Proposal with conditions. These site-specific alternative cleanup standards can be used in place of those presented in the look-up tables.

1.3.2 Natural Attenuation With Monitoring

The FDEP recognizes natural attenuation with monitoring as a viable site remediation strategy. The following criteria must be met to demonstrate that this strategy is appropriate for a site:

- No free product is present (as specified in 62-770.690 (1)(a),FAC);
- Contaminated soil is not present to the extent that it may increase cleanup costs;
- Groundwater contaminant concentrations above applicable TCLs are not migrating beyond a temporary point of compliance (POC);
- Available data show an overall decrease in the mass of contamination; and
- Contaminant concentrations in groundwater do not exceed appropriate criteria (Table IX levels, 62-770, FAC); or the technical evaluations (as specified in 62-770.690 (1)(f), FAC) indicate that natural attenuation is an appropriate remedial alternative.

Natural attenuation with monitoring requires the establishment of a temporary POC based on site-specific conditions relating to land and groundwater use, potentially exposed populations, hydrogeology, and type and concentrations of contaminants. Concentrations of petroleum compounds at the POC cannot exceed levels presented in the rule. Monitoring of natural attenuation to show plume stability and/or contaminant reductions can eventually lead to a proposal for NFA With or Without Conditions.

1.3.3 Summary

In summary, the *Petroleum Contamination Site Cleanup Criteria* rule allows a rapid determination of whether or not a site can qualify for a NFA proposal and/or the appropriateness of natural attenuation with monitoring as a remedial strategy. The rule allows for inclusion of site-specific information in developing alternative cleanup levels for NFA with conditions, and provides guidance on preparation of a RAP if active remediation is warranted.

1.4 REPORT ORGANIZATION

This CAP consists of eight sections, including this introduction, and five appendices. Site background, including operating history and a review of environmental site

investigations conducted to date, is provided in the remainder of this section. Section 2 summarizes the 1998 site characterization activities performed by Parsons ES. Physical characteristics of the site and surrounding area are described in Section 3. A Tier 1 evaluation is completed in Section 4 to identify those site contaminants that are considered chemicals of potential concern (COPCs). Section 5 summarizes the nature and extent of COPC contamination at the site. Section 6 addresses the effects of natural chemical attenuation processes that are documented to be occurring at the site, and presents chemical fate and transport and receptor exposure analyses. The Tier 2 risk evaluation is detailed in Section 7. Section 8 presents a remedial alternatives evaluation. Section 9 presents the summary and conclusions of this evaluation of risk-based remediation at the site. Section 10 presents a long-term monitoring (LTM) plan. Section 11 presents references used in preparing this CAP.

Analytical data sheets and chain-of-custody records are in Appendix A. Pertinent information from prior investigations is presented in Appendix B. Boring logs, groundwater sampling forms, and well construction diagrams for all drilling and sampling activities completed by Parsons ES during the March 1998 field effort are included in Appendix C. Appendix D includes the input and output from the aquifer slug test analyses. Appendix E includes the supporting documentation for the quantitative calculations used in the predictive chemical fate assessment and computation of Tier 2 SSTLS. Appendix F includes BIOSCREEN model input and output. Appendix G contains cost calculations for proposed remedial alternatives.

1.5 SITE DESCRIPTION AND BACKGROUND

Eglin AFB is located in Okaloosa County in the Florida panhandle (Figure 1.1). The Seventh Street Service Station is located southeast of the intersection of Seventh Street and Eglin Boulevard (Figure 1.2). Features of the site include Building 501, an attached canopy with 3 abandoned pump islands, a former underground storage tank (UST) pit located east of Building 501, and a treatment system storage compound east-southeast of Building 501 (Figure 1.3).

The Seventh Street Service Station opened in 1955 as a retail gasoline and automobile service station. Retail fuel sales were discontinued in July 1993. Building 501 currently houses a four-bay vehicle repair and auto parts shop. The fuel dispensers at the pump islands have been removed. The former tank pit contained USTs which stored leaded and unleaded gasoline. All of the tanks were removed except one that is partially buried below the concrete base of the treatment system compound.

A fuel leak from the UST system, reported to FDEP in 1983, released an estimated 3,600 gallons of unleaded gasoline over a period of years. Free product was detected in the subsurface at thicknesses of 0.5 to 1.5 inches during the environmental investigation conducted by Geraghty & Miller (1985). A free-product recovery and groundwater treatment system was designed by Jones, Edmunds, and Associates (subcontracted by Geraghty & Miller) and installed by Phoenix Construction at the site in Fall 1987. However, the system was not operable until Fall 1989, and at that time only two groundwater recovery wells were in operation (Engineering-Science, Inc. [ES], 1990). The product recovery and groundwater treatment system consists of two product recovery wells, six groundwater recovery wells, and an air-stripper treatment

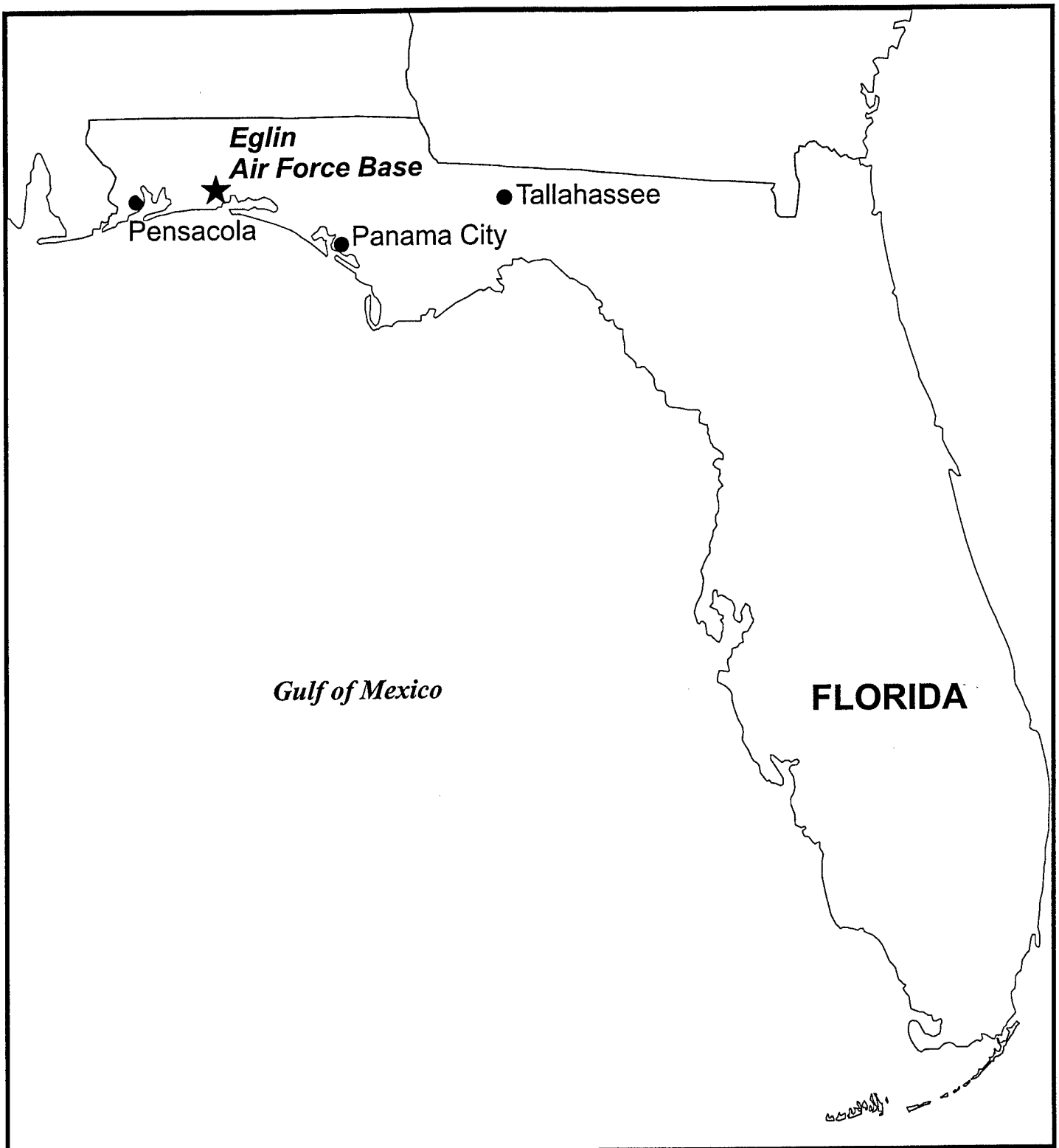


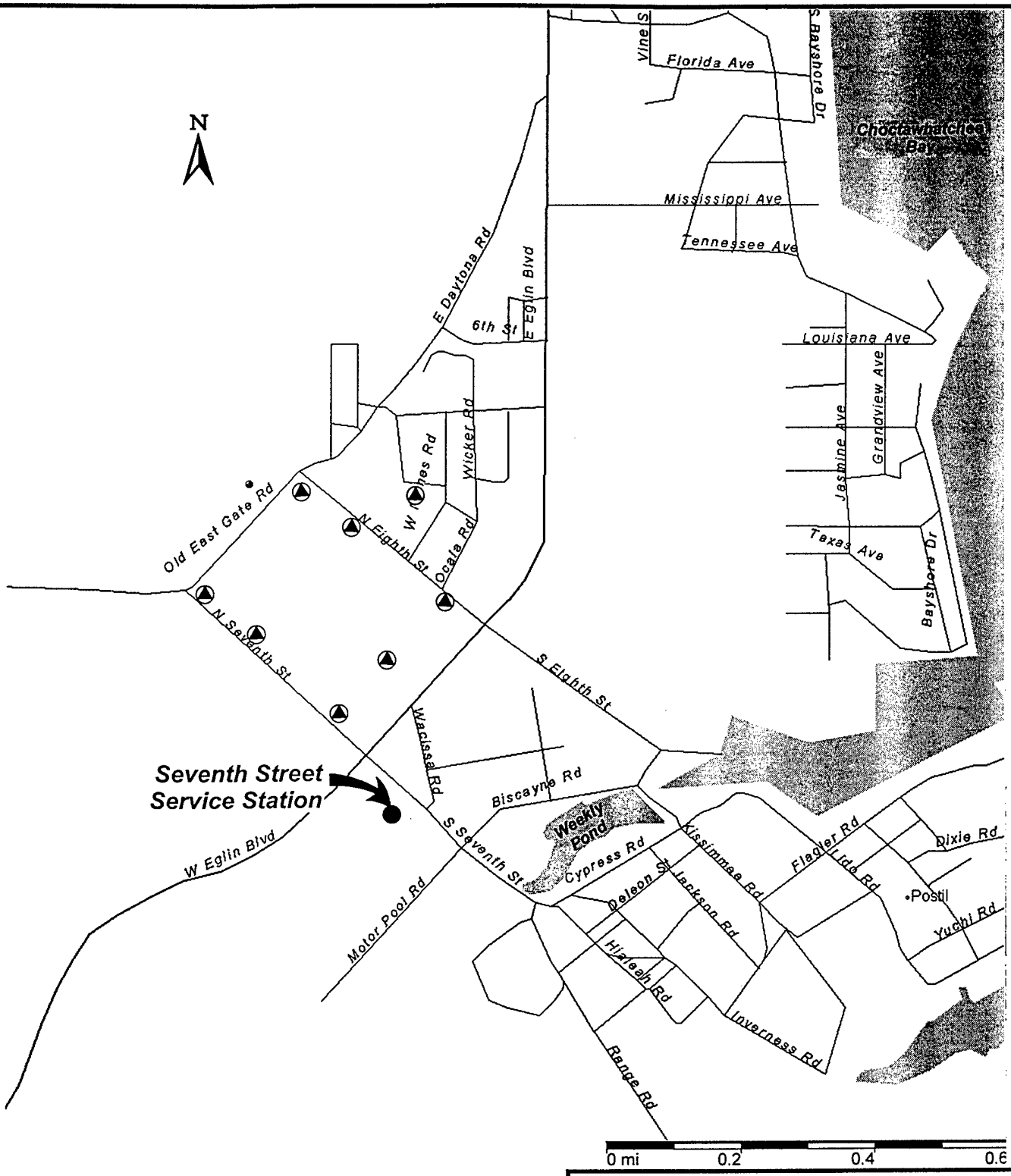
FIGURE 1.1

BASE LOCATION

Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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Legend

Irrigation Wells

FIGURE 1.2

SITE LOCATION

Risk-Based Approach to Remediation
Seventh Street Service station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Source: Microsoft Automap©, 1988-1996

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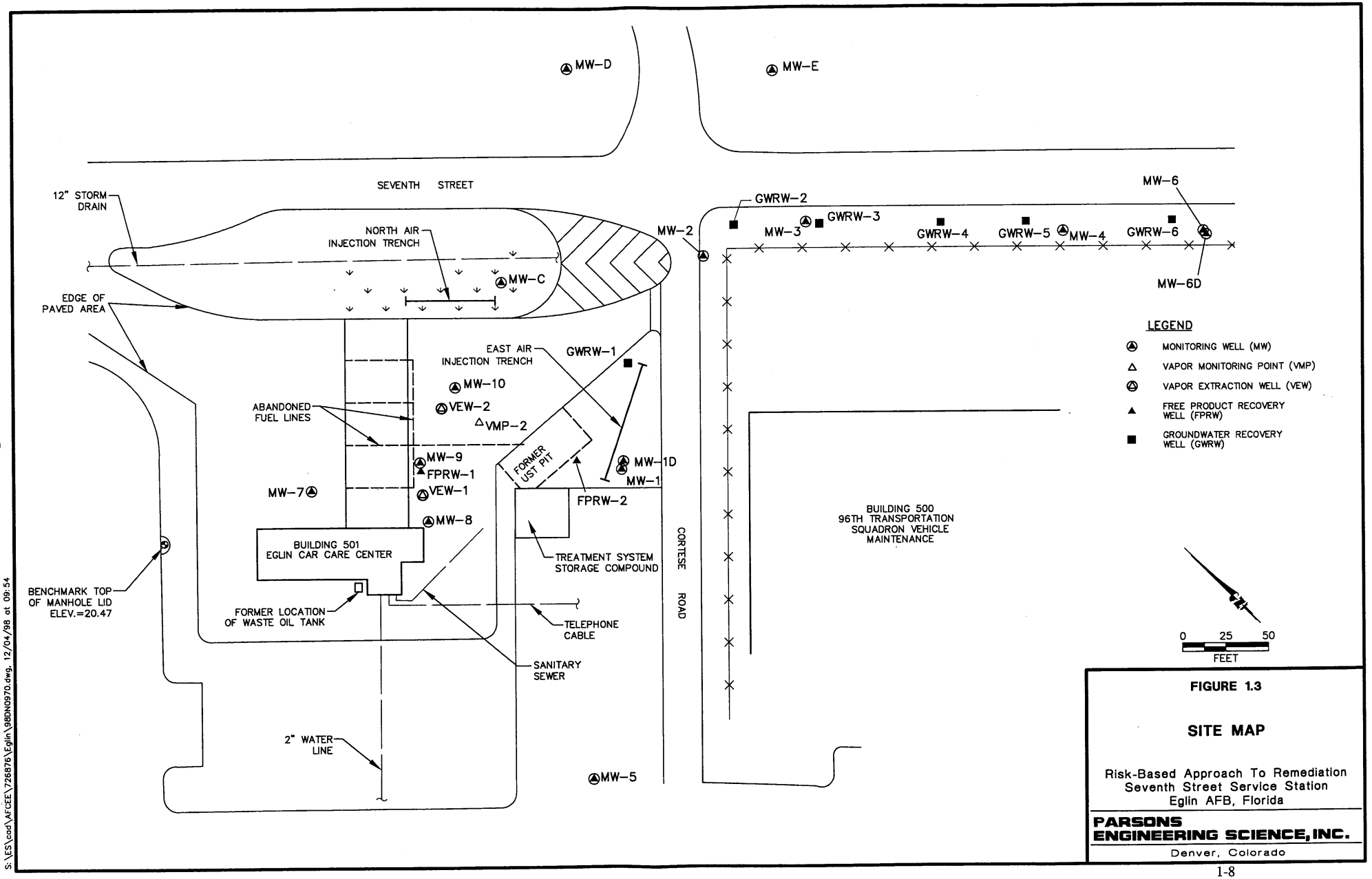


FIGURE 1.3

SITE MAP

Risk-Based Approach To Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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system. Air stripper effluent from the pump and treat system is discharged to the sanitary sewer. A bioventing system was installed by ES in May 1992 to remediate soil contamination (ES, 1992 and 1993). The bioventing system consists of two vapor extraction wells, two vapor monitoring points, and 2 recirculation/reinjection trenches. Groundwater samples are collected semi-annually to evaluate the effectiveness of the groundwater treatment system, and soil samples were collected in May 1992 and May 1993 to evaluate the effectiveness of the bioventing system (ES, 1993).

Other possible sources of site contamination include a UST on the east side of Building 500 and a waste oil UST southwest of Building 501, which was excavated in July 1994. A closure report has been submitted to the FDEP for the waste oil UST site (Williams, 1997).

SECTION 2

SITE CHARACTERIZATION ACTIVITIES

Several soil and groundwater investigations have been conducted at the Seventh Street Service Station. These investigations focused on characterizing and delineating dissolved hydrocarbons in groundwater and residual fuel hydrocarbons in soil. Parsons ES conducted an investigation at the site during March 1998 to collect site-specific data relevant to quantifying the effects of natural contaminant attenuation processes and to facilitate development and implementation of a risk-based remedial action for the site. Soil gas, soil, and groundwater were sampled to:

- Further delineate the extent of contamination;
- Assess temporal trends in soil and groundwater contaminant concentrations;
- Support contaminant fate and transport analyses; and
- Develop appropriate exposure-point concentrations to compare to final remediation goals.

Data collected during previous investigations were used to augment this study. Emphasis was placed on collecting data documenting the natural biodegradation and attenuation of fuel hydrocarbons in soil and groundwater at the site.

The March 1998 supplemental site characterization activities performed by Parsons ES are briefly described in the remainder of this section. Most site characterization procedures (i.e., soil, soil gas, and groundwater sampling procedures) are described in detail in the project Sampling and Analysis Plan (SAP) (Parsons ES, 1997).

2.1 SCOPE OF DATA COLLECTION ACTIVITIES

As part of the risk-based remedial approach for the site, field data collection efforts focused on investigating specific chemical constituents that potentially pose a threat to human health or the environment. The chemicals targeted for study at this site were identified from previous site investigations and the chemical composition of the primary contaminant source (i.e., release(s) of gasoline from the former USTs). The petroleum hydrocarbons and associated constituents identified and addressed as part of this study, as either historically above FDEP levels or previously unquantified, include benzene, toluene, ethylbenzene, and xylenes (BTEX); methyl tertiary butyl ether (MTBE); ethylene dibromide (EDB); polynuclear aromatic hydrocarbons (PAHs); total recoverable petroleum hydrocarbons (TRPH); and lead.

The risk-based investigation for the site was conducted according to the methodologies presented in the *Work Plan for the Risk-Based Investigation and Closure of the Base Exchange Service Station and the Military Gas Station* (Parsons ES, 1998c), hereafter referred to as the work plan. A work plan addendum (Parsons ES, 1998a) that described the proposed soil sampling activities in greater detail was prepared. The work plan and addendum were developed according to available guidelines and requirements of the FDEP to support site closure.

The following sampling and testing activities were performed by Parsons ES during March 1998 at the site as part of this investigation:

- Conducted aquifer slug tests at 2 existing monitoring wells (MW-1 and MW-2);
- Drilled 20 soil borings (SB01-SB14, VEW-1, VEW2, VMP-2, MP-1, MP-2, & MP-3);
- Collected 25 subsurface soil samples for field headspace screening from 20 boreholes;
- Sent 22 subsurface soil samples for fixed-base laboratory analysis from 14 of the 20 boreholes;
- Collected groundwater samples for field and fixed-base laboratory analysis from 8 existing groundwater monitoring wells and 3 temporary monitoring points; and
- Collected 3 soil gas samples for laboratory analysis.

Analytical method detection limit (MDL) requirements were considered before site characterization work was initiated. Suitable analytical methods and quality control (QC) procedures were selected (Parsons ES, 1997) to ensure that the data collected under this program are of sufficient quality to be used in a quantitative risk assessment.

Soil and groundwater samples were analyzed in the field and by Quanterra, Inc. of Arvada, Colorado; Dallas, Texas; and Tampa, Florida. Soil gas samples were analyzed in the field and by Air Toxics, Ltd. of Folsom, California. The laboratory data sheets and chain-of-custody records are presented in Appendix A. The analytical protocols for all samples are summarized in Table 2.1. Tables 2.2 and 2.3 summarize the field and fixed-base laboratory analyses performed by sampling location. These analyses and measurements were performed for various inorganic, geochemical, and physical parameters to document natural biodegradation processes and to assess the potential effectiveness of low-cost source reduction technologies.

2.2 SUBSURFACE SOIL SAMPLING

Soil samples were collected from the site to obtain soil total organic carbon (TOC) data and to further characterize soil contamination at the site. The boring locations are shown on Figure 2.1. Soil samples were analyzed to facilitate evaluation of the potential for contaminant partitioning from soil into groundwater and soil gas, and to assess the magnitude of any changes in contaminant concentrations that have occurred over time. These borings were advanced using a Geoprobe® hydraulic sampling rig as described in the SAP (Parsons ES, 1997).

TABLE 2.1
ANALYTICAL PROTOCOL FOR
GROUNDWATER, SOIL, AND SOIL GAS SAMPLES
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

MATRIX	METHOD	WHERE ANALYZED
GROUNDWATER		
Ferrous Iron (Fe^{+2})	Colorimetric, Hach Method 8146	Field
Sulfate (SO_4^{-2})	Colorimetric, Hach Method 8051	Field
Conductivity	Direct reading meter	Field
Dissolved Oxygen	Direct reading meter	Field
pH	Direct reading meter	Field
Redox Potential	Direct reading meter	Field
Temperature	Direct reading meter	Field
BTEX	SW8020A	QUANTERRA[a/]
EDB	SW8011 /504	QUANTERRA
Polynuclear Aromatic Hydrocarbons	SW8310	QUANTERRA
Total Recoverable Petroleum Hydrocarbons (TRPH)	FL-PRO (C8-C40)	QUANTERRA
Methane (CH_4)	RSK-175	QUANTERRA
Nitrate as Nitrogen (NO_3^{-1}-N)	E300.0/SW9056	QUANTERRA
Lead	SW7421	QUANTERRA
SOIL		
BTEX + MTBE	SW8020A	QUANTERRA
Polynuclear Aromatic Hydrocarbons	SW8310	QUANTERRA
Total Recoverable Petroleum Hydrocarbons (TRPH)	FL-PRO (C8-C40)	QUANTERRA
Total Organic Carbon	SW9060	QUANTERRA
SOIL GAS		
BTEX	TO-3	Air Toxics[b/]
Total Petroleum Hydrocarbons (TPH)	TO-3	Air Toxics

Notes:

a/ Quanterra, Inc. of Arvada, Colorado; Dallas, Texas (methane only); and Tampa, Florida (TRPH and EDB only).

b/ Air Toxics LTD. of Folsom, California

TABLE 2.2
SOIL AND SOIL GAS ANALYSES BY SAMPLE LOCATION
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Sample Location	SB01	SB02	SB03	SB06	SB06	SB06	SB07	SB07	SB08	SB09	SB11	SB12
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Depth (ft. bgs) [a/]	7-8	7-8	7-8	3-4	4-5	7-8	4.5-5.5	7-8	5-6	8-9	5-6	7-8
ANALYTE												
BTEX [b/]				X	X	X	X	X	X	X	X	X
MTBE [c/]				X	X	X	X	X	X	X	X	X
PAHs [d/]				X	X	X	X	X	X	X	X	X
TRPH [e/]				X	X	X	X	X	X	X	X	X
TOC [f/]	X	X	X									
BTEX/TPH [g/]												

Sample Location	SB14	MP-2	MP-2	VMP2	VMP2	VMP2	VEW1	VEW1	VEW1	VEW2	SG1	SG2	SG3
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Gas	Gas	Gas
Depth (ft. bgs)	7-8	3-4	5-6	3-4	5-6	7-8	3-4	5-6	7-8	5.5-6.5	NA	NA	NA
ANALYTE													
BTEX	X	X	X	X	X	X	X	X	X	X			
MTBE	X	X	X	X	X	X	X	X	X	X			
PAHs	X	X	X	X	X	X	X	X	X	X			
TRPH	X	X	X	X	X	X	X	X	X	X			
TOC													
BTEX/TPH											X	X	X

Notes:

a/ ft. bgs = Feet below ground surface.

b/ BTEX = Benzene, toluene, ethylbenzene, and xylenes.

c/ MTBE = Methyl tert butyl ether.

d/ PAHs = Polynuclear aromatic hydrocarbons.

e/ TRPH = Total recoverable petroleum hydrocarbons.

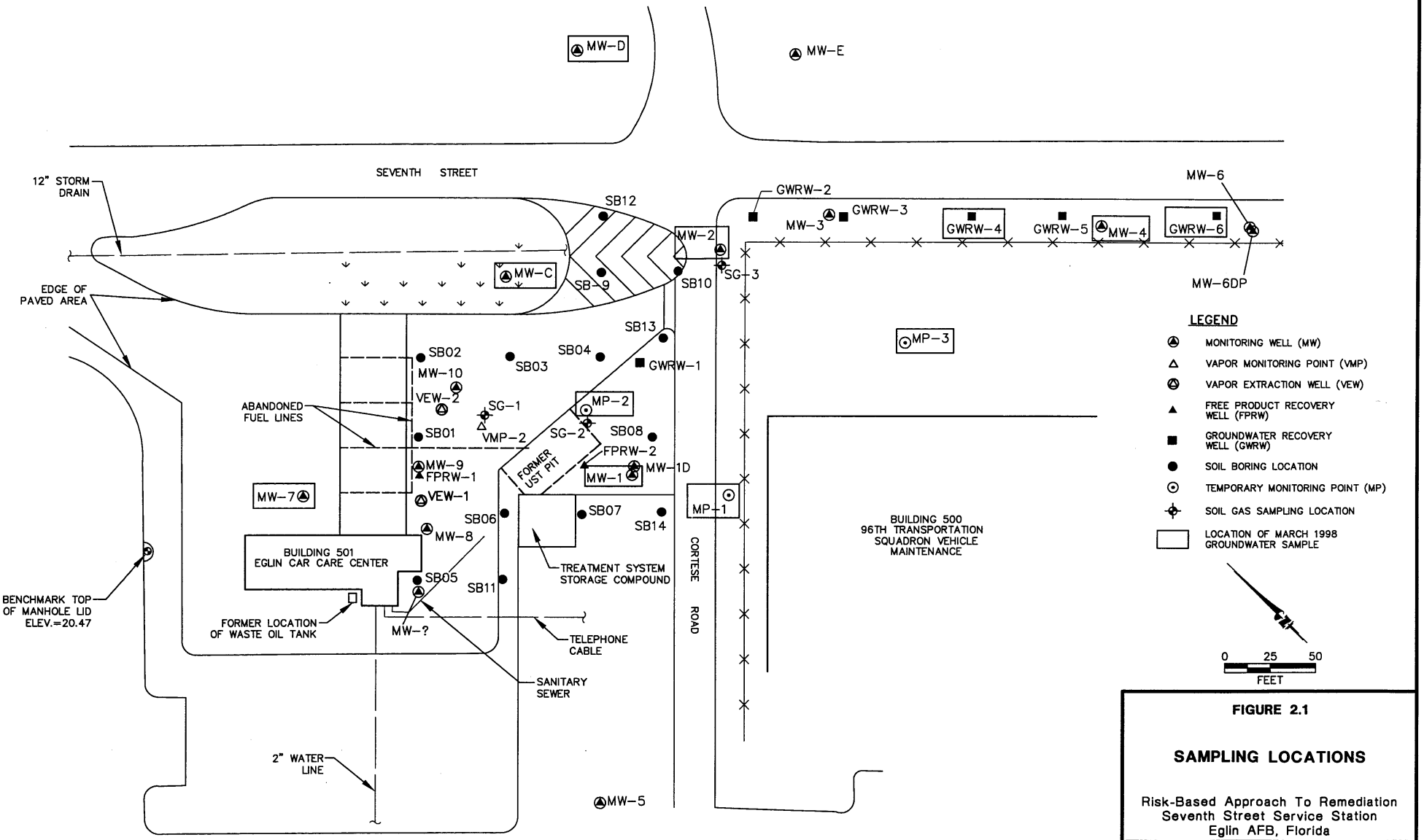
f/ TOC = Total organic carbon.

g/ TPH = Total petroleum hydrocarbons.

TABLE 2.3
GROUNDWATER ANALYSES BY SAMPLE LOCATION
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Sample Location	MW-1	MW-2	MW-20 (duplicate of MW-2)	MW-4	MW-7	MW-C	MW-D	GWRW-4	GWRW-6	MP-1	MP-2	MP-3
ANALYTE												
BTEX [a/]	X	X	X	X	X	X	X	X	X	X	X	X
EDB [b/]	X	X	X	X				X	X		X	
PAHs [c/]	X	X	X	X				X	X		X	
TRPH [d/]	X	X	X								X	
Total Lead	X	X	X				X	X		X	X	
Dissolved Lead							X	X		X	X	
Methane	X	X	X		X	X	X				X	
ORP [e/]	X	X		X	X	X	X	X	X	X	X	X
Conductivity	X	X		X	X	X	X	X	X	X	X	X
Dissolved Oxygen	X	X		X	X	X	X	X	X	X	X	X
Temperature	X	X		X	X	X	X	X	X	X	X	X
pH	X	X		X	X	X	X	X	X	X	X	X
Ferrous Iron	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate	X	X	X	X	X	X	X	X	X	X	X	X
Nitrate	X	X	X		X	X	X				X	

Notes:
a/ BTEX = Benzene, toluene, ethylbenzene, and xylenes
b/ EDB = Ethylene dibromide
c/ PAHs = Polynuclear aromatic hydrocarbons
d/ TRPH = Total recoverable petroleum hydrocarbons
e/ ORP = Oxidation-reduction potential



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FIGURE 2.1

SAMPLING LOCATIONS

Risk-Based Approach To Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Samples from 20 boreholes were described for lithology and field screened for volatile organic vapors using a photoionization detector (PID). Twenty-two soil samples from 14 boreholes were submitted to Quanterra, Inc. for laboratory analysis. Borehole logs are included in Appendix C. Field and laboratory analyses for each soil sampling location are summarized in Table 2.2. Soil analytical results are summarized and discussed in Sections 4 and 5.

2.3 GROUNDWATER SAMPLING

Groundwater samples were collected from 8 existing monitoring/recovery wells and 3 temporary monitoring points at the site in March 1998 (Figure 2.1). The groundwater samples were analyzed for fuel-related contaminants and for various inorganic and geochemical indicators to evaluate natural chemical and physical attenuation processes that are occurring at the site. Field and laboratory analyses for each groundwater sampling location are summarized in Table 2.3.

All monitoring wells and temporary monitoring points were purged using a peristaltic pump with dedicated high-density polyethylene (HDPE) and silicone tubing. Purging consisted of removing groundwater from the well until the pH, DO concentration, oxidation/reduction potential (ORP), conductivity, and temperature stabilized.

Within 24 hours of the purge event, groundwater samples were collected from the monitoring wells using a peristaltic pump and dedicated tubing. The water was carefully poured down the inner walls of each sample bottle to minimize aeration of the sample. Sample bottles for BTEX, MTBE, EDB, methane, and/or Hach® field analyses were filled so that there was no headspace or air bubbles within the container. One duplicate sample was collected during the groundwater sampling event.

Field and laboratory groundwater analytical results are discussed in Sections 4 and 5 of this report. These results are used in Section 6 to evaluate the natural physical, chemical, and biological processes that are affecting the COPCs at this site.

2.4 SOIL GAS MEASUREMENTS

Soil gas samples were collected at the site for fixed-base laboratory analyses. The purpose of soil gas sampling was to assess the potential risk to future workers at the site from inhalation of volatilized contaminants.

Three soil gas samples, SG-1 through SG-3, were collected at the locations shown on Figure 2.1 at a depth of 3 feet bgs. The samples were collected in SUMMA® canisters and submitted to Air Toxics, Ltd. in Folsom, California for analysis of total petroleum hydrocarbons (TPH) and BTEX using US Environmental Protection Agency (USEPA) Method TO-3. Field and laboratory analyses for each soil gas sampling location are summarized in Table 2.2. Analytical results for the soil gas samples are summarized in Sections 4 and 5.

2.5 SLUG TESTS AND ANALYSIS

Four slug tests were conducted in two existing monitoring wells at the site in March 1998. Two tests were conducted in each of wells MW-1 and MW-2. The data were analyzed using AQTESOLV® aquifer test analysis software (Geraghty & Miller, 1994) and the method described by Bouwer and Rice (1976) and Bouwer (1989). Analysis results are presented in Appendix D and discussed in Section 3.3.

2.6 EQUIPMENT DECONTAMINATION PROCEDURES

All downhole soil sampling tools (e.g., Geoprobe® drive-shoe and sampling barrel) were cleaned prior to collection of each sample with a clean water/phosphate-free detergent mix followed by a clean water rinse. Decontaminated tools also were used for soil gas sampling. The water level indicator probe was decontaminated prior to each use with a clean water/phosphate-free detergent mix followed by a distilled water rinse.

2.7 INVESTIGATION-DERIVED WASTES (IDW)

Soil cuttings and unused soil samples were moved to an approved on-Base storage area for later disposal by the Base. Purge water was discharged to the influent of the groundwater treatment system.

2.8 ANALYTICAL DATA QUALITY ASSESSMENT

2.8.1 Introduction

An electronic Level III validation was performed by a qualified chemist on the March 1998 analytical results obtained from Quanterra to determine data quality. The validation included internal data checks and application of data qualifiers to the analytical results based on adherence to method protocols and project-specific control limits. The electronic validation aided in assessing the quality of the data; however, professional judgement was used in applying qualifiers. Method protocols reviewed included:

- Analytical holding times,
- Method blanks,
- Trip blanks,
- Surrogate spikes,
- Matrix spikes/matrix spike duplicates (MS/MSDs),
- Laboratory control samples (LCSs), and
- Sample temperatures during shipping and storage.

Data qualifiers were applied to analytical results during the data validation process. All data were validated using method applicable guidelines and in accordance with the *National Functional Guidelines for Organic Data Review* (USEPA, 1994b) and the *National Functional Guidelines for Inorganic Data Review* (USEPA, 1994c). The following definitions provide explanations of the USEPA (1994b and 1994c) qualifiers assigned to analytical results during data validation. The data qualifiers described were applied to both inorganic and organic results.

U - The analyte was not present above the reported sample quantitation limit (SQL).

J1 - The analyte is qualified as an estimated value solely because it is greater than the MDL and less than the practical quantitation limit (PQL), indicating no laboratory quality issues.

2.8.2 Data Quality

Data quality for each QC parameter where exceptions were noted during the validation is summarized in this section. Only results that exceeded quality assurance (QA)/QC criteria are presented. All frequency requirements for collection of field QA/QC samples (MS/MSDs and blanks) were met. The frequency requirements for laboratory specific method QA/QC also were met.

Samples were collected and analyzed as specified in the methods. All samples are representative of the site and comparable with the results of previous and future investigations (when used in accordance with the validation qualifiers).

Post digestion spikes were out of control for lead in five samples. The spike recoveries were consistently high, and a review of the data revealed that continuing check standard recoveries were also very high. This information, combined with the fact that the MS/MSD recoveries were in control, indicates an analytical bias. Therefore, the sample results were not qualified. The surrogate spike recovery for terphenyl-d14, Method SW8310, was low and out of control. As a result, all compounds in this sample were qualified as estimated ("UJ"). The low surrogate recovery is most likely due to matrix interference.

Methane concentrations detected in groundwater samples from MW-7 (0.00024 mg/L), MW-C (0.0021 mg/L), and MW-D (0.00015 mg/L) were qualified as not detected ("U") due to the detection of methane in the associated method blank. The remaining detected methane concentratios were sufficiently higher than the blank concentrations that the results were not qualified.

All sample results qualified as "U", "UJ", or "J1" and used in accordance with the data validation qualifiers applied are usable for the intended purposes. Results qualified as "UJ" represent an association to non-compliant QC criteria which has caused the reported concentration to be estimated. Project objectives do not exclude the use of estimated concentrations, and therefore the data value is usable for project purposes.

SECTION 3

PHYSICAL CHARACTERISTICS OF THE STUDY AREA

This section describes the physical characteristics of the Seventh Street Service Station and adjacent environs at Eglin AFB, as determined from data collected during previous site investigations (Geraghty & Miller, 1985; ES, 1990; ES, 1992; ES, 1993) and by Parsons ES in March 1998 as part of the risk-based investigation. A summary of site characterization activities completed by Parsons ES to supplement existing data is presented in Section 2 of this CAP.

3.1 PHYSIOGRAPHY

Eglin AFB is located in the East Gulf Coastal Plain Physiographic Province. This province is characterized by relatively low topographic relief and a gradual slope toward the Gulf of Mexico. White sand beaches and sand ridges typically border the coastline, while flatlands and swamps extend 10 to 15 miles inland.

3.2 REGIONAL GEOLOGY AND HYDROGEOLOGY

Surficial deposits are characterized by unconsolidated sands, silts, and clayey sands of Pliocene to Recent age which extend to a depth of approximately 60 feet below ground surface (bgs). The Surficial Aquifer System contains the undifferentiated Quaternary sediments and the Citronelle Formation. The typical lithology of the surficial aquifer is primarily fine to coarse quartz sand, with clay, silt and gravel, and clayey sand and sandy clay lenses. Limonite-cemented zones, shell beds, and carbonates are also common. The thickness of the surficial aquifer varies from 40 to 100 feet and the elevation of the water table varies from 0 to 30 feet above mean sea level (msl). The water within the Surficial Aquifer System is generally unconfined; however, beds of low permeability may cause semi-confined or locally confined conditions in its deeper parts. Water table elevations and horizontal gradients generally reflect contours of the land surface.

Below the surficial aquifer is the Pensacola Clay, a relatively impermeable unit separating the surficial aquifer from the Floridan Aquifer. The Floridan Aquifer System contains the Bruce Creek Limestone, St. Marks Formation, Chattahoochee Formation, Suwannee Limestone, Marianna Limestone, and Ocala Limestone. The typical lithology of the Floridan Aquifer System is vuggy, fossiliferous, micro-crystalline to granular, argillaceous to sandy, porous limestone and dolomite. The limestone and dolomite may be interbedded with dolomitic sand, silt, and clay beds. The Ocala Limestone forms one of the most permeable zones within the Floridan Aquifer System. The extensive development of secondary porosity by dissolution and dolomitization has greatly increased the permeability of the unit. The thickness of the

Floridan Aquifer System varies from 900 to 1,000 feet and the elevation of the top of this unit varies from 270 to 320 feet below msl.

3.3 SITE GEOLOGY AND HYDROGEOLOGY

Site geology at the Seventh Street Service Station is characterized by poorly- to moderately-sorted, fine to coarse-grained quartz sand with varying amounts of silt and clay. Depth to groundwater, as measured at the site in March 1998, ranged from approximately 5 to 8 feet bgs (Table 3.1). Groundwater elevations ranged from approximately 11.4 to 14.7 feet above msl. Groundwater flows toward the groundwater and free product recovery wells at the site (Figure 3.1). The background hydraulic gradient is approximately 0.004 foot per foot (ft/ft) and gradually steepens near the recovery wells.

Data from a 24-hour aquifer pumping test conducted by Layne-Western Company, Inc. in June 1987 indicate that the transmissivity of the surficial deposits at the site range from 12,692 gallons per day per foot (gpd/ft) to 70,400 gpd/ft. Assuming an aquifer thickness of 60 feet (Section 3.2), the hydraulic conductivity of the surficial deposits at the site ranges from 28 feet per day (ft/day) to 157 ft/day. Data from a hydraulic conductivity test at MW-1 indicate a hydraulic conductivity of 21.5 ft/day (Geraghty & Miller, 1985). During the March 1998 field effort, slug tests were conducted at wells MW-1 and MW-2. The slug tests were analyzed using AQTESOLV® computer-assisted aquifer test data analysis software (Geraghty & Miller, 1994). The results of the slug test data analysis indicate that the hydraulic conductivity at the two wells tested ranges from 0.8 ft/day to 28.1 ft/day and averages 11.7 ft/day (Table 3.2). Based on the overall average of the accumulated hydraulic conductivity data (with the exception of the outlying value of 157 ft/day) and an estimated effective porosity of 25 percent for sand (Spitz and Moreno, 1996), the average advective groundwater velocity at the site is 123 feet per year (ft/yr).

3.4 SITE TOPOGRAPHY AND SURFACE WATER HYDROLOGY

The area has relatively flat topography, with ground elevations at the site at approximately 20 feet msl. Surface water hydrology around the site is dominated by the stormwater sewer system. The closest surface water body to the site is Weekly Pond, which is located approximately one-quarter mile downgradient of the site (Figure 1.2).

3.5 CLIMATOLOGICAL CHARACTERISTICS

Eglin AFB has a humid, semitropical climate. Daily average temperature in the hottest summer months, July and August, may range from a low of 70 degrees Fahrenheit (°F) to a high of 88°F, with an average of approximately 82°F. Winters are mild, with occasional frost from November through February. During the coldest months, December and February, the temperature may be as low as 18°F or as high as 74°F, with the average around 50°F. Average annual rainfall is approximately 64 inches and ranges from 3.5 inches in October to almost 9 inches in July.

TABLE 3.1
GROUNDWATER ELEVATIONS - MARCH 25, 1998
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Location	TOC [a/] Elevation (ft msl) [b/]	Depth to Water (ft below TOC)	Groundwater Elevation (ft msl)
MW-1	20.76	6.55	14.21
MW1D	22.7	8.46	14.24
MW-2	21.27	7.23	14.04
MW-3	21.26	7.49	13.77
MW-4	21.32	7.91	13.41
MW-5	19.59	4.92	14.67
MW-6	20.44	7.35	13.09
MW-6D	22.09	9.2	12.89
MW-8	19.84	5.25	14.59
MW-9	19.31	4.79	14.52
MW-10	18.95	4.44	14.51
MW-C	19.89	5.5	14.39
MW-D	20.13	5.9	14.23
MW-E	21.38	7.67	13.71
GWRW-1	19.58	5.79	13.79
GWRW-2	20.84	7.77	13.07
GWRW-3	20.35	8.04	12.31
GWRW-4	21.13	8.4	12.73
GWRE-5	21.25	8.02	13.23
GWRW-6	18.7	7.35	11.35
FPRW-1	19.46	5.47	13.99
FPRW-2R	19.92	6.86	13.06

Notes:
a/ TOC = top of casing
b/ ft msl = feet above mean sea level
c/ NM = not measured

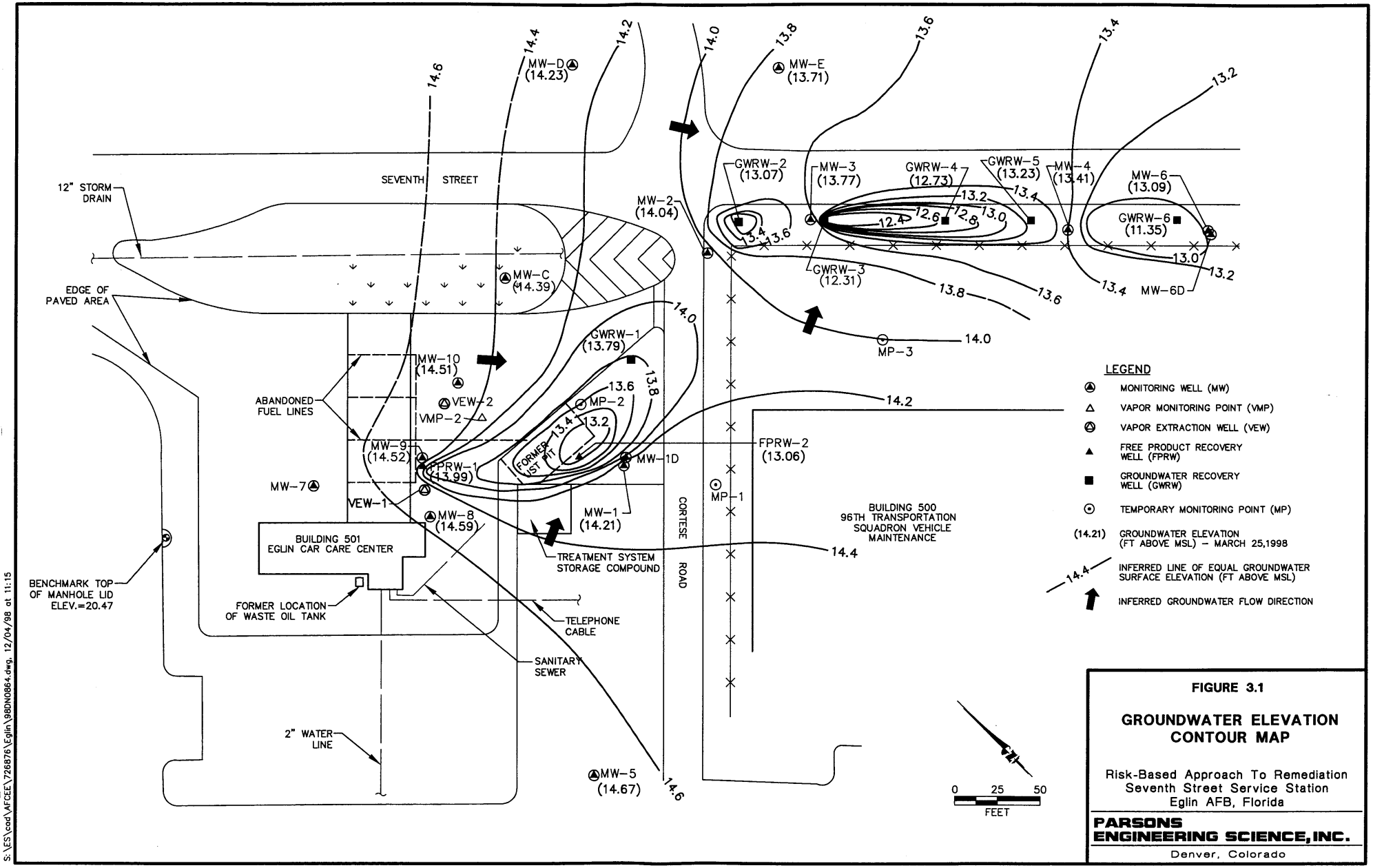


FIGURE 3.1

GROUNDWATER ELEVATION CONTOUR MAP

Risk-Based Approach To Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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TABLE 3.2
SLUG TEST ANALYSIS RESULTS
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Test	Date	Well	Hydraulic Conductivity (ft/day [a/])	Gradient (ft/ft[b/])	Effective Porosity	Advective Groundwater Flow Velocity (ft/day)	Advective Groundwater Flow Velocity (ft/yr[c/])
Hydraulic conductivity test conducted by Geraghty & Miller	1985	MW-1	21.5	0.004	0.25	0.344	126
24-hr pumping test conducted by Layne-Western	Jun-87	GWRW-1	28	0.004	0.25	0.448	164
		GWRW-2	61	0.004	0.25	0.976	356
		distance-drawdown analysis	28	0.004	0.25	0.448	164
Slug tests conducted by Parsons ES	Mar-98	MW-1	16.3	0.004	0.25	0.261	
		MW-1	28.1	0.004	0.25	0.450	164
		MW-2	0.8	0.004	0.25	0.013	4.7
		MW-2	2.0	0.004	0.25	0.032	11.7
Average			21.0[d/]	0.004	0.25	0.4	141.3

a/ ft/day = feet per day

b/ ft/ft = foot per foot

c/ ft/yr = feet per year

d/ average computed using the average hydraulic conductivities computed from the following tests: the 1985 Geraghty & Miller test, the1987 pump test results, the two slug tests in MW-1, and the two slug tests in MW-2.

3.6 WATER WELL SURVEY RESULTS

There are 8 irrigation wells located north (cross-gradient) of the site. The irrigation wells are screened within the surficial aquifer and supply water to irrigate base lawns. The locations of the irrigation wells are shown on Figure 1.2 (EA Engineering, Science, and Technology [EA], 1994). There also is a Base supply well (Base Supply Well number 5) located approximately 400 feet northeast of the site which is screened within the Floridan Aquifer (ES, 1992).

SECTION 4

TIER 1 ANALYSIS AND IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

This section provides an overview of the regulatory requirements for a risk-based, tiered approach to identification of COPCs and reviews the preliminary conceptual site model (CSM) developed for the Seventh Street Service Station in the work plan (Parsons ES, 1998c) as a means of selecting appropriate regulatory screening criteria to identify COPCs in affected site media (i.e., chemicals present at concentrations that could pose a risk to human and/or ecological receptors exposed to the affected media). This section also presents a screening-level Tier 1 analysis used to select the COPCs that are the focus of this CAP. The COPCs for the site are identified in the Tier 1 analysis based on estimated risks to human health posed by maximum detected contaminant concentrations.

4.1 REGULATORY REVIEW OF THE TIER 1 SCREENING PROCESS

As an initial step in determining the necessity for remedial action at the Seventh Street Service Station, representative concentrations of site contaminants are compared to the generic NFA-With-Conditions TCLs for soil and groundwater presented in Tables IV and V of the *Petroleum Contamination Site Cleanup Criteria* (FDEP, 1997). Contaminant soil concentrations must be below the Direct Exposure II target levels presented in Table IV (based on applicable groundwater criteria specified in 62-770.680 (1)(c), FAC). Concentrations of COPCs in groundwater must be below background concentrations or less than levels presented in Table V. Maximum dissolved site contaminant concentrations also are compared to the Table IX Natural Attenuation Source Default Values. This comparison provides an initial assessment of the potential appropriateness of monitored natural attenuation (MNA) as a remedial alternative.

Those analytes with site concentrations that exceed the appropriate TCLs for soil and groundwater are considered to be COPCs, and are retained for further analysis concerning the risk-reduction requirements for the site. The nature and extent of these COPCs are described more fully in Section 5. Qualitative and quantitative fate and transport analyses are presented in Section 6 to evaluate the migration and persistence of COPCs in affected media.

4.2 PRELIMINARY CONCEPTUAL SITE MODEL REVIEW

Figure 4.1 presents the preliminary conceptual site model (CSM) developed for the site. The model was developed using data collected during previous site investigations and is based on a review of potential receptors and feasible exposure scenarios. The

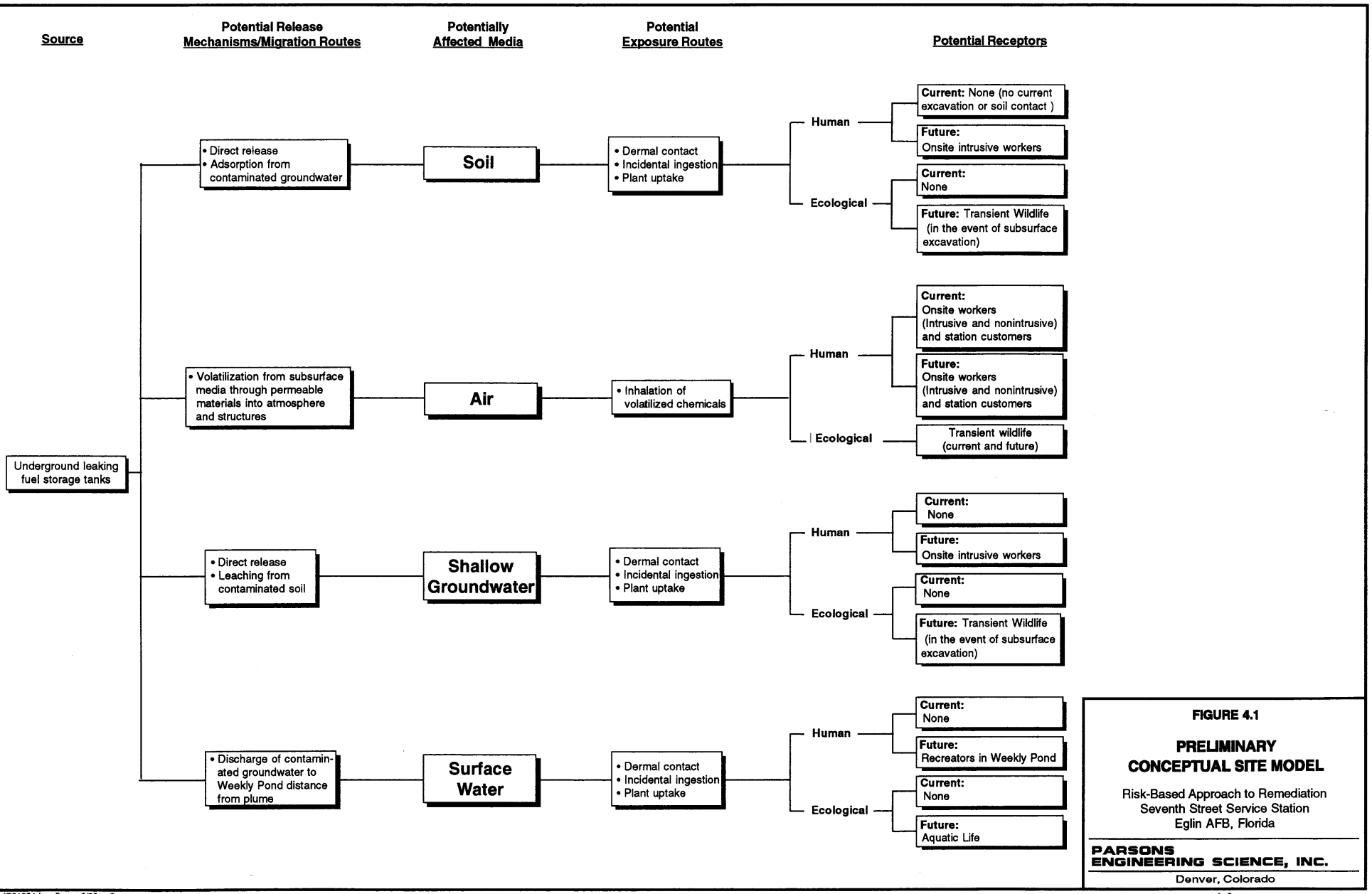


FIGURE 4.1

PRELIMINARY CONCEPTUAL SITE MODEL

Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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purpose of developing a CSM is to guide the evaluation of available site information, including:

- Potential contaminant sources;
- Mechanisms of contaminant release and potential migration routes (e.g., leaching and volatilization);
- Media affected by contaminant releases;
- Routes of possible receptor exposure (e.g., inhalation, ingestion, or dermal contact); and
- Potential human and ecological receptors based on conservative, reasonable land use assumptions.

The CSM also was developed to provide an outline for addressing all media-specific current and future exposure scenarios at the site. The CSM has been constructed to identify potentially completed receptor exposure pathways. For an exposure pathway to be completed, there must be a contaminant source, a release mechanism, a contaminant migration pathway, an exposure route, and a receptor. If any of these components is missing, the pathway is considered incomplete, and receptors are not at risk from exposure to site contaminants.

4.2.1 Potential Contaminant Sources, Potential Release Mechanisms, and Potentially Affected Media

As shown on Figure 4.1, the source of the fuel contamination at the Seventh Street Service Station is the former underground gasoline storage and distribution system. The initial mechanism of release was leakage from the storage tanks and distribution lines, resulting in direct release of gasoline to soil and groundwater. Continuing release mechanisms may include adsorption of fuel hydrocarbons to soil from contaminated groundwater, volatilization of hydrocarbons from soil and groundwater into the atmosphere, leaching of hydrocarbons from contaminated soil into groundwater, and discharge of contaminated groundwater to surface water. Air, soil, shallow groundwater, and surface water are the potentially affected physical media at or downgradient from the site.

4.2.2 Potential Exposure Routes

An understanding of potential exposure pathways is important in determining how potential receptors could contact contaminated media and how that contact could result in the uptake of chemicals. Potential exposure routes by which contaminants could impact potential receptors include the following:

- Uptake of contamination from soil, groundwater, or surface water by local vegetation;

- Dermal contact with or incidental ingestion of contaminated soil by site workers (e.g., during excavation activities);

- Inhalation of the volatilized contaminant by site workers, service station customers, or transient wildlife;

- Dermal contact with or incidental ingestion of contaminated groundwater by site workers (e.g., during excavation activities); and

- Dermal contact with or incidental ingestion of contaminated surface water by recreators at Weekly Pond (if the dissolved contaminant plume migrates and discharges to the pond).

4.2.3 Land Use and Potential Receptors

On the basis of available site-specific information, current and future land use at the site is assumed to be industrial/commercial as opposed to residential. The site is an active automotive repair station located within the industrial/commercial section of the main Base. Potential receptors include onsite intrusive and non-intrusive workers, customers of the service station, site vegetation, and transient wildlife. Weekly Pond, a surface water body located approximately one-quarter mile downgradient of the site, is not classified as a fishery, but public access to the pond is not restricted. Therefore, recreators at Weekly Pond could be potential future receptors.

4.3 TIER 1 SCREENING ANALYSIS

It is the intention of the Air Force to obtain FDEP approval for a corrective action for the site that will protect potential receptors from unacceptable exposures to site-related chemicals. To accomplish this objective, the COPCs that drive potential risks and impact the final remedial requirements at this site were identified.

FDEP (1997) Tier 1 TCLs are based on 1) analyte-specific toxicity data; 2) an exposure-pathway-specific cancer target risk limit of 10^{-6} (i.e., one additional cancer above the background rate in a population of one million) and a noncancer hazard quotient less than or equal to 1; and 3) conservative receptor exposure assumptions.

4.3.1 Tier 1 Screening Analysis for Soil

TCLs for direct exposure of industrial workers (Direct Exposure II) were selected as the appropriate set of Tier 1 screening values for soil at the site. The FDEP (1997) guidance provides industrial-scenario TCLs for petroleum constituents in soil that incorporate risks posed by the dermal contact, ingestion, and inhalation exposure pathways. Table 4.1 compares the maximum concentrations for each compound measured in soil at the site during the 1998 risk-based sampling event to the Direct-Exposure II TCLs. Based on these comparisons, ethylbenzene and xylenes are identified as COPCs in soil.

TABLE 4.1
TIER 1 SCREENING SUMMARY FOR SOIL
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Units	Maximum Concentration	Location (and Depth Interval in ft bgs) of Concentration	Direct Exposure [a] II
Benzene	mg/kg [b]	0.0032 J1 [c]	VMP2 (7-8)	1.50
Ethylbenzene	mg/kg	710 B [d]	SB06 (7-8)	240
Toluene	mg/kg	83	SB06 (7-8)	2,000
Xylenes (total)	mg/kg	1,400	SB06 (7-8)	290
Methyl-tert-butyl ether	mg/kg	59 U [e]	NA [f]	6,100
TRPH (C8-C40) [g]	mg/kg	1,300	MP-2 (5-6)	2,500
Acenaphthene	mg/kg	0.24 U	NA	22,000
Acenaphthylene	mg/kg	0.24 U	NA	11,000
Anthracene	mg/kg	0.0099 J1	MP-2 (5-6)	290,000
Benzo(a)anthracene	mg/kg	0.14	MP-2 (5-6)	5.1
Benzo(a)pyrene	mg/kg	0.082	MP-2 (5-6)	0.5
Benzo(b)fluoranthene	mg/kg	0.082	MP-2 (5-6)	5
Benzo(g,h,i)perylene	mg/kg	0.049 J1	MP-2 (5-6)	45,000
Benzo(k)fluoranthene	mg/kg	0.019	MP-2 (5-6)	52
Chrysene	mg/kg	0.048 U	NA	490
Dibenz(a,h)anthracene	mg/kg	0.024 U	NA	0.5
Fluoranthene	mg/kg	0.43	MP-2 (5-6)	45,000
Fluorene	mg/kg	0.048 U	NA	24,000
Indeno(1,2,3-cd)pyrene	mg/kg	0.036 U	NA	5.2
Naphthalene	mg/kg	6.5	SB06 (7-8)	8,600
Phenanthrene	mg/kg	0.048 U	NA	29,000
Pyrene	mg/kg	0.3	MP-2 (5-6)	40,000

Notes:

a/ Direct Exposure II = FDEP (1997) TCLs based on No Further Action With Conditions (industrial worker exposure scenario).

b/ mg/kg = Milligrams per kilogram.

c/ J1 = The analyte was positively identified and has a concentration between the method detection limit and the reporting limit.

d/ B = The compound also was detected in the blank.

e/ U = The analyte was analyzed for and is not present above the reporting limit.

f/ NA = Not applicable.

g/ TRPH = Total recoverable petroleum hydrocarbons.

The maximum soil contaminant concentrations were not compared to the leachability TCLs presented in Table IV of FDEP (1997). The leachability criteria were established to ensure that leaching of residual contamination adsorbed to soil particles will not result in significant impairment of groundwater quality. At the Seventh Street Service Station, the vadose zone is thin (approximately 5 feet thick), and groundwater is continually or seasonally in direct contact with the contaminated soil, minimizing the significance of downward leaching of contaminants from the vadose zone to the water table. In addition, the contamination has been present for approximately 15 years, and the impacts of site contamination on groundwater quality have been demonstrated by the results of several years of groundwater monitoring. The gradual desorption of residual fuel contaminants from the soil and dissolution into the groundwater is significant to the extent that it represents a continuing source of groundwater contamination. The length of time that the soil contamination will continue to cause dissolved contaminant concentrations to exceed Tier 1 TCLs (Table V levels in Chapter 62-770) is addressed in Section 6.

4.3.2 Tier 1 Screening Analysis for Groundwater

The Tier 1 groundwater TCLs presented by the FDEP (1997) and used in this CAP are based on the conservative assumption of unrestricted future use of groundwater (e.g., use as a drinking water source). Comparisons of the TCLs for unrestricted groundwater use to March 1998 data are presented in Table 4.2. Based on these comparisons, benzene, ethylbenzene, toluene, xylenes, TRPH, lead, and naphthalene are identified as COPCs in groundwater. Note that dissolved lead was detected at MP2 at a concentration of 1.1 μg/L and total lead was detected at a concentration of 19μg/L. The elevated total lead concentration may be due to the presence of suspended sediment in the sample, and does not appear to be representative of what is dissolved in the groundwater. Maximum concentrations of ethylbenzene, toluene, xylenes, and naphthalene also exceeded their natural attenuation source default values.

4.3.3 Tier 1 Screening Analysis for Soil Gas

FDEP (1997) guidance does not provide RBSLs for screening soil gas concentrations or for directly screening ambient air values. FDEP guidance accounts for the potential for volatilization of contaminants from soil into ambient air in the calculation of the Tier 1 TCLs for direct contact with soil. The Tier 1 TCLs do not account for the presence of the pavement cover over much of the site, which would act to further minimize the potential for exposure via the inhalation pathway.

As a means of assessing the potential for exposure via inhalation of volatiles, the soil gas samples collected in March 1998 were analyzed for BTEX, and maximum detections of each compound were compared to the chemical-specific Occupational Safety and Health Administration (OSHA) 8-hour time-weighted average Permissible Exposure Limit (PEL) (NIOSH, 1997) and Threshold Limit Values (TLVs) (ACGIH, 1996). Table 4.3 presents the results of this comparison. No BTEX constituents were detected above the OSHA PELs or the TLVs, indicating that inhalation of volatilized contaminants does not currently, and will not in the future, pose a risk to potential receptors.

TABLE 4.2
TIER 1 SCREENING SUMMARY FOR GROUNDWATER
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Units	Maximum Detection	Detection Location	Table V Target Cleanup Level [a/]	Table IX Natural Attenuation Source Default Values
Benzene	µg/L [b/]	86 J1 [c/]	MP-2	1	100
Ethylbenzene	µg/L	1,600	MP-2	30	300
Toluene	µg/L	11,000	MP-2	40	400
Xylenes (total)	µg/L	13,000	MP-2	20	200
TRPH (C8-C40) [d/]	µg/L	38	MP-2	5	50
EDB [e/]	µg/L	0.02 U [f/]	NA [g/]	0.02	2
Lead	µg/L	19	MP-2	15	150
Acenaphthene	µg/L	20 U	NA	20	200
Acenaphthylene	µg/L	20 U	NA	210	2,100
Anthracene	µg/L	0.57 J1	MW-1	2,100	21,000
Benzo(a)anthracene	µg/L	2.6 U (1.2) [h/]	NA	0.2	20
Benzo(a)pyrene	µg/L	4.6 U (1.3)	NA	0.2	20
Benzo(b)fluoranthene	µg/L	3.6 U (1.2)	NA	0.2	20
Benzo(g,h,i)perylene	µg/L	4.0 U	NA	210	2,100
Benzo(k)fluoranthene	µg/L	3.4 U (1.2)	NA	0.5	50
Chrysene	µg/L	4.0 U	NA	5	500
Dibenz(a,h)anthracene	µg/L	6.1 U (1.5)	NA	0.2	20
Fluoranthene	µg/L	1.6 J1	MW-1	280	2,800
Fluorene	µg/L	4.0 U	NA	280	2,800
Indeno(1,2,3-cd)pyrene	µg/L	8.7 U (1.1)	NA	0.2	20
Naphthalene	µg/L	510	MP-2	20	200
Phenanthrene	µg/L	0.85 J1	MW-1	210	2,100
Pyrene	µg/L	1.7 J1	MW-1	210	2,100

Notes:

a/ Table V Target Cleanup Level = FDEP (1997) TCLs for Groundwater

b/ µg/L = micrograms per liter.

c/ J1 = The analyte was positively identified and had a concentration between the method detection limit and the reporting limit.

d/ TRPH = Total recoverable petroleum hydrocarbons.

e/ EDB = Ethylene dibromide.

f/ U = The analyte was analyzed for and was not present above the reporting limit.

g/ NA = Not applicable.

h/ Value in parentheses is the method detection limit. Largest RL & MDL are used if no detection.

TABLE 4.3
TIER 1 SCREENING SUMMARY FOR SOIL GAS
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Maximum Detection (ppmv [a/])	OSHA PEL [b/] (ppmv)	TLV [c/] (ppmv)
Benzene	0.023	1	0.5
Ethylbenzene	0.53	100	100
Toluene	0.092	100	50
Xylenes (total)	0.41	100	100
TPH (C5+) [d/]	22	--[e/]	--
TRPH (C2-C4)[f/]	0.076	--	--

Notes:

a/ ppmv = parts per million, volume per volume.

b/ OSHA PEL = Occupational Safety and Health Administration (NIOSH, 1997) 8-hour time-weighted average permissible exposure limit.

c/ TLV = Threshold limit value time weighted average -- Recommended by the American Conference of Government Industrial Hygienists (ACGIH), 1996.

d/ TPH = Total Petroleum Hydrocarbons.

e/ -- = no comparison value available.

f/ TRPH - total recoverable petroleum hydrocarbons.

4.3.4 Summary of Site COPCs

Based on comparisons of the maximum soil, groundwater, and soil gas concentrations to FDEP (1997) TCLs, OSHA PELs (NIOSH, 1997), and TLVs (ACGIH, 1996), dissolved benzene, adsorbed and dissolved ethylbenzene, dissolved toluene, adsorbed and dissolved xylenes, total lead in groundwater, dissolved TRPH, and dissolved naphthalene are identified as COPCs for the Seventh Street Service Station.

SECTION 5

ANALYTICAL DATA SUMMARY AND EXTENT OF CHEMICALS OF POTENTIAL CONCERN

5.1 OVERVIEW

This section presents analytical results from the March 1998 field sampling event in tabular form, and summarizes the magnitude and extent of COPC contamination in sampled media at the Seventh Street Service Station. Discussion in this section is primarily limited to those chemicals that were identified as COPCs based on the Tier 1 screening analysis presented in Section 4 (i.e., BTEX, TRPH, lead, and naphthalene).

5.2 SOIL SAMPLING RESULTS

Soil sampling was performed as part of the recent risk-based investigation. Field screening results are summarized in Table 5.1, and laboratory analytical results are summarized in Table 5.2. Boring logs are included in Appendix C. Soil borings were advanced in areas of elevated fuel contamination (based on previous investigations) to determine worst-case hydrocarbon concentrations in soil, in addition to facilitating evaluation of the change in concentrations over time. Soil boring locations are shown on Figure 2.1. The soil sample locations were selected based on the former locations of USTs, underground fuel transport lines, and fuel dispensers and analytical results from previously-collected soil samples. Soil samples were collected across the site at approximately 45-foot intervals to delineate the area of contaminated soil.

As shown on Figure 5.1, three of the sampling locations are adjacent to previous soil sampling locations (vapor monitoring point VMP-2 and vapor extraction wells VEW-1 and VEW-2). Soil samples were collected at these locations by ES in May 1992 and May 1993. Sampling the same location and depth interval again facilitates the assessment of temporal changes in contaminant concentrations in these historically contaminated areas.

As shown in Table 4.1, only ethylbenzene and xylenes were detected above the Direct Exposure II levels; the exceedences were found in the soil sample from the 7- to 8-foot interval at boring SB06. The highest concentrations of volatile organics detected by the PID were located approximately 8 ft bgs in most of the borings at the site. This indicates that a significant amount of soil contamination is located beneath the water table. This observation is supported by the laboratory analytical results. The five highest total BTEX concentrations and two highest naphthalene concentrations were detected in soil samples collected between 5 and 9 feet bgs, 0.5 to 3 feet below the estimated water table.

TABLE 5.1
SOIL BORING SUMMARY AND FIELD SCREENING RESULTS
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Boring Location	Boring Date	Highest PID Measurement (ppmv) [a/] [Measurement Depth (ft bgs [b/])]	Estimated Depth to Water (ft bgs)	Total Depth (ft bgs)
SB01	3/28/98	322 (6 - 7)	4.5	8
SB02	3/28/98	265 (6 - 7)	4.5	8
SB03	3/28/98	570 (6 - 7)	4.5	8
SB04	3/28/98	530 (5 - 6)	5.0	8
SB05	3/28/98	0.0 (NA [c/])	5.0	8
SB06	3/28/98	1017 (4 - 5)	5.0	8
SB07	3/28/98	47 (4 - 5)	6.0	8
SB08	3/28/98	750 (6 - 7)	6.0	8
SB09	3/29/98	980 (8 - 9)	6.0	12
SB10	3/29/98	2100 (7 - 8)	6.0	8
SB11	3/29/98	60 (7 - 8)	5.0	8
SB12	3/30/98	40 (7 - 8)	6.0	8
SB13	3/30/98	880 (7 - 8)	6.0	8
SB14	3/30/98	100 (7 - 8, 9 - 10, and 11 - 12)	6.0	12
MP-1	3/26/98	0.0 (NA)	6.5	9
MP-2	3/26/98	500 (5 - 6)	6.5	9
VMP2	3/28/98	940 (5 - 6)	4.5	8
VEW1	3/28/98	1027 (5 - 6)	5.0	8
VEW2	3/28/98	750 (8 - 9)	4.5	10

a/ ppmv = parts per million, volume per volume; PID - photoionization detector

b/ ft bgs = feet below ground surface

c/ NA = not applicable

TABLE 5.2
SUMMARY OF SOIL ANALYTICAL DATA
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Units	Sample Locations, Depth Intervals (ft bgs), and Sampling Dates									
		SB06 3-4 3/28/98	SB06 4-5 3/28/98	SB06 7-8 3/28/98	SB07 4.5-5.5 3/28/98	SB07 7-8 3/28/98	SB08 5-6 3/28/98	SB09 8-9 3/29/98	SB11 5-6 3/29/98	SB12 7-8 3/30/98	SB14 7-8 3/30/98
Benzene	mg/kg [a/]	1.2 U [b/]	1.1 U	59 U	0.0055 U	0.0058 U	0.0053 U	2.4 U	0.0054 U	0.0059 U	0.0058 U
Ethylbenzene	mg/kg	4.1	1.2	710	0.047 U	0.0023 U	0.0021 U	3.5	0.0016 U [c/]	0.0024 U	0.0007 U
Toluene	mg/kg	1.2 U	1.1 U	83	0.02	0.0058 U	0.0053 U	9.9	0.0035 J1	0.0059 U	0.0014 J1
Xylenes (total)	mg/kg	13	4.3	1400	0.11	0.0058 U	0.0053 U	45	0.0039 J1	0.0059 U	0.0058 U
Methyl-tert-butyl ether	mg/kg	1.2 U	1.1 U	59 U	0.0055 U	0.0058 U	0.0053 U	2.4 U	0.0054 U	0.0059 U	0.0058 U
TRPH (C8-C40) [c/]	mg/kg	25	34	7.5 J1	75	5.1 J1	11	29	25	5.5 J1	18
Acenaphthene	mg/kg	0.24 U	0.22 U	0.24 U	0.22 U	0.23 U	0.21 U	0.24 U	0.22 UJ [d/]	0.24 U	0.23 U
Acenaphthylene	mg/kg	0.24 U	0.22 U	0.24 U	0.22 U	0.23 U	0.21 U	0.24 U	0.22 U J	0.24 U	0.23 U
Anthracene	mg/kg	0.024 U	0.022 U	0.024 U	0.022 U	0.023 U	0.021 U	0.024 U	0.022 UJ	0.024 U	0.023 U
Benzo(a)anthracene	mg/kg	0.024 U	0.022 U	0.024 U	0.022 U	0.023 U	0.021 U	0.024 U	0.022 UJ	0.024 U	0.023 U
Benzo(a)pyrene	mg/kg	0.018 U	0.016 U	0.018 U	0.017 U	0.017 U	0.016 U	0.018 U	0.0073 J [e/]	0.018 U	0.017 U
Benzo(b)fluoranthene	mg/kg	0.014 U	0.013 U	0.014 U	0.013 U	0.014 U	0.013 U	0.014 U	0.0069 J	0.014 U	0.014 U
Benzo(g,h,i)perylene	mg/kg	0.060 U	0.054 U	0.059 U	0.055 U	0.058 U	0.053 U	0.059 U	0.0047 J	0.059 U	0.058 U
Benzo(k)fluoranthene	mg/kg	0.013 U	0.012 U	0.013 U	0.012 U	0.013 U	0.012 U	0.013 U	0.012 UJ	0.013 U	0.013 U
Chrysene	mg/kg	0.048 U	0.044 U	0.047 U	0.044 U	0.046 U	0.043 U	0.048 U	0.043 UJ	0.047 U	0.047 U
Dibenz(a,h)anthracene	mg/kg	0.024 U	0.022 U	0.024 U	0.022 U	0.023 U	0.021 U	0.024 U	0.022 UJ	0.024 U	0.023 U
Fluoranthene	mg/kg	0.048 U	0.044 U	0.047 U	0.044 U	0.046 U	0.043 U	0.048 U	0.043 UJ	0.047 U	0.047 U
Fluorene	mg/kg	0.048 U	0.044 U	0.047 U	0.044 U	0.046 U	0.043 U	0.048 U	0.043 UJ	0.047 U	0.047 U
Indeno(1,2,3-cd)pyrene	mg/kg	0.036 U	0.033 U	0.035 U	0.033 U	0.035 U	0.032 U	0.036 U	0.032 UJ	0.036 U	0.035 U
Naphthalene	mg/kg	0.19 J1	0.16 J1	6.5	0.22 U	0.23 U	0.21 U	0.24 U	0.22 UJ	0.24 U	0.23 U
Phenanthrene	mg/kg	0.048 U	0.044 U	0.047 U	0.044 U	0.046 U	0.043 U	0.048 U	0.043 UJ	0.047 U	0.047 U
Pyrene	mg/kg	0.048 U	0.044 U	0.047 U	0.044 U	0.046 U	0.043 U	0.048 U	0.043 UJ	0.047 U	0.047 U
TOC [f/]	mg/kg	NA [g/]	NA	NA	NA	NA	NA	NA	NA	NA	NA

a/ mg/kg = Milligrams per kilogram.

b/ U = The analyte was analyzed for and is not present above the associated reporting limit.

c/ TRPH = Total recoverable petroleum hydrocarbons.

d/ UJ = The analyte was not present above the associated quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in the sample.

e/ J = The analyte was positively identified, but the associated numerical value may not be consistent with the amount actually present in the sample. The data should be considered as a basis for decision-making and are usable for many purposes.

f/ TOC = Total organic carbon.

g/ NA = not analyzed.

TABLE 5.2 (concluded)
SUMMARY OF SOIL ANALYTICAL DATA
Streamlined Risk-Based Investigation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Units	Sample Locations, Depth Intervals (ft bgs), and Sampling Dates											
		MP-2 3-4 3/26/98	MP-2 5-6 3/26/98	VMP2 3-4 3/28/98	VMP2 5-6 3/28/98	VMP2 7-8 3/28/98	VEW1 3-4 3/28/98	VEW1 5-6 3/28/98	VEW1 7-8 3/28/98	VEW2 5.5-6.5 3/28/98	SB01 7-8 3/28/98	SB02 7-8 3/28/98	SB03 7-8 3/28/98
Benzene	mg/kg [a/]	0.0055 U	2.3 U	2.2 U	2.3 U	0.0032 J1	0.55 U	2.4 U	5.7 U	0.0058 U	NA	NA	NA
Ethylbenzene	mg/kg	0.0012 U	0.93 U	0.89 U	0.94 U	0.0039 U	0.13 J1	2.4	8	0.0023 U	NA	NA	NA
Toluene	mg/kg	0.0034 J1	2.3 U	2.2 U	2.3 U	0.019	0.55 U	2.4 U	5.7 U	0.0058 U	NA	NA	NA
Xylenes (total)	mg/kg	0.0055 U	4.2	12	18	0.35	2	28	28	0.0058 U	NA	NA	NA
Methyl-tert-butyl ether	mg/kg	0.0055 U	2.3 U	2.2 U	2.3 U	0.0059 U	0.55 U	2.4 U	5.7 U	0.0058 U	NA	NA	NA
TRPH (C8-C40) [c/]	mg/kg	4.8 J1	1300	49	490	5 J1	31	7.6 J1	28	11	NA	NA	NA
Acenaphthene	mg/kg	0.22 U	0.23 U	0.22 U	0.23 U	0.23 U	0.22 U	0.24 U	0.23 U	0.23 U	NA	NA	NA
Acenaphthylene	mg/kg	0.22 U	0.23 U	0.22 U	0.23 U	0.23 U	0.22 U	0.24 U	0.23 U	0.23 U	NA	NA	NA
Anthracene	mg/kg	0.022 U	0.0099 J1	0.022 U	0.023 U	0.023 U	0.022 U	0.024 U	0.023 U	0.023 U	NA	NA	NA
Benzo(a)anthracene	mg/kg	0.022 U	0.14	0.022 U	0.023 U	0.023 U	0.022 U	0.024 U	0.023 U	0.023 U	NA	NA	NA
Benzo(a)pyrene	mg/kg	0.016 U	0.082	0.017 U	0.018 U	0.018 U	0.016 U	0.018 U	0.017 U	0.017 U	NA	NA	NA
Benzo(b)fluoranthene	mg/kg	0.013 U	0.082	0.013 U	0.014 U	0.014 U	0.013 U	0.014 U	0.014 U	0.014 U	NA	NA	NA
Benzo(g,h,i)perylene	mg/kg	0.055 U	0.049 J1	0.056 U	0.059 U	0.059 U	0.055 U	0.060 U	0.057 U	0.058 U	NA	NA	NA
Benzo(k)fluoranthene	mg/kg	0.012 U	0.019	0.012 U	0.013 U	0.013 U	0.012 U	0.013 U	0.013 U	0.013 U	NA	NA	NA
Chrysene	mg/kg	0.044 U	0.047 U	0.045 U	0.047 U	0.047 U	0.044 U	0.048 U	0.046 U	0.046 U	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg	0.022 U	0.023 U	0.022 U	0.023 U	0.023 U	0.022 U	0.024 U	0.023 U	0.023 U	NA	NA	NA
Fluoranthene	mg/kg	0.044 U	0.43	0.045 U	0.047 U	0.047 U	0.044 U	0.048 U	0.046 U	0.046 U	NA	NA	NA
Fluorene	mg/kg	0.044 U	0.047 U	0.045 U	0.047 U	0.047 U	0.044 U	0.048 U	0.046 U	0.046 U	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg	0.033 U	0.035 U	0.034 U	0.035 U	0.035 U	0.033 U	0.036 U	0.034 U	0.035 U	NA	NA	NA
Naphthalene	mg/kg	0.22 U	0.23 U	0.2 J1	2.2	0.23 U	0.19 J1	0.1 J1	0.23 U	0.23 U	NA	NA	NA
Phenanthrene	mg/kg	0.044 U	0.047 U	0.045 U	0.047 U	0.047 U	0.044 U	0.048 U	0.046 U	0.046 U	NA	NA	NA
Pyrene	mg/kg	0.044 U	0.30	0.045 U	0.047 U	0.047 U	0.044 U	0.048 U	0.046 U	0.046 U	NA	NA	NA
TOC [f/]	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000 U	2000 U	2000 U

a/ mg/kg = Milligrams per kilogram.

b/ U = The analyte was analyzed for and is not present above the associated reporting limit.

c/ TRPH = Total recoverable petroleum hydrocarbons.

d/ UJ = The analyte was not present above the associated quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in the sample.

e/ J = The analyte was positively identified, but the associated numerical value may not be consistent with the amount actually present in the sample. The data should be considered as a basis for decision-making and are usable for many purposes.

f/ TOC = Total organic carbon.

g/ NA = not analyzed.

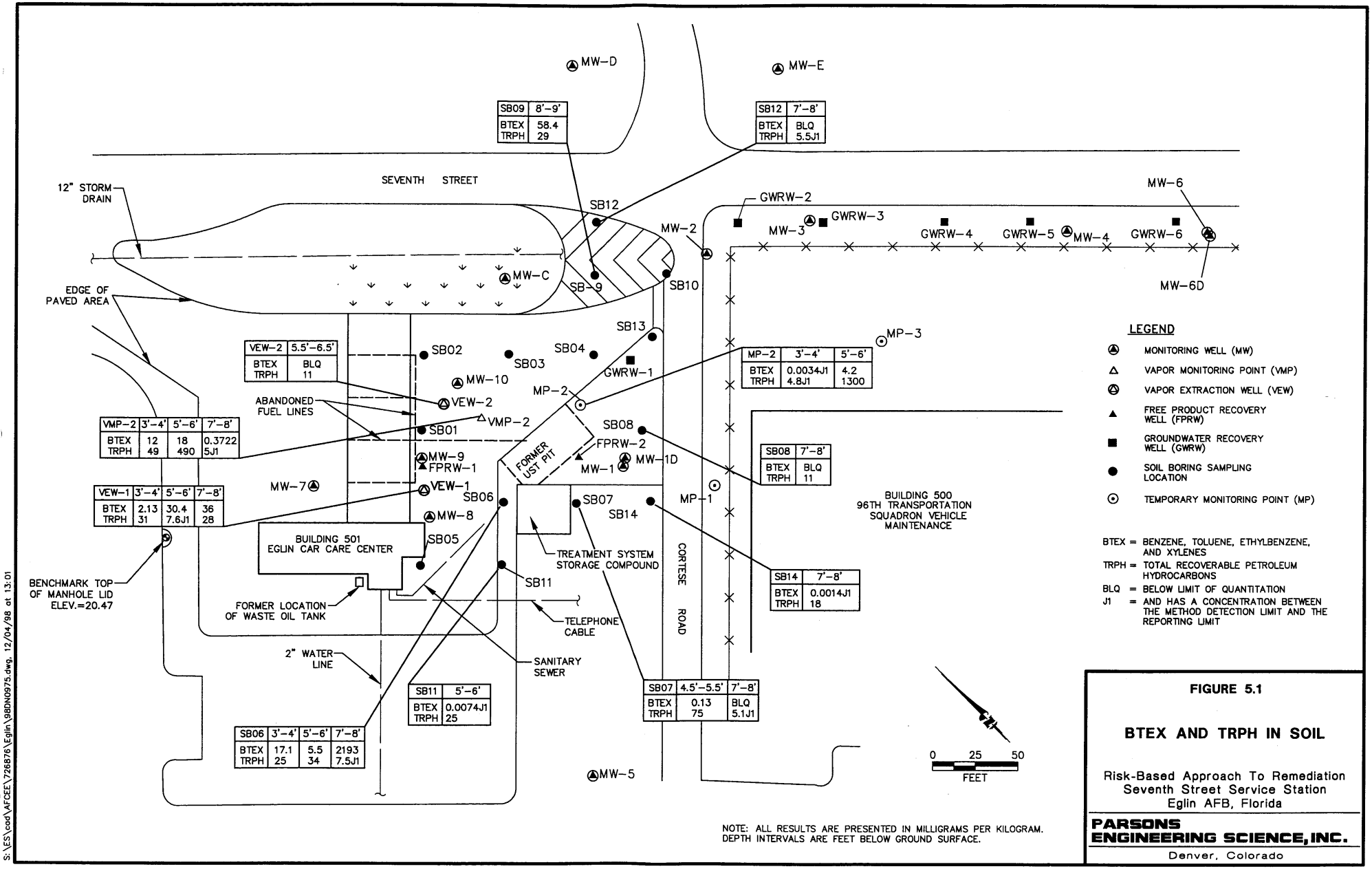


FIGURE 5.1

BTEX AND TRPH IN SOIL

Risk-Based Approach To Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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5.3 GROUNDWATER SAMPLING RESULTS

Groundwater sampling was performed as part of the recent risk-based investigation; analytical results are summarized in Table 5.3. Sample locations were selected based on the results of previous investigations and the objectives of this study. The sampling objectives were to determine the current areal extent and magnitude of fuel hydrocarbon and lead concentrations in groundwater, and to obtain the appropriate chemical and geochemical data to document the occurrence and significance of biodegradation processes. As shown in Table 4.2, maximum concentrations of dissolved benzene, ethylbenzene, toluene, xylenes, TRPH, lead, and naphthalene exceeded their respective Tier 1 TCLs. The locations of the exceedences, shown on Figure 5.2, were at wells MW-1, MW-2, MW-3, and GWRW-4 and temporary monitoring points MP-2 and MP-3.

5.4 SOIL GAS SAMPLING RESULTS

Three soil gas samples were collected at the site to facilitate assessment of the potential risk to future workers at the site from inhalation of VOCs. The soil gas samples were collected at a depth of 3 feet bgs from areas containing relatively elevated soil contaminant concentrations (Figure 2.1). The samples were submitted to Air Toxics, Ltd of Folsom California for analysis of BTEX and TPH (referenced to gasoline and propane). Field and laboratory analytical results for the March 1998 soil gas samples are summarized in Table 5.4. Maximum soil gas BTEX concentrations are compared to OSHA 8-hour time-weighted average PELs and TLVs in Table 4.3.

TABLE 5.3
SUMMARY OF GROUNDWATER ANALYTICAL DATA
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Units	Sample Locations and Dates											
		MW-1	MW-2	MW-20 (duplicate of MW-2)	MW-4	MW-7	MW-C	MW-D	GWRW-4	GWRW-6	MP-1	MP-2	MP-3
Benzene	µg/L[a/]	23 J1 [b/]	42 J1	59 J1	2.0 U [c/]	2.0 U	2.0 U	2.0 U	23 J1	2.0 U	2.0 U	86 J1	5.8 J1
Ethylbenzene	µg/L	490	660	690	2.0 U	2.0 U	2.0 U	2.0 U	80	2.0 U	2.0 U	1,600	160
Toluene	µg/L	1,000	8,400	8,600	2.0 U	2.0 U	2.0 U	2.0 U	590	2.0 U	2.0 U	11,000	180
Xylenes (total)	µg/L	6,600	6,300	6,500	2.0 U	2.0 U	2.0 U	2.0 U	650	2.0 U	2.0 U	13,000	720
EDB [d/]	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	NA [e/]	NA	NA	0.02 U	0.02 U	NA	0.02 U	NA
Acenaphthene	µg/L	10 U	10 U	10 U	1.0 U	NA	NA	NA	1.0 U	1.0 U	NA	20 U	NA
Acenaphthylene	µg/L	10 U	10 U	10 U	1.0 U	NA	NA	NA	1.0 U	1.0 U	NA	20 U	NA
Anthracene	µg/L	0.57 J1	1.0 U	1.0 U	0.10 U	NA	NA	NA	0.10 U	0.10 U	NA	2.0 U	NA
Benzo(a)anthracene	µg/L	1.3 U	1.3 U	1.3 U	0.13 U	NA	NA	NA	0.13 U	0.13 U	NA	2.6 U	NA
Benzo(a)pyrene	µg/L	2.4 U	2.3 U	2.3 U	0.24 U	NA	NA	NA	0.23 U	0.23 U	NA	4.6 U	NA
Benzo(b)fluoranthene	µg/L	1.9 U	1.8 U	1.8 U	0.18 U	NA	NA	NA	0.18 U	0.18 U	NA	3.6 U	NA
Benzo(g,h,i)perylene	µg/L	2.1 U	2.0 U	2.0 U	0.21 U	NA	NA	NA	0.20 U	0.20 U	NA	4.0 U	NA
Benzo(k)fluoranthene	µg/L	1.8 U	1.7 U	1.7 U	0.17 U	NA	NA	NA	0.17 U	0.17 U	NA	3.4 U	NA
Chrysene	µg/L	2.1 U	2.0 U	2.0 U	0.21 U	NA	NA	NA	0.20 U	0.20 U	NA	4.0 U	NA
Dibenz(a,h)anthracene	µg/L	3.1 U	3.0 U	3.1 U	0.31 U	NA	NA	NA	0.30 U	0.30 U	NA	6.1 U	NA
Fluoranthene	µg/L	1.6 J1	2.0 U	2.0 U	0.21 U	NA	NA	NA	0.20 U	0.20 U	NA	4.0 U	NA
Fluorene	µg/L	2.1 U	2.0 U	2.0 U	0.21 U	NA	NA	NA	0.20 U	0.20 U	NA	4.0 U	NA
Indeno(1,2,3-cd)pyrene	µg/L	4.4 U	4.3 U	4.4 U	0.44 U	NA	NA	NA	0.43 U	0.43 U	NA	8.7 U	NA
Naphthalene	µg/L	370	280	270	1.0 U	NA	NA	NA	32	1.0 U	NA	510	NA
Phenanthrene	µg/L	0.85 J1	2.0 U	2.0 U	0.21 U	NA	NA	NA	0.20 U	0.20 U	NA	4.0 U	NA
Pyrene	µg/L	1.7 J1	2.0 U	2.0 U	0.21 U	NA	NA	NA	0.20 U	0.20 U	NA	4.0 U	NA
TRPH (C8-C40) [f/]	µg/L	22	25	16	NA	NA	NA	NA	NA	NA	NA	38	NA
Total Lead	µg/L	12	5 U	3.3 J1	NA	NA	NA	1.2 J	2.1 J	NA	1.1 J	19	NA
Dissolved Lead	µg/L	NA	NA	NA	NA	NA	NA	5 U	5 U	NA	5 U	1.1 J	NA

Notes:

a/ µg/L = Micrograms per liter.

b/ J1 = The analyte was positively identified and has a concentration between the method detection limit and the associated reporting limit.

c/ U = The analyte was analyzed for and is not present above the associated reporting limit.

d/ EDB = Ethylene dibromide.

e/ NA = Not analyzed.

f/ TRPH = Total recoverable petroleum hydrocarbons.

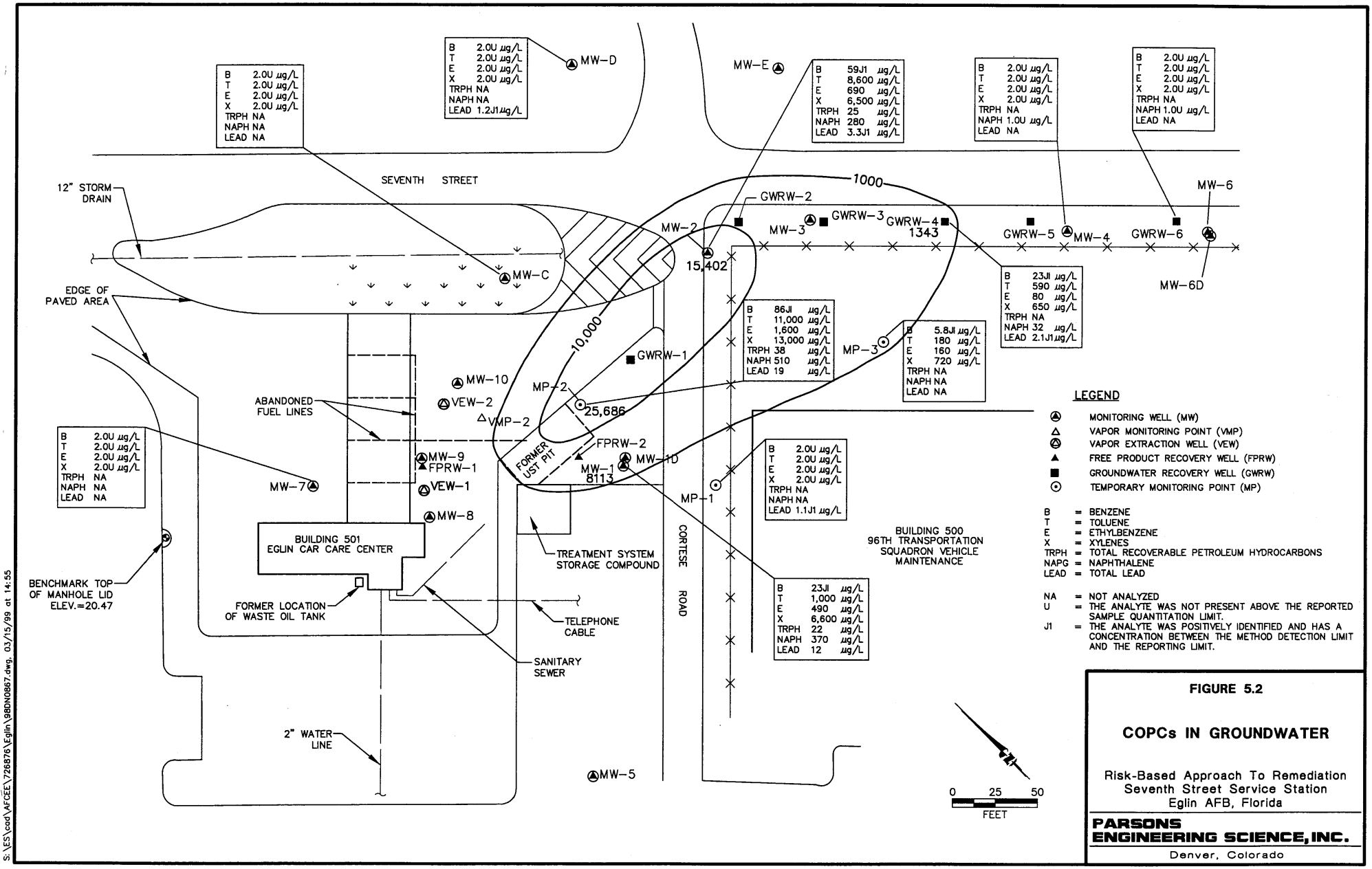


FIGURE 5.2

COPCs IN GROUNDWATER

Risk-Based Approach To Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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TABLE 5.4
SUMMARY OF SOIL GAS ANALYTICAL DATA
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Sample Locations, Dates, and Units BX SG1 1-Apr-98 ppmv [a/]	 µg/L [b/]
Benzene	0.020 U [c/]	0.066 U
Toluene	0.059	0.22
Ethylbenzene	0.048	0.21
Xylenes (total)	0.19	0.84
TPH (C5+ Hydrocarbons) [d/]	5.9	24
TPH (C2 - C4 Hydrocarbons)	0.20 U	0.37 U

Analyte	Sample Locations, Dates, and Units BX SG2 1-Apr-98 ppmv	 µg/L
Benzene	0.023	0.074
Toluene	0.092	0.35
Ethylbenzene	0.53	2.3
Xylenes (total)	0.41	1.8
TPH (C5+ Hydrocarbons)	22	92
TPH (C2 - C4 Hydrocarbons)	0.076	0.14

Analyte	Sample Locations, Dates, and Units BX SG3 1-Apr-98 ppmv	 µg/L
Benzene	0.020 U	0.065 U
Toluene	0.047	0.18
Ethylbenzene	0.032	0.14
Xylenes (total)	0.12	0.51
TPH (C5+ Hydrocarbons)	0.79	3.3
TPH (C2 - C4 Hydrocarbons)	0.20 U	0.36 U

a/ ppmv = parts per million, volume per volume

b/ µg/L = micrograms per liter

c/ U = The analyte was not detected above the reporting limit

d/ TPH = Total petroleum hydrocarbons

SECTION 6

CHEMICAL FATE ASSESSMENT

6.1 INTRODUCTION

Biodegradation of dissolved fuel constituents and the future migration and persistence of the dissolved COPCs identified in Section 4 are assessed in this section to support development of a remedial alternative and of a LTM plan that can be used to ensure that downgradient receptors will not be impacted by the dissolved COPCs.

As used throughout this report, the term "remediation by natural attenuation" (RNA) refers to a subsurface contaminant remediation strategy that relies on natural physical, chemical, and biological mechanisms to control exposure of potential receptors to concentrations of contaminants in soil and groundwater that exceed regulatory levels. These mechanisms include the processes of advection, hydrodynamic dispersion, dilution from recharge, sorption, volatilization, and biodegradation, which facilitate RNA of a variety of anthropogenic chemicals.

This section summarizes and interprets specific site characterization data relevant to documenting the effectiveness of RNA at minimizing dissolved COPC migration and reducing COPC concentration, mass, and toxicity over time. This assessment was used to develop Tier 2 SSTLs and determine whether natural attenuation may be a useful component of a cost-effective remedial approach for the site.

6.2 OPERATIVE MECHANISMS OF CONTAMINANT ATTENUATION

Understanding the fate of COPCs in environmental media is critical to evaluating and predicting contaminant distribution patterns. There are several physical, chemical, and biological processes that influence how a chemical behaves in soil and groundwater.

Nondestructive attenuation processes can be described as those physical and chemical processes that may prohibit significant contaminant migration but will not result in a permanent reduction in contaminant mass. Examples of nondestructive attenuation processes include volatilization, sorption, dilution from recharge, advection, and hydrodynamic dispersion. These processes must be evaluated when determining whether some type of remediation is warranted because chemical contamination poses or has the potential to pose a risk to human or ecological receptors. If contamination cannot reach a potential receptor exposure point, the contamination poses no risk.

In comparison to nondestructive chemical attenuation processes, destructive chemical attenuation processes result in the permanent removal of contaminant mass from the

environment. Documenting and distinguishing the effects of destructive attenuation processes, such as biodegradation, from nondestructive attenuation processes is critical to evaluating the potential for RNA to bring about a reduction in contaminant mass over time. The effectiveness of destructive attenuation processes at reducing contaminant mass at a site depends on how susceptible the chemical is to biodegradation and whether the site is characterized by physical, chemical, and biological conditions favorable to such processes.

Numerous laboratory and field studies have shown that hydrocarbon-degrading bacteria can participate in the degradation of many of the chemical components of different types of fuels (e.g., gasoline) under both aerobic and anaerobic conditions. Biodegradation of fuel hydrocarbons will occur when an indigenous population of hydrocarbon-degrading microorganisms is present in the soil and groundwater, and sufficient concentrations of electron acceptors and nutrients, including fuel hydrocarbons, are available to these organisms. Soil and groundwater with a history of exposure to fuel hydrocarbon compounds, such as at the Seventh Street Service Station, generally contain microbial populations capable of facilitating biodegradation reactions (Wiedemeier *et al.,* 1995). The chemical basis for the biodegradation of BTEX is described in more detail in Section 6.4, where geochemical data relevant to documenting biodegradation at the field scale at the site are presented.

6.3 EVIDENCE OF CONTAMINANT REDUCTION OVER TIME

The first step in determining whether contaminant concentrations are being reduced in soil and groundwater at the site was to compare contaminant concentrations at selected sampling locations over time. The purpose of this comparison is to assess the evidence of field-scale contaminant mass loss. Decreases in the magnitude of contaminant concentrations at a site over time that cannot be explained by physical processes (e.g., source removal actions such as SVE, air sparging, mass transport in groundwater) may be the first indication that contaminants are biodegrading at the site.

6.3.1 VOC Concentration Trends in Soil

March 1998 soil contamination data are compared to historical soil contamination data to assess the effects of biodegradation and SVE/bioventing. In 1992 and 1993, soil samples were collected at locations VEW-1, VEW-2, and VMP-2 (Figure 2.1). The laboratory analytical data are compared in Table 6.1 to the analytical results for the March 1998 soil samples that were collected immediately adjacent to the installed extraction wells and monitoring point. The data indicate that soil contaminant concentrations at and near the water table (which was present in this area at a depth of approximately 5 feet bgs) have been substantially reduced since 1992 due to the combined effects of biodegradation and SVE/bioventing.

6.3.2 BTEX Concentration Trends in Groundwater

BTEX and naphthalene concentrations measured at select monitoring wells from December 1994 to March 1998 are summarized in Table 6.2 and plotted on Figures 6.1, 6.2, and 6.3. Figure 6.1 shows the COPC concentrations over time at well MW-1. The plot shows an overall decrease in the concentration of COPCs since

TABLE 6.1
SUMMARY OF HISTORICAL COPC CONCENTRATIONS IN SOIL
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

BORING	DATE	BENZENE (mg/kg)	ETHYLBENZENE (mg/kg)	TOLUENE (mg/kg)	TOTAL XYLENES (mg/kg)	TRPH (mg/kg)
VEW-1	May-92	ND	23	4.76	56.7	150
SS-2	May-93	ND	5.5	1.1	18	31
(5 - 6' bgs)	Mar-98	< 2.4	2.4	< 2.4	28	7.6 J1

BORING	DATE	BENZENE (mg/kg)	ETHYLBENZENE (mg/kg)	TOLUENE (mg/kg)	TOTAL XYLENES (mg/kg)	TRPH (mg/kg)
VEW-2	May-92	1.19 J	6.43	7.62	32.1	130
SS-2	May-93	< 5.4	8.9	22	150	55
(5 - 6' bgs)	Mar-98	< 0.0058	< 0.0023	< 0.0058	< 0.0058	11

BORING	DATE	BENZENE (mg/kg)	ETHYLBENZENE (mg/kg)	TOLUENE (mg/kg)	TOTAL XYLENES (mg/kg)	TRPH (mg/kg)
VMP-2	May-92	26.5	55.3	152	274	1,200
(5 - 6' bgs)	May-93	< 5.4	38	73	340	190
	Mar-98	< 2.3	< 0.94	< 2.3	18	490

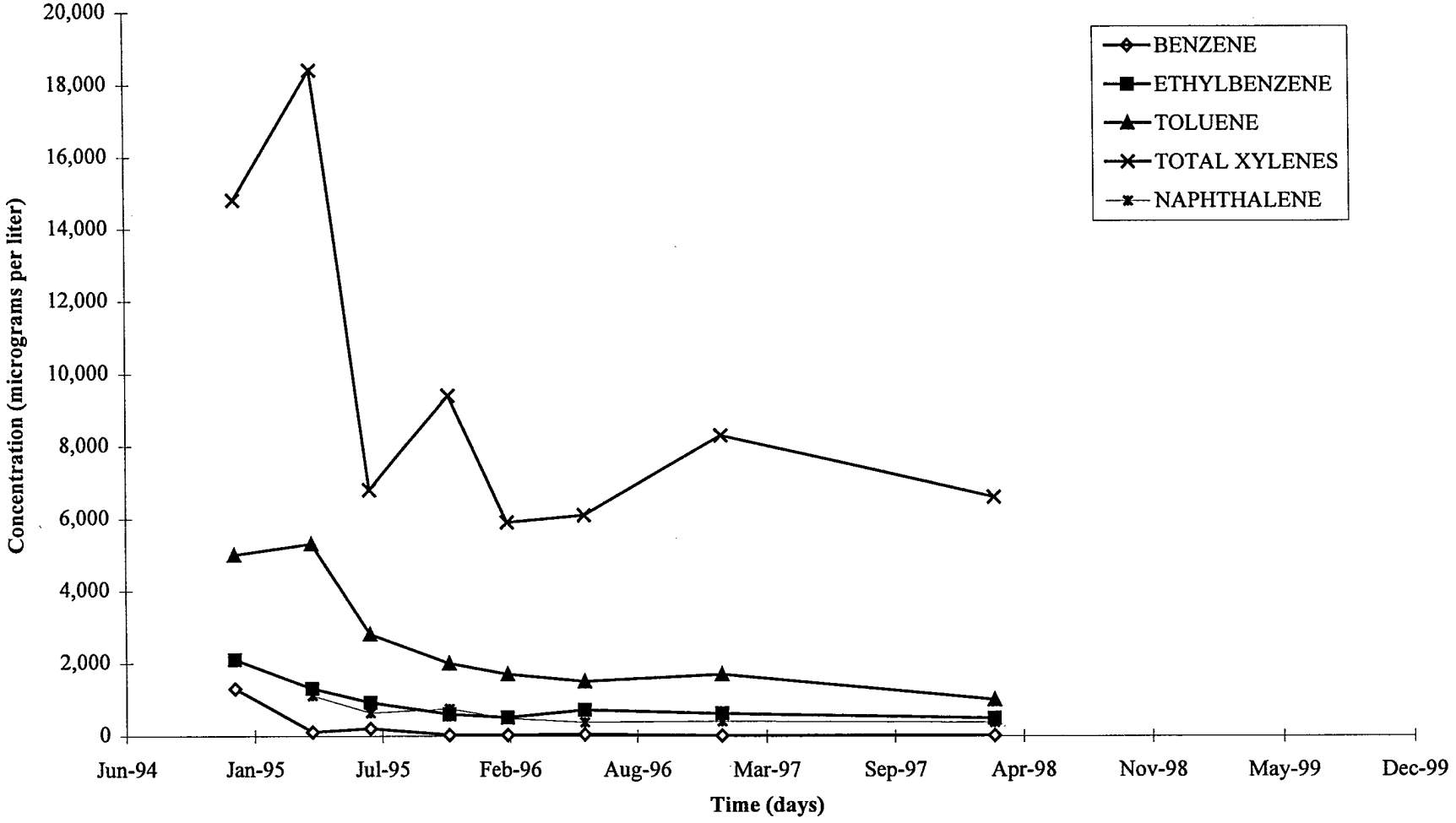
TABLE 6.2
SUMMARY OF HISTORICAL COPC CONCENTRATIONS IN GROUNDWATER
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

WELL	DATE	BENZENE (mg/L)	ETHYLBENZENE (mg/L)	TOLUENE (mg/L)	TOTAL XYLENES (mg/L)	NAPHTHALENE (mg/L)
MW-1	Dec-94	1,300	2,100	5,000	14,800	
	Apr-95	110	1,300	5,300	18,400	1,100
	Jul-95	210	920	2,800	6,800	630
	Nov-95	40	600	2,000	9,400	750
	Feb-96	39	510	1,700	5,900	480
	Jun-96	52	720	1,500	6,100	380
	Jan-97	20	620	1,700	8,300	410
	Mar-98	23	490	1,000	6,600	370

WELL	DATE	BENZENE (mg/L)	ETHYLBENZENE (mg/L)	TOLUENE (mg/L)	TOTAL XYLENES (mg/L)	NAPHTHALENE (mg/L)
MW-2	Dec-94	2,400	1,100	10,000	8,200	
	Apr-95	2,200	1,100	9,500	9,900	670
	Jul-95	5,100	2,800	32,000	21,200	700
	Nov-95	2,500	2,100	25,000	18,300	540
	Feb-96	1,800	1,900	20,000	15,400	770
	Jun-96	2,300	2,100	23,000	16,200	700
	Jan-97	1,100	1,800	18,000	13,700	500
	Mar-98	42	660	8,400	6,300	280

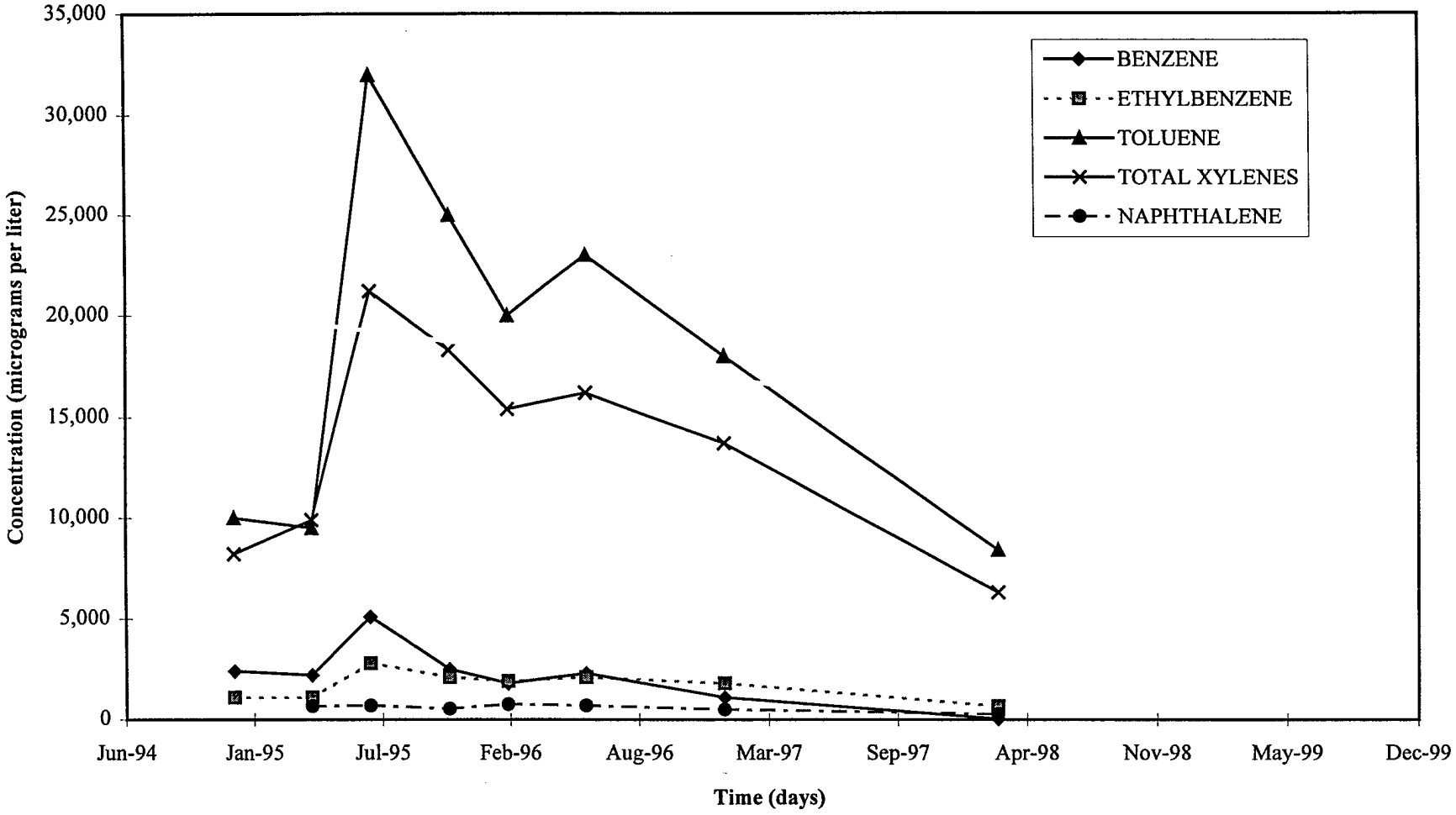
WELL	DATE	BENZENE (mg/L)	ETHYLBENZENE (mg/L)	TOLUENE (mg/L)	TOTAL XYLENES (mg/L)	NAPHTHALENE (mg/L)
GWRW-4	Dec-94	1,800	570	5,900	4,100	
	Apr-95	1,300	790	90	2,000	
	Mar-98	23	80	590	650	32

FIGURE 6.1
DISSOLVED COPC CONCENTRATIONS VS TIME AT MW-1
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida



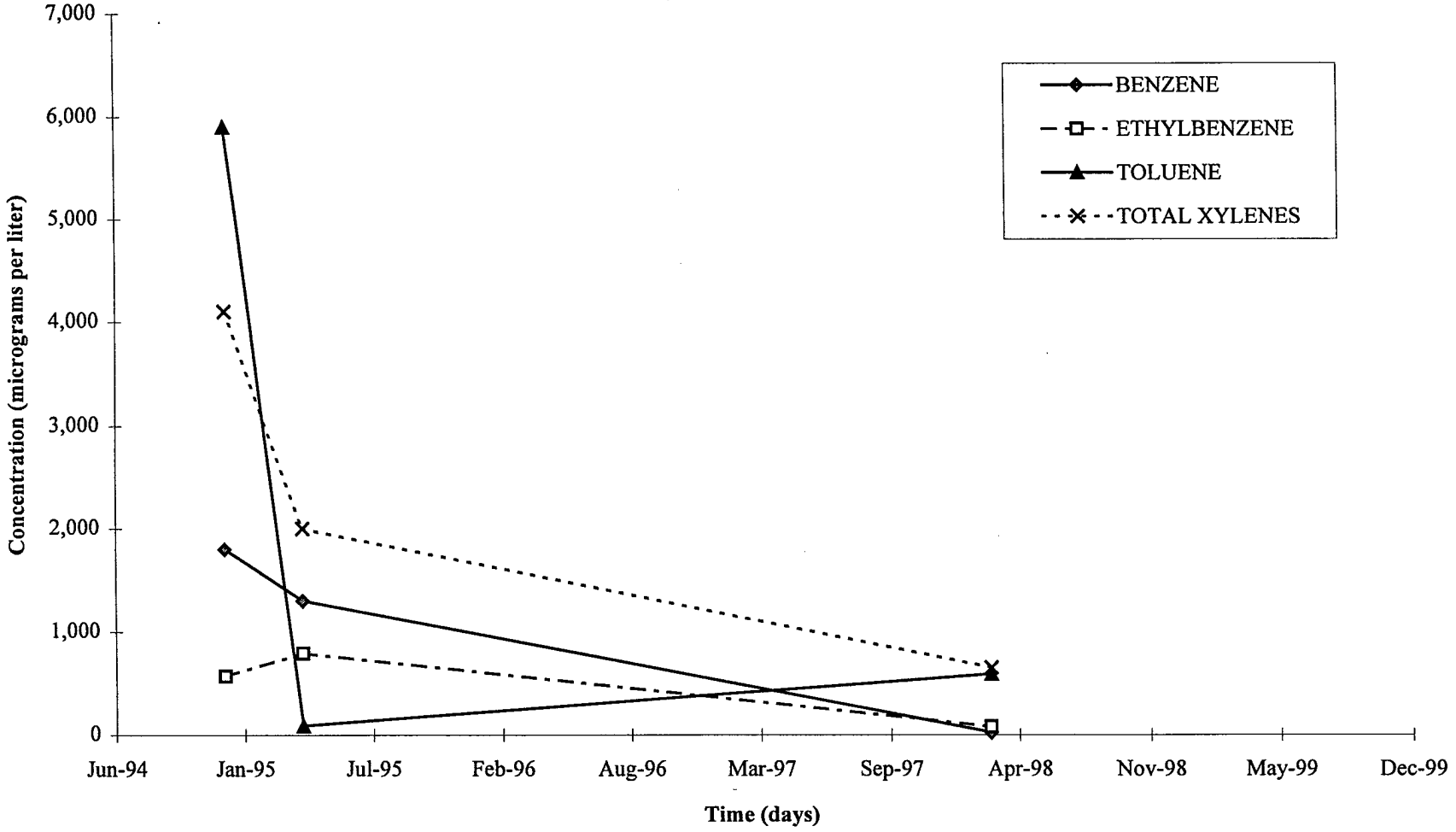
S:\ES\REMED\AFSITCL\EGLIN\BX\BXTables.xlsFigure 6.1

FIGURE 6.2
DISSOLVED COPC CONCENTRATIONS VS TIME AT MW-2
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida



S:\ES\REMED\AFSITCL\EGLIN\BX\BXTables.xlsFigure 6.2

FIGURE 6.3
DISSOLVED COPC CONCENTRATIONS VS TIME AT GWRW-4
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida



S:\ES\REMED\AFSITCL\EGLIN\BX\BXTables.xlsFigure 6.3

December 1994. Total BTEX concentrations have decreased from 23,200 μg/L in December 1994 to 8,113 μg/L in March 1998. Similarly, naphthalene concentrations have decreased from 1,100 μg/L in April 1995 to 370 μg/L in March 1998.

Figure 6.2 is a plot of the concentrations of the COPCs over time at well MW-2. Similar to Figure 6.1, the plot shows an overall decrease in the concentrations of COPCs since December 1994. Total BTEX concentrations have decreased from 21,700 μg/L in December 1994 to 15,402 μg/L in March 1998. Naphthalene concentrations have decreased from 670 μg/L in April 1995 to 280 μg/L in March 1998.

Figure 6.3 is a plot of the concentrations of the COPCs over time at well GWRW-4. The plot shows an overall decrease in the concentration of COPCs since December 1994. Total BTEX concentrations have decreased from 12,370 μg/L in December 1994 to 1,343 μg/L in March 1998.

The significance of biodegradation at this site is indicated by the biodegradation rates computed for a similar site at Eglin AFB (the petroleum, oils, and lubricants (POL) Site SS-36) (Parsons ES, 1995). Similar to the Seventh Street Service Station, Site SS-36 is underlain primarily by sand, and the water table is present at a depth of approximately 4 feet bgs. The BTEX assimilative capacity computed for Site SS-36 using geochemical data was 17 mg/L, which is similar to the values computed for COPCs at the Seventh Street Service Station (12.9 mg/L to 14.5 mg/L). Geochemical data for the two sites also indicate that the anaerobic biodegradation processes of sulfate reduction and methanogenesis are responsible for most of the contaminant mass losses at both sites. In addition, the ORP of the groundwater in the plume source area at the Seventh Street Service Station (-225 mV) was similar to the values measured in the plume core at Site SS-36 (-137 mV to -190 mV), indicating the presence of reducing conditions at both sites. The groundwater geochemistry of the Seventh Street Service Station is discussed in Section 6.4.

First-order BTEX biodegradation rates calculated for POL Site SS-36 using site-specific data ranged from 0.006 day^{-1} (half-life of 0.3 years) to 0.01 day^{-1} (half-life of 0.2 years) (Table 6.3). The rates computed for Site SS-36 also are similar to BTEX decay rates reported in technical literature. These rates typically range from 0.0009 day^{-1} (half-life of 2 years) to 0.09 day^{-1} (half-life of 0.02 year) (ASTM, 1995).

Because a decay rate cannot be calculated for xylenes from site-specific data at the Seventh Street Service Station due to operation of the groundwater recovery system, the decay rates calculated using data from the POL Site SS-36 were used to estimate the time for xylene concentrations at MP-2 to decrease to below its TCL. Results indicate that the estimated time ranges from 1.8 to 3 years. Xylenes in MP-2 groundwater exceeded its Tier 1 TCL by a relatively large factor relative to the other COPCs.

6.4 EVIDENCE OF CONTAMINANT BIODEGRADATION VIA MICROBIALLY MEDIATED REDOX REACTIONS

Fuel hydrocarbons are typically utilized as electron donors in biologically mediated redox reactions under a wide range of geochemical conditions. Therefore, analytical data on potential electron acceptors can be used as geochemical indicators of fuel

hydrocarbon biodegradation (Wiedemeier *et al.*, 1995). Reductions in the concentrations of oxidized chemical species that are used by microorganisms to facilitate the oxidation of fuel hydrocarbon compounds within contaminated media are an indication that contaminants are biodegrading. Alternately, an increase in the metabolic byproducts resulting from the reduction of electron acceptors can be used as

TABLE 6.3
SUMMARY OF BIODEGRADATION RATES CALCULATED FOR POL SITE SS-36
RISK-BASED APPROACH TO REMEDIATION
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Method	Rate (day^{-1})
TMB Tracer	0.006[a/]
Buscheck and Alcantar (1995)	0.01[a/]
Shrinking Plume Method	0.008[a/]
Technical Literature (as summarized by Wiedemeier *et al.*, 1995)	0.005 - 0.18[a/]

a/ Rates calculated for total BTEX.
Source: Parsons ES, 1995

an indicator of contaminant biodegradation. The availability of potential electron acceptors to participate in contaminant biodegradation reactions can be used to estimate the total contaminant mass that can be biodegraded over time at this site. This information can be used to predict how much dissolved COPC mass can be removed from saturated soil and groundwater at the site as a result of natural processes.

6.4.1 Relevance of Redox Couples in Biodegradation

Microorganisms obtain energy to replenish enzymatic systems and to reproduce by oxidizing organic matter. Biodegradation of dissolved fuel hydrocarbons is the result of a series of redox reactions that maintain the charge balance within the natural environment. Microorganisms facilitate the degradation of these organic compounds by transferring electrons from the electron donor (i.e., fuel hydrocarbons and native organic carbon) to available electron acceptors. Electron acceptors are elements or compounds that occur in relatively oxidized states and can participate in redox reactions involving these available electron donors. Electron acceptors known to be present in saturated soil and groundwater at the site are oxygen, nitrate/nitrogen, sulfate, ferric iron, and carbon dioxide.

Microorganisms facilitate fuel hydrocarbon biodegradation to produce energy for their use. The amount of energy that can be released when a reaction occurs or is required to drive the reaction to completion is quantified by the free energy of the

reaction (Stumm and Morgan, 1981). Microorganisms are able to utilize electron transport systems and chemiosmosis to combine energetically favorable and unfavorable reactions to produce energy for life processes (i.e., cell production and maintenance). Microorganisms will facilitate only those redox reactions that will yield energy. By coupling the oxidation of fuel hydrocarbon compounds, which requires energy, to the reduction of other compounds (e.g., oxygen, nitrate/nitrite, manganese, ferric iron, sulfate, and carbon dioxide), which yields energy, the overall reaction will yield energy. Detailed information on the redox reactions required to biodegrade dissolved COPCs is included in Table 6.4. The reader is encouraged to review this information to more fully understand the chemical basis of biodegradation.

Figure 6.4 illustrates the sequence of microbially mediated redox processes based on the amount of free energy released for microbial use. In general, reactions yielding more energy tend to take precedence over processes that yield less energy (Stumm and Morgan, 1981). As Figure 6.4 shows, oxygen reduction would be expected to occur in an aerobic environment with microorganisms capable of aerobic respiration because oxygen reduction yields significant energy. However, once the available oxygen is depleted and anaerobic conditions dominate the interior regions of the contaminant plume, anaerobic microorganisms can utilize other electron acceptors in the following order of preference: nitrate/nitrite, manganese, ferric iron, sulfate, and finally carbon dioxide. Each successive redox reaction provides less energy to the system, and each step down in redox energy yield would have to be paralleled by an ecological succession of microorganisms capable of facilitating the pertinent redox reactions.

The expected sequence of redox processes can be estimated by the ORP of the groundwater. The ORP measures the relative tendency of a solution or chemical reaction to accept or transfer electrons, and can be measured in the field. This measurement can be used as a crude indicator of which redox reactions may be operating at a site. High ORPs mean that the solution (or available redox couple) has a relatively high oxidizing potential.

Microorganisms can facilitate the biodegradation (oxidation) of the fuel hydrocarbon compounds only by using redox couples that have a higher ORP than the contaminants. This is why these electron acceptors can be used to oxidize the fuel hydrocarbon compounds. The reduction of highly oxidized species results in an overall decrease in the oxidizing potential of the groundwater. As shown in Figure 6.4, the reduction of oxygen and nitrate will reduce the oxidizing potential to levels at which ferric iron (Fe^{3+}) reduction can occur. As each chemical species that can be used to oxidize the contaminants is exhausted, the microorganisms are forced to use other available electron acceptors with lower oxidizing capacity. When sufficiently low (negative) ORP levels have been developed as a result of these redox reactions, sulfate reduction and methanogenesis can occur almost simultaneously (Stumm and Morgan, 1981).

ORP values measured in shallow groundwater at the site in March 1998 ranged from -225 millivolts (mV) at MP-2 to 66 mV at MW-D (Table 6.5). Areas with the lowest ORP measurements generally coincided with the presence of fuel-contaminated groundwater, indicating that the progressive use of electron acceptors in the order shown on Figure 6.4 has caused the groundwater in the contaminated areas to become more reducing. These data imply that oxygen, nitrate, manganese, and ferric iron may

TABLE 6.4
COUPLED OXIDATION REACTIONS
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Coupled Benzene Oxidation Reactions	$\Delta G°_r$ (kcal/mole Benzene)	$\Delta G°_r$ (kJ/mole Benzene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$7.5O_2 + C_6H_6 \Rightarrow 6CO_{2,g} + 3H_2O$ *Benzene oxidation /aerobic respiration*	-765.34	-3202	3.07:1
$6NO_3^- + 6H^+ + C_6H_6 \Rightarrow 6CO_{2,g} + 6H_2O + 3N_{2,g}$ *Benzene oxidation / denitrification*	-775.75	-3245	4.77:1
$30H^+ + 15MnO_2 + C_6C_6 \Rightarrow 6CO_{2,g} + 15Mn^{2+} + 18H_2O$ *Benzene oxidation / manganese reduction*	-765.45	-3202	10.56:1
$60H^+ + 30Fe(OH)_{3,a} + C_6H_6 \Rightarrow 6CO_2 + 30Fe^{2+} + 78H_2O$ *Benzene oxidation / iron reduction*	-560.10	-2343	21.5:1[a/]
$7.5H^+ + 3.75SO_4^{2-} + C_6H_6 \Rightarrow 6CO_{2,g} + 3.75H_2S^o + 3H_2O$ *Benzene oxidation / sulfate reduction*	-122.93	-514.3	4.61:1
$4.5H_2O + C_6H_6 \Rightarrow 2.25CO_{2,g} + 3.75CH_4$ *Benzene oxidation / methanogenesis*	-32.40	-135.6	0.77:1 [b/]

Coupled Toluene Oxidation Reactions	$\Delta G°_r$ (kcal/mole Toluene)	$\Delta G°_r$ (kJ/mole Toluene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$9O_2 + C_6H_5CH_3 \Rightarrow 7CO_{2,g} + 4H_2O$ *Toluene oxidation /aerobic respiration*	-913.76	-3823	3.13:1
$7.2NO_3^- + 7.2H^+ + C_6H_5CH_3 \Rightarrow 7CO_{2,g} + 7.6H_2O + 3.6N_{2,g}$ *Toluene oxidation / denitrification*	-926.31	-3875	4.85:1
$36H^+ + 18MnO_2 + C_6H_5CH_3 \Rightarrow 7CO_{2g} + 18Mn^{2+} + 22H_2O$ *Toluene oxidation / manganese reduction*	-913.89	-3824	10.74:1
$72H^+ + 36Fe(OH)_{3,a} + C_6H_5CH_3 \Rightarrow 7CO_2 + 36Fe^{2+} + 94H_2O$ *Toluene oxidation / iron reduction*	-667.21	-2792	21.86:1[a/]
$9H^+ + 4.5SO_4^{2-} + C_6H_5CH_3 \Rightarrow 7CO_{2,g} + 4.5H_2S^o + 4H_2O$ *Toluene oxidation / sulfate reduction*	-142.86	-597.7	4.7:1
$5H_2O + C_6H_5CH_3 \Rightarrow 2.5CO_{2,g} + 4.5CH_4$ *Toluene oxidation / methanogenesis*	-34.08	-142.6	0.78:1 [b/]

TABLE 6.4 (Continued)
COUPLED OXIDATION REACTIONS
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

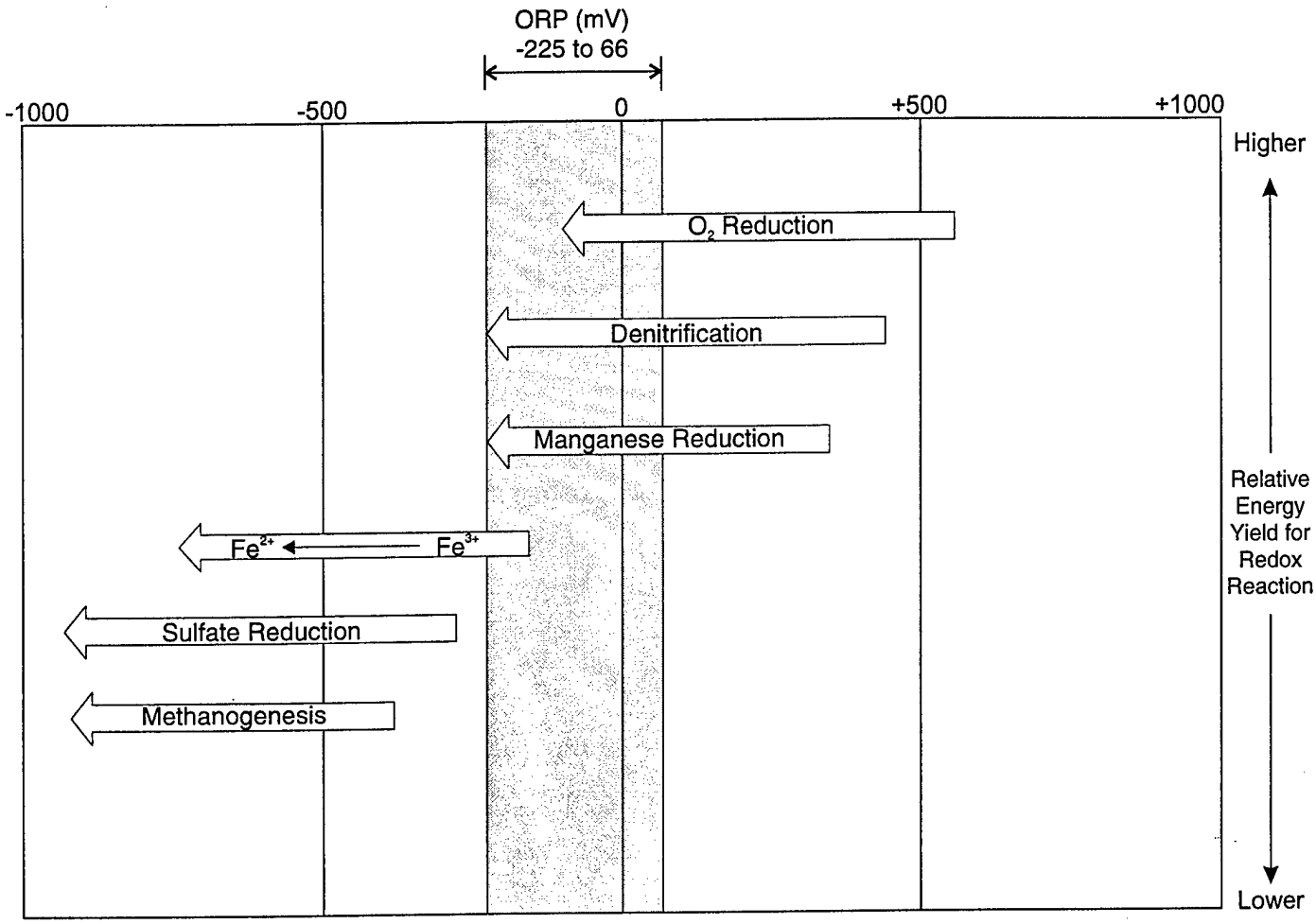
Coupled Ethylbenzene Oxidation Reactions	$\Delta G°_r$ (kcal/mole Ethyl-benzene)	$\Delta G°_r$ (kJ/mole Ethyl-benzene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$10.5O_2 + C_6H_5C_2H_5 \Rightarrow 8CO_{2,g} + 5H_2O$ *Ethylbenzene oxidation /aerobic respiration*	-1066.13	-4461	3.17:1
$8.4NO_3^- + 8.4H^+ + C_6H_5C_2H_5 \Rightarrow 8CO_{2,g} + 9.2H_2O + 4.2N_{2,g}$ *Ethylbenzene oxidation / denitrification*	-1080.76	-4522	4.92:1
$42H^+ + 21MnO_2 + C_6H_5C_2H_5 \Rightarrow 8CO_{2g} + 21Mn^{2+} + 26H_2O$ *Ethylbenzene oxidation / manganese reduction*	-1066.27	-4461	17.24:1
$84H^+ + 42\underline{Fe(OH)_{3,a}} + C_6H_5C_2H_5 \Rightarrow 8CO_2 + 42Fe^{2+} + 110H_2O$ *Ethylbenzene oxidation / iron reduction*	-778.48	-3257	22:1[a/]
$10.5H^+ + 5.25SO_4^{2-} + C_6H_5C_2H_5 \Rightarrow 8CO_{2,g} + 5.25H_2S^o + 5H_2O$ *Ethylbenzene oxidation / sulfate reduction*	-166.75	-697.7	4.75:1
$5.5H_2O + C_6H_5C_2H_5 \Rightarrow 2.75CO_{2,g} + 5.25CH_4$ *Ethylbenzene oxidation / methanogenesis*	-39.83	-166.7	0.79:1 [b/]

Coupled m-Xylene Oxidation Reactions	$\Delta G°_r$ (kcal/mole *m*-xylene)	$\Delta G°_r$ (kJ/mole *m*-xylene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$10.5O_2 + C_6H_4(CH_3)_2 \Rightarrow 8CO_{2,g} + 5H_2O$ *m-Xylene oxidation /aerobic respiration*	-1063.25	-4448	3.17:1
$8.4NO_3^- + 8.4H^+ + C_6H_4(CH_3)_2 \Rightarrow 8CO_{2,g} + 9.2H_2O + 4.2N_{2,g}$ *m-Xylene oxidation / denitrification*	-1077.81	-4509	4.92:1
$42H^+ + 21\underline{MnO_2 + C_6H_5C_2H_5 \Rightarrow 8CO_{2g} + 21Mn^{2+} + 26H_2O}$ *m-Xylene oxidation / manganese reduction*	-1063.39	-4449	17.24:1
$84H^+ + 42\underline{Fe(OH)_{3,a}} + C_6H_4(CH_3)_2 \Rightarrow 8CO_2 + 42Fe^{2+} + 110H_2O$ *m-Xylene oxidation / iron reduction*	-775.61	-3245	22:1[a/]
$10.5H^+ + 5.25SO_4^{2-} + C_6H_4(CH_3)_2 \Rightarrow 8CO_{2,g} + 5.25H_2S^o + 5H_2O$ *m-Xylene oxidation / sulfate reduction*	-163.87	-685.6	4.75:1
$5.5H_2O + C_6H_4(CH_3)_2 \Rightarrow 2.75CO_{2,g} + 5.25CH_4$ *m-Xylene oxidation / methanogenesis*	-36.95	-154.6	0.79:1 [b/]

TABLE 6.4 (Concluded)
COUPLED OXIDATION REACTIONS
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Coupled Naphthalene Oxidation Reactions	$\Delta G°_r$ (kcal/mole naphthalene)	$\Delta G°_r$ (kJ/mole naphthalene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$12O_2 + C_{10}H_8 \Rightarrow 10CO_2 + 4H_2O$ *Naphthalene oxidation /aerobic respiration*	-1217.40	-5094	3.00:1
$9.6NO_3^- + 9.6H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 8.8H_2O + 4.8N_2$ *Naphthalene oxidation / denitrification*	-1234.04	-5163	4.65:1
$24MnO_2 + 48H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 24Mn^{2+} + 28H_2O$ *Naphthalene oxidation / manganese reduction*	-1217.57	-5094	16.31:1
$48Fe(OH)_{3,a} + 96H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 48Fe^{2+} + 124H_2O$ *Naphthalene oxidation / iron reduction*	-932.64	-3902	40.13:1
$6SO_4^{2-} + 12H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 6H_2S^o + 4H_2O$ *Naphthalene oxidation / sulfate reduction*	-196.98	-824.2	4.50:1
$8H_2O + C_{10}H_8 \Rightarrow 4CO_2 + 6CH_4$ *Naphthalene oxidation / methanogenesis*	-44.49	-186.1	0.75:1

[a/] Mass of ferrous iron produced during microbial respiration.
[b/] Mass of methane produced during microbial respiration.



Notes

ORP = Oxidation Reduction Potential

Range of ORP measured at the Seventh Street Service Station

1. These reactions would be expected to occur in sequence if the system is moving toward equilibrium.

2. These redox processes occur in order of their energy-yielding potential (provided microorganisms are available to mediate a specific reaction). Reduction of a highly oxidized species decreases the ORP of the system.

3. The ORP of the system determines which electron acceptors are available for organic carbon oxidation.

4. Redox sequence is paralleled by an ecological succession of biological mediators.

Adapted from Stumm and Morgan, 1981.

FIGURE 6.4

SEQUENCE OF MICROBIALLY MEDIATED REDOX PROCESSES

Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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TABLE 6.5
SUMMARY OF GROUNDWATER GEOCHEMICAL DATA
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Parameter	Units	MW-1 31-Mar-98	MW-2 31-Mar-98	MW-20 31-Mar-98	MW-4 25-Mar-98	MW-7 26-Mar-98	MW-C 25-Mar-98	MW-D 31-Mar-98	GWRW-4 31-Mar-98	GWRW-6 25-Mar-98	MP-1 31-Mar-98	MP-2 31-Mar-98
Ferrous Iron	mg/L [a/]	0.20	0.13	0.12	0.03	0.01	0.01	0.07	0.08	0.00	0.00	0.55
Sulfate	mg/L	167	27	36	71	155	45	89	161	131	236	152
Nitrate	mg/L	0.22 J1 [b/]	1.6	1.7	NA [c/]	1.9	0.14 J1	0.84	NA	NA	NA	0.5 U [d/]
Methane	mg/L	2.4	0.2	0.18	NA	0.00024 U	0.0021 U	0.00015 U	NA	NA	NA	2
Temperature	°C [e/]	20.7	22.3	NA	19.9	20.2	16.8	19.8	19.5	19.8	21.1	20.1
pH	SU [f/]	6.08	6.51	NA	6.84	6.54	6.78	6.86	6.44	6.46	6.53	6.91
Conductivity	µS/cm [g/]	0.450	0.223	NA	0.178	0.196	0.086	0.133	0.191	0.192	0.249	0.187
Dissolved Oxygen	mg/L	0.33	1.3	NA	5.57	3.44	5.71	3.37	5.09	5.11	5.80	0.15
ORP [h/]	mV [i/]	-108	11	NA	4	65	-77	66	4	4	3	-225

Notes:

a/ mg/L = milligrams per liter.

b/ J1 = the analyte was positively identified and has a concentration between the method detection limit and the reporting limit.

c/ NA = not available.

d/ U = not detected above the associated quantitation limit.

e/ Deg C = degrees Celcius.

f/ SU = Standard Units.

g/ µS/cm = microsiemens per centimeter.

h/ ORP = oxidation reduction potential.

i/ mV = millivolts.

be used to biodegrade fuel hydrocarbon contaminants at this site. However, many authors have noted that field ORP data alone cannot be used to reliably predict all of the electron acceptors that may be operating at a site, because the platinum electrode probes are not sensitive to some redox couples (e.g., sulfate/sulfide) (Stumm and Morgan, 1981; Godsey, 1994; Lovley *et al.*, 1994). Analytical data on oxidized and reduced species are presented in the following subsections to verify which electron acceptors actually are being used to biodegrade the BTEX in saturated soil and groundwater at the site.

Throughout the following subsections, the distributions of geochemical parameters are examined by comparing background concentrations to BTEX plume core concentrations. Analytical data from upgradient and cross-gradient wells MW-7, MW-D, and MP-1 are used for background concentrations. Analytical data from wells MW-1, MW-2, and MP-2 are used for BTEX plume core concentrations.

6.4.2 Dissolved Oxygen

Almost all types of fuel hydrocarbons can be biodegraded under aerobic conditions (Borden *et al.*, 1994). Mineralization of fuel hydrocarbons to carbon dioxide and water under aerobic conditions involves the use of oxygen as a cosubstrate during the initial stages of metabolism, and as a terminal electron acceptor during the later stages of metabolism for energy production. The reduction of molecular oxygen during the oxidation of the fuel hydrocarbon compounds yields a significant amount of free energy that the microorganisms could utilize.

Dissolved oxygen (DO) concentrations were measured at groundwater sampling locations in March 1998. Table 6.5 presents the analytical results for DO by sampling location. DO measured in groundwater from background wells ranged from 3.4 mg/L to 5.8 mg/L and averaged 4.2 mg/L. DO measured in contaminated groundwater in the plume core ranged from 0.2 mg/L to 1.3 mg/L and averaged 0.6 mg/L. The presence of the lowest observed DO concentration (0.2 mg/L) in the most contaminated sample, MP-2, is an indication that biodegradation through aerobic respiration has occurred in this area.

6.4.3 Nitrate

Once available DO concentrations are depleted through aerobic respiration, nitrate can be used as an electron acceptor by indigenous facultative anaerobes that mineralize fuel hydrocarbon compounds via either denitrification or nitrate reduction processes. Concentrations of nitrate (as nitrogen [N]) measured at the site in March 1998 are summarized in Table 6.5. Nitrate measured in groundwater from background wells ranged from 0.84 mg/L to 1.9 mg/L and averaged 1.37 mg/L. Nitrate measured in contaminated groundwater ranged from 0.22 mg/L to 1.6 mg/L and averaged 0.77 mg/L. These data indicate that nitrate concentrations within the dissolved plume are depleted relative to measured background concentrations. The results indicate that minor amounts of nitrate are being used to oxidize fuel hydrocarbons in the anaerobic core of the dissolved plumes via denitrification or nitrate reduction.

6.4.4 Ferrous Iron

Although relatively little is known about the anaerobic metabolic pathways involving the reduction of ferric iron (Fe^{3+}), this process has been shown to be a major metabolic pathway for some microorganisms (Lovley and Phillips, 1988; Chapelle, 1993). Elevated concentrations of ferrous iron (Fe^{2+}) often are found in anaerobic, fuel-contaminated groundwater systems. Concentrations of dissolved ferrous iron once were attributed to the spontaneous and reversible reduction of ferric oxyhydroxides, which are thermodynamically unstable in the presence of organic compounds such as benzene. However, more recent studies suggest that the reduction of ferric iron cannot proceed at all without microbial mediation (Lovley and Phillips, 1988; Lovley *et al.*, 1991; Chapelle, 1993). None of the common organic compounds found in low-temperature, neutral, reducing groundwater could reduce ferric oxyhydroxides to ferrous iron under sterile laboratory conditions (Lovley *et al.*, 1991). This means that the reduction of ferric iron to ferrous iron requires mediation by microorganisms with the appropriate enzymatic capabilities.

To determine if ferric iron is being used as an electron acceptor for fuel biodegradation at the site, ferrous (reduced) iron concentrations were measured at groundwater sampling locations in March 1998. The data are summarized in Table 6.5. Ferrous iron concentrations measured in groundwater from background wells ranged from 0.00 mg/L to 0.07 mg/L and averaged 0.03 mg/L. Ferrous iron measured in contaminated groundwater ranged from 0.13 mg/L to 0.55 mg/L and averaged 0.29 mg/L. The occurrence of elevated ferrous iron concentrations within the plume core indicates that ferric iron is acting as an electron acceptor at this location. In addition, the measured redox potential of the groundwater at monitoring point MP-2 is within the range that would be expected for the ferric iron-reducing conditions implied by the observed ferrous iron concentration at that point (Figure 6.4).

6.4.5 Sulfate

Sulfate also may be used as an electron acceptor during microbial degradation of fuel hydrocarbons under anaerobic conditions (Grbic'-Galic', 1990). Sulfate can be reduced to sulfide during the oxidation of the fuel hydrocarbon compounds. The presence of decreased concentrations of sulfate in the source area relative to background concentrations indicates that sulfate is participating in redox reactions at the site. To investigate the potential for sulfate reduction at the site, sulfate concentrations were measured during the March 1998 groundwater sampling event. The data are summarized in Table 6.5. Sulfate measured in groundwater from background wells ranged from 89 mg/L to 236 mg/L and averaged 160 mg/L. Sulfate measured in contaminated groundwater ranged from 27 mg/L to 167 mg/L and averaged 115 mg/L. The substantial depletion of sulfate at MW-2 indicates that this compound is acting as an electron acceptor during fuel biodegradation reactions in that area.

6.4.6 Dissolved Methane

On the basis of free energy yield and the oxidizing potential of the site groundwater, the carbon dioxide/methane (CO_2/CH_4) redox couple also could be used to oxidize fuel hydrocarbon compounds to CO_2 and water once the groundwater is sufficiently

reducing. To attain these reducing levels, other highly oxidized chemical species such as oxygen, nitrate, ferric iron, and sulfate must first be reduced. This redox reaction is called methanogenesis or methane fermentation. Methanogenesis yields the least free energy to the system in comparison to other chemical species (Figure 6.4 and Table 6.4). The presence of methane in groundwater at elevated concentrations relative to background concentrations is a good indicator of methane fermentation.

Dissolved methane was measured at groundwater monitoring wells sampled during the March 1998 sampling event. Table 6.5 presents the analytical data for methane. Methane concentrations were not detected in groundwater from background wells. In contrast, methane concentrations measured in contaminated groundwater ranged from 0.2 mg/L to 2.4 mg/L and averaged 1.5 mg/L. The presence of elevated methane levels in groundwater at the site strongly indicates that biodegradation is occurring via methanogenesis.

6.4.7 pH

The pH of groundwater samples collected from groundwater monitoring points and monitoring wells in March 1998 was measured (Table 6.5). The pH of a solution is the negative logarithm of the hydrogen ion concentration [H^+]. Groundwater pH values measured at the site were within the optimal range for fuel hydrocarbon-degrading microbes of 6 to 8.

6.4.8 Temperature

Groundwater temperature was measured at groundwater monitoring wells in March 1998 (Table 6.5). Temperature affects the types and growth rates of bacteria that can be supported in the groundwater environment, with higher temperatures generally resulting in higher growth rates. The temperature of groundwater samples collected from the shallow monitoring wells varied from 16.8 degrees Celsius (°C) to 22.3 °C. The relatively warm temperatures should promote microbial growth and may enhance rates of hydrocarbon biodegradation.

6.5 THEORETICAL ASSIMILATIVE CAPACITY ESTIMATES

The preceding discussions have been devoted to determining if fuel hydrocarbons are biodegrading in saturated soil and groundwater at the site. Analytical data on reduced and oxidized chemical species indicate that indigenous microorganisms are facilitating the oxidation of fuel hydrocarbons and the reduction of electron acceptors to generate free energy for cell maintenance and production. The question of how much contaminant mass can be biodegraded must be addressed to assess the full potential for long-term intrinsic bioremediation to minimize plume size and mass over time.

Mass balance relationships can be used to determine how much contaminant mass can be degraded by each of the redox reactions that the microorganisms might use to make free energy available for cell maintenance and production. The stoichiometric relationship between the contaminant and the electron acceptor can be used to estimate the expressed assimilative capacity of the groundwater. Once the redox reactions

operating at the site have been defined, it is possible to estimate how much contaminant mass can be assimilated or oxidized by available electron acceptors.

Table 6.4 presents the coupled redox reactions that represent the biodegradation of the individual COPCs, including the stoichiometric mass ratio of electron acceptors needed to oxidize each compound. These stoichiometric mass ratios can be used to estimate the assimilative capacity of the groundwater at the Seventh Street Service Station. For oxygen, nitrate, and sulfate, this is accomplished by first determining the initial (background) mass of each electron acceptor available in the groundwater. Data on these chemical species were collected at sampling locations upgradient and cross-gradient from the dissolved plume. As groundwater slowly migrates into the source area, electron acceptors are brought into contact with hydrocarbon-degrading microorganisms and site contamination. The change in the electron acceptor mass from background sampling locations to sampling locations within the plume core is divided by the mass of electron acceptors required to mineralize the COPCs. For ferrous iron and methane, the highest observed concentration in the plume core wells is divided by the mass of electron acceptors required to mineralize the COPC. These numbers are summed to estimate the expressed intrinsic capacity of the groundwater to biodegrade each COPC.

Estimates of the background and plume core concentrations were used to calculate the expressed assimilative capacity of the groundwater system attributable to aerobic respiration, denitrification, and sulfate reduction. The source area concentrations of ferrous iron and methane are used to "back-calculate" the expressed assimilative capacity that is attributable to ferric iron reduction and methanogenesis. The calculations are summarized in Table 6.6. On the basis of these calculations, one pore volume of saturated soil and groundwater at the Seventh Street Service Station has the capacity to oxidize a benzene concentration of 13,100 μg/L, a toluene concentration of 12,860 μg/L, an ethylbenzene concentration of 12,720 μg/L, a xylenes concentration of 12,720 μg/L, and a naphthalene concentration of 13,420 μg/L. As shown in Table 6.6, the assimilative capacities for benzene, ethylbenzene, and naphthalene are substantially higher than the maximum concentrations of those analytes detected in groundwater at the Seventh Street Service Station. The estimated assimilative capacities for toluene and xylenes are slightly higher and slightly lower, respectively, than the maximum concentration of those analytes detected in groundwater at the site.

It should be noted that the conclusion that sulfate reduction is a primary mechanism of contaminant mass loss results from the low sulfate concentration detected at MW-2. The ORP measured at this location (+11 mV), and the presence of nitrate (1.6 mg/L) and DO (1.3 mg/L) suggest that sulfate reduction should not be the primary mass reduction process at this location. Therefore, the geochemical data for this well are not internally consistent, and the computed assimilative capacity is speculative.

This estimate essentially represents an estimate of the reduction capability of one pore volume of groundwater at the Seventh Street Service Station. The estimate identifies how much contaminant mass can be theoretically oxidized as one pore volume travels through the plume core. In reality, multiple pore volumes are expected to move through the contaminated aquifer material in the source area each year based on the estimated average groundwater velocity of 123 ft/yr (Section 3.3).

TABLE 6.6
ESTIMATED ASSIMILATIVE CAPACITY OF SATURATED SOIL AND GROUNDWATER
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

BENZENE

Electron Acceptor or Metabolic Byproduct	Background Concentration (mg/L) [a/]	Concentration in Core of Plume (mg/L)	Mass Ratio of Electron Acceptor/ Byproduct to COPCs [b/] (unitless)	Benzene Assimilative Capacity [c/] (mg/L)
Oxygen	4.2	0.58	3.07	1.18
Nitrate	1.37	0.60	4.77	0.16
Sulfate	160	115	4.61	9.76
Ferrous Iron	0.03	0.29	21.5	0.01
Methane	0.0	1.53	0.77	1.99
			Total	13.10
			Max. 1998 Concentration (mg/L)	0.086

TOLUENE

Electron Acceptor or Metabolic Byproduct	Background Concentration (mg/L) [a/]	Concentration in Core of Plume (mg/L)	Mass Ratio of Electron Acceptor/ Byproduct to COPCs [b/] (unitless)	Toluene Assimilative Capacity [c/] (mg/L)
Oxygen	4.2	0.58	3.13	1.16
Nitrate	1.37	0.60	4.85	0.16
Sulfate	160	115	4.7	9.57
Ferrous Iron	0.03	0.29	21.86	0.01
Methane	0.0	1.53	0.78	1.96
			Total	12.86
			Max. 1998 Concentration (mg/L)	11.00

TABLE 6.6 (continued)
ESTIMATED ASSIMILATIVE CAPACITY OF
SATURATED SOIL AND GROUNDWATER
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

ETHYLBENZENE

Electron Acceptor or Metabolic Byproduct	Background Concentration (mg/L) [a/]	Concentration in Core of Plume (mg/L)	Mass Ratio of Electron Acceptor/ Byproduct to COPCs [b/] (unitless)	Ethylbenzene Assimilative Capacity [c/] (mg/L)
Oxygen	4.2	0.58	3.17	1.14
Nitrate	1.37	0.60	4.92	0.16
Sulfate	160	115	4.75	9.47
Ferrous Iron	0.03	0.29	22	0.01
Methane	0.0	1.53	0.79	1.94
			Total	12.72
			Max. 1998 Concentration (mg/L)	1.60

XYLENES

Electron Acceptor or Metabolic Byproduct	Background Concentration (mg/L) [a/]	Concentration in Core of Plume (mg/L)	Mass Ratio of Electron Acceptor/ Byproduct to COPCs [b/] (unitless)	Xylenes Assimilative Capacity [c/] (mg/L)
Oxygen	4.2	0.58	3.17	1.14
Nitrate	1.37	0.60	4.92	0.16
Sulfate	160	115	4.75	9.47
Ferrous Iron	0.03	0.29	22	0.01
Methane	0.0	1.53	0.79	1.94
			Total	12.72
			Max. 1998 Concentration (mg/L)	13.00

TABLE 6.6 (concluded)
ESTIMATED ASSIMILATIVE CAPACITY OF
SATURATED SOIL AND GROUNDWATER
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

NAPHTHALENE

Electron Acceptor or Metabolic Byproduct	Background Concentration (mg/L) [a/]	Concentration in Core of Plume (mg/L)	Mass Ratio of Electron Acceptor/ Byproduct to COPCs [b/] (unitless)	Naphthalene Assimilative Capacity [c/] (mg/L)
Oxygen	4.2	0.58	3.00	1.21
Nitrate	1.37	0.60	4.65	0.17
Sulfate	160	115	4.50	10.00
Ferrous Iron	0.03	0.29	40.13	0.01
Methane	0.0	1.53	0.75	2.04
			Total	13.42
			Max. 1998 Concentration (mg/L)	0.51

a/ mg/L = milligrams per liter.

b/ Calculation based on the ratio of the total mass of electron acceptor required to oxidize a given average of the mass of contaminants of potential concern (BTEX and naphthalene).

c/ Assimilative capacity is the amount of contaminant that can be degraded by a given process.

A closed system containing 2 liters of water can be used to help visualize the physical meaning of assimilative capacity. Assume that the first liter contains no fuel hydrocarbons, but it contains fuel-degrading microorganisms and has an assimilative capacity of exactly "x" mg of fuel hydrocarbons. The second liter has no assimilative capacity; however, it contains fuel hydrocarbons. As long as these 2 liters of water are kept separate, biodegradation of fuel hydrocarbons will not occur. If these 2 liters are combined in a closed system, biodegradation will commence and continue until the fuel hydrocarbons or electron acceptors are depleted. If less than "x" mg of fuel hydrocarbons are in the second liter, all of the fuel hydrocarbons will eventually degrade given a sufficient time; likewise, if greater than "x" mg of fuel hydrocarbons were in the second liter of water, only "x" mg of fuel hydrocarbons would ultimately degrade.

This example shows that in a closed system, the measured expressed assimilative capacity eventually should be equivalent to the loss in contaminant mass; however, the groundwater beneath the site is an open system. Electron acceptors can continually enter the system from upgradient flow. Furthermore, contaminant mass can be added to the system through dissolution or leaching from LNAPL or contaminated soil. This means that the assimilative capacity is not fixed as it would be in a closed system, and therefore should not be quantitatively compared to concentrations of dissolved contaminants in the groundwater. Rather, the expressed assimilative capacity of groundwater is intended to serve as a qualitative tool. The fate of BTEX in groundwater is dependent on the relationship between the kinetics of biodegradation and the solute transport velocities (Chapelle, 1994).

6.6 COPC MIGRATION

The migration velocity of the groundwater COPCs benzene, ethylbenzene, toluene, xylenes, TRPH, naphthalene, and lead, would be expected to be lower than the advective groundwater velocity computed in Section 3.3 (123 ft/yr) due to the effects of retardation. Retardation coefficients are calculated using the following formula:

$$R = 1 + (K_d \rho_b / n)$$

where

K_d = $(K_{oc})(f_{oc})$

K_{oc} = Organic Carbon Partition Coefficient

f_{oc} = Fraction Organic Carbon

ρ_b = Soil Bulk Density of Aquifer Matrix

n = Total Porosity

Three soil samples collected at the site were analyzed for TOC; however, organic carbon was not detected above the method detection limit of 500 mg/kg. Similarly, organic carbon was not detected in the soil sample collected at the Military Gas Station at Eglin AFB. If it is assumed that the TOC content of the shallow sand aquifer beneath the site is equal to one-half the method detection limit of 500 mg/kg, then the retardation coefficients of benzene, ethylbenzene, toluene, xylenes, and naphthalene

would range from 1.11 to 1.79 (Table 6.7). The resulting average migration velocities of the COPCs would ranged from 112 to 69 ft/yr based on an estimated average advective groundwater velocity of 123 ft/yr. Lead typically adsorbs strongly to organic carbon or clay mineral surfaces, and is relatively immobile. Therefore, while lead resulting from gasoline contamination is not susceptible to degradation processes, it is generally restricted to the vicinity of the source area and does not pose a threat to offsite receptors.

6.7 PREDICTING CONTAMINANT TRANSPORT AND FATE

Understanding the effects of natural physical, chemical, and biological processes on chemicals in the subsurface is an important step in determining potential long-term risks associated with chemical migration in the environment. The behavior of COPCs under the influence of these processes must be quantified to assess the expected persistence, mass, concentration, and toxicity of dissolved COPCs over time at the site and to estimate potential receptor exposure-point concentrations. If destructive and nondestructive attenuation processes can minimize or eliminate the concentration of contaminants to which a receptor could be exposed, engineered remedial action may not be warranted either because no reasonable exposure pathway exists or because the exposure pathway would result in insignificant risks. The focus of this section is to predict how the COPCs will be naturally attenuated (without pumping) over time in soil and groundwater based on site data and site-specific contaminant transport and fate models.

BIOSCREEN is a screening model which simulates RNA of dissolved hydrocarbons at petroleum fuel release sites (Newell *et al.*, 1996). The software is based on the Domenico (1987) analytical solute transport model and is designed to simulate advection, dispersion, adsorption, and aerobic decay as well as anaerobic reactions that have been shown to be the dominant biodegradation processes at many petroleum release sites.

6.7.1 Description of BIOSCREEN Model

BIOSCREEN includes three different model types:

1. Solute transport without decay;

2. Solute transport with biodegradation modeled as a first-order decay process (simple, lumped parameter approach); and

3. Solute transport with biodegradation modeled as an "instantaneous" biodegradation reaction.

The first model is appropriate for predicting the movement of conservative (non-degrading) solutes such as chloride. The only attenuation mechanisms simulated are dispersion in the longitudinal, transverse, and vertical directions and adsorption of the chemical to the soil matrix.

TABLE 6.7
RETARDATION COEFFICIENTS OF COPCs
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Compound	K_{oc} (L/kg [a/])	Fraction Organic Carbon [b/]	Distribution Coefficient (L/kg)	Bulk Density (kg/L) [c/]	Porosity	Coefficient of Retardation	Estimated Groundwater Velocity (ft/yr) [d/]	Estimated Contaminant Velocity (ft/yr)
Benzene	79	0.00025	0.020	1.72	0.30	1.11	123	110
Toluene	190	0.00025	0.048	1.72	0.30	1.27	123	97
Ethylbenzene	468	0.00025	0.117	1.72	0.30	1.67	123	74
Xylenes	395	0.00025	0.099	1.72	0.30	1.57	123	79
Naphthalene	550	0.00025	0.138	1.72	0.30	1.79	123	69

a/ L/kg = liters per kilogram.

b/ Fraction organic carbon = one-half the method detection limit, March 1998 analytical data.

c/ kg/L = kilograms per liter.

d/ ft/yr = feet per year.

With the second model, the solute degradation rate is proportional to the initial solute concentration. This is a conventional method for simulating biodegradation in dissolved hydrocarbon plumes. With this method, dispersion, sorption, and biodegradation parameters are lumped together in a single calibration parameter. The first-order decay model does not account for site-specific information such as the availability of electron acceptors. In addition, it does not assume any biodegradation of dissolved constituents in the source zone. In other words, this model assumes that biodegradation starts immediately downgradient from the source and that it does not decrease the concentrations of dissolved organic compounds in the source zone itself.

First-order expressions may be overly conservative for describing biodegradation of organic chemicals in groundwater because electron acceptor limitations are not considered. A more accurate prediction of biodegradation effects may be realized by incorporating the instantaneous reaction equation into a transport model (Newell *et al.*, 1996).

At almost all petroleum release sites, biodegradation is present and can be verified by demonstrating the consumption of aerobic and anaerobic electron acceptors. Therefore, results from the No Biodegradation model are intended only to be used for comparison purposes and to demonstrate the effects of biodegradation on plume migration. The Instantaneous Reaction model is recommended either alone or in addition to the First-Order Decay model for most sites where electron acceptor and metabolic byproduct concentration data have been collected (Newell *et al.*, 1996).

Use of the Instantaneous Reaction Model for the Seventh Street Service Station may yield overly conservative results because electron acceptor and metabolic byproduct concentrations, used as input data for this model, may not be representative of ion-pumping conditions. Use of the Instantaneous Reaction Model for the Seventh Street Service Station may yield overly conservative results because electron acceptor and metabolic byproduct concentrations, used as input data for this model, may not be representative of non-pumping conditions. Groundwater pumping at the Seventh Street Service Station causes the hydraulic gradient to steepen, resulting in faster groundwater velocities. The rate of pore volume exchange in the contaminated area is increased over equilibrium (non-pumping) conditions, and the residence time of groundwater in the contaminated area is decreased. Therefore, a new geochemical equilibrium is established that may not be representative of non-pumping conditions. For example, there will be less time for microorganisms to utilize electron acceptors to metabolize fuel hydrocarbons in the treatment zone (e.g., concentrations of DO, nitrate, and sulfate may not become depleted as much as under non-pumping conditions), and less time for metabolic byproducts to be produced (e.g., methane and ferrous iron concentrations may not be as high as under non-pumping conditions). In addition, the enhanced influx of DO from clean areas outside of the plume may inhibit anaerobic biodegradation reactions.

6.7.2 Modeling Objectives

The BIOSCREEN modeling was performed for the Seventh Street Service Station site to accomplish the following three objectives:

- To estimate the maximum migration distance of the plume associated with the former UST pit and fuel transport lines over time, assuming that the pump and treat and SVE/bioventing systems are not operating;

- To assess the persistence of the plume over time; and

- To support future remedial actions.

The migration potential and persistence of xylenes at the site was modeled because, of the groundwater COPCs identified in Section 4, xylene has been found at concentrations which exceed its TCL by the largest margin. Therefore, xylenes will likely persist at concentrations exceeding the TCL for the longest period of time.

6.7.3 Conceptual Model Design and Limiting Assumptions

BIOSCREEN has the following limitations:

- As an analytical model, BIOSCREEN assumes simple groundwater flow conditions; and

- As a screening tool, BIOSCREEN only approximates the more complicated processes that occur in the field.

Because the model is not capable of simulating a complicated flow regime, the hydraulic input parameters for the site were based on the average values calculated from analyses of aquifer test data collected from site wells.

Although there has been contamination at the site for many years, only 1998 groundwater quality data were used in the model for the following reasons: 1) historical groundwater quality data prior to 1994 are not available; 2) the source history (e.g., dates and magnitudes or releases) is not well known; and 3) the groundwater recovery system creates a hydrogeologic system that is too complicated for BIOSCREEN to simulate accurately. In summary, maximum 1998 dissolved benzene concentrations were used as a starting point for model simulations. The source mass was conservatively estimated from 1998 soil quality data.

6.7.4 Model Input Data

Input data for the BIOSCREEN model are used to specify or calculate groundwater velocity, aquifer dispersivity, a retardation factor, a chemical-specific decay coefficient, dissolved hydrocarbon concentrations in the source area, a half-life of the hydrocarbon source, and the dimensions of the source zone. The parameters were obtained from site-specific data and commonly accepted literature values. The BIOSCREEN input screen is presented in Appendix F. Each of these input values is described in more detail below.

6.7.4.1 Hydrogeology

Seepage Velocity (V_s) Seepage velocity is the actual interstitial groundwater velocity. It is defined as the hydraulic conductivity multiplied by the hydraulic gradient divided by the effective porosity.

Hydraulic Conductivity (K) Hydraulic conductivity (K) is a term that describes the relative ease with which water can move through a permeable medium. The horizontal K value used for shallow aquifer modeling, 21.0 ft/day, was derived from site-specific hydraulic conductivity data (Section 3.4).

Hydraulic Gradient (dH/dL) The hydraulic gradient is a unitless value which represents the change in water table elevation per unit distance in a direction parallel to groundwater flow. The average hydraulic gradient at the site was calculated to be 0.004 ft/ft based on water table elevation data collected in March 1998.

Effective Porosity (n_e) The effective porosity of a medium is the ratio of the volume of interconnected voids to the bulk volume of the aquifer matrix. The effective porosity is typically less than total porosity because of non-interconnected pores, dead-end pores, and boundary effects of aquifer solids. An effective porosity of 0.25 (25 percent) was used for the model. This value is commonly used for silt and sand lithologies (Newell *et al.*, 1996).

6.7.4.2 Dispersion

Dispersivity is a property of a porous medium that determines the dispersion or spreading characteristics of the medium by a relationship between pore-water velocity and dispersion coefficients. Published data summarized by Spitz and Moreno (1996) suggest that, as a rule of thumb, longitudinal dispersivity is approximately one-tenth the travel distance of the plume (from the source to the downgradient toe). Available data indicate that the current plume is shortened due to operation of the pump and treat system. Assuming that the plume extended at least to recovery well GWRW-6 prior to installation of the pump and treat system, a longitudinal dispersivity of 40 feet was input into the model. The transverse dispersivity value is estimated as one-tenth of the longitudinal dispersivity value (Domenico and Schwartz, 1990), and vertical dispersivity is assumed to be negligible. It should be noted that the instantaneous reaction model is very sensitive to the dispersivity value.

6.7.4.3 Adsorption

Retardation Factor The retardation factor is a measure of the degree of retardation of dissolved organic chemical movement through the aquifer. A retardation value of 1.57 was calculated for xylenes in Section 6.6 (Table 6.7).

Organic Carbon Partition Coefficient (K_{oc}) The organic carbon partition coefficient (K_{oc}) is a chemical-specific partition coefficient between organic carbon and water (Newell *et al.*, 1996). The selected K_{oc} value for xylene was 395 liters per kilogram (L/kg) (Weidemeier *et al.*, 1995).

Fraction Organic Carbon (f_{oc}) The fraction organic carbon (f_{oc}) is the weight fraction of organic carbon in soil and is used in the estimation of the retardation factor. Typical f_{oc} values range from 0.0002 to 0.02 (Knox *et al.*, 1993). Total organic carbon was not detected in site soil samples, so half of the laboratory detection limit (500 mg/kg) was assumed to exist in site soil, which translates to a f_{oc} value of 2.5×10^{-4}.

Soil Bulk Density (ρ_b) The soil bulk density is the bulk density of the aquifer matrix and is related to the porosity and pure solids density. An estimated value of 1.72 kilograms per liter (kg/L) was used in this model (Newell *et al.*, 1996).

6.7.4.4 Biodegradation

First Order Decay Coefficient and Solute Half-Life The solute half-life is a chemical specific value which specifies the amount of time it takes for a compound to degrade to half its original concentration. The first-order decay coefficient is equal to the natural log of 2 (0.693) divided by the half-life of the chemical in groundwater. The half-life of xylene published in literature typically ranges from 0.038 year to 1 year (Newell et al., 1996). Instead of using a literature value, a first-order decay coefficient calculated for a similar site at Eglin AFB (POL Site SS-36) (Table 6.4) using site-specific data (1995) was used. The average first-order BTEX decay coefficient of 2.9 $year^{-1}$ (half-life = 0.24 year) was used in the model.

Instantaneous Reaction Model First-order expressions may not be accurate for describing biodegradation of organic chemicals in groundwater because electron acceptor limitations are not considered. A more accurate prediction of biodegradation effects may be realized by incorporating the instantaneous reaction equation into a transport model (Newell *et al.*, 1996). However, for the Seventh Street Service Station, this model may give overly conservative results (see Section 6.7.1).

Site-specific geochemical data were used as described in the Bioscreen User's Manual (Newell *et al.*, 1996) to determine input values for Bioscreen's instantaneous reaction model. Although BTEX compounds dominate the dissolved plumes of gasoline spills, there are non-BTEX hydrocarbons that exert a demand on the available electron acceptors. A conservative approach is to reduce all available electron acceptor/by-product concentrations used in the model by thirty percent to account for the possible impacts of non-BTEX organics in groundwater (Newell *et al.*, 1997). Therefore, the delta for each of the indicators was reduced by 30 percent. Since xylene was the only constituent being modeled and constituted approximately 50 percent of the total BTEX contamination in the groundwater plume, the values were reduced by an additional 50 percent before being input into the model. In summary, only 35 percent of the available electron acceptor capacity was assumed to be available for xylene biodegradation. BIOSCREEN calculates the biodegradation capacities (BCs) for individual parameters. The BC is the amount (in mg/L) of a parameter utilized to biodegrade 1 mg/L of hydrocarbon. The calculated differences are provided below.

Difference in DO

35% [(average background oxygen conc.) - (minimum source area oxygen conc)]

Change in DO = 0.35 * (4.2 mg/L - 0.15 mg/L) = 1.4 mg/L

Difference in Nitrate

35% of [(average background nitrate conc.) - (minimum source area nitrate conc.)]

Change in Nitrate = 0.35 * (1.37 mg/L - 0 mg/L) = 0.48 mg/L

Difference in Ferrous Iron

35% of average source area ferrous iron conc.

Ferrous Iron = 0.35 * 0.29 mg/L = 0.10 mg/L

Difference in Sulfate

35% of [(average background sulfate conc.) - (Average source area sulfate conc.)]

Change in Sulfate = 0.35 * (160 mg/L - 115 mg/L) = 15.75 mg/L

Difference in Methane

35% of average source area methane conc.

Methane = 0.35 * 1.53 mg/L = 0.53 mg/L

6.7.4.5 General

The modeled area length and width were set at 1,300 feet (approximate distance to Weekly Pond) and 200 feet, respectively. The model was run for 400 years (1997 to 2397) for predictive purposes.

6.7.4.6 Source Data

Source Thickness in Saturated Zone The source thickness in the aquifer was input as 2.5 feet, based on soil contamination data collected in March 1998 (Section 5.2).

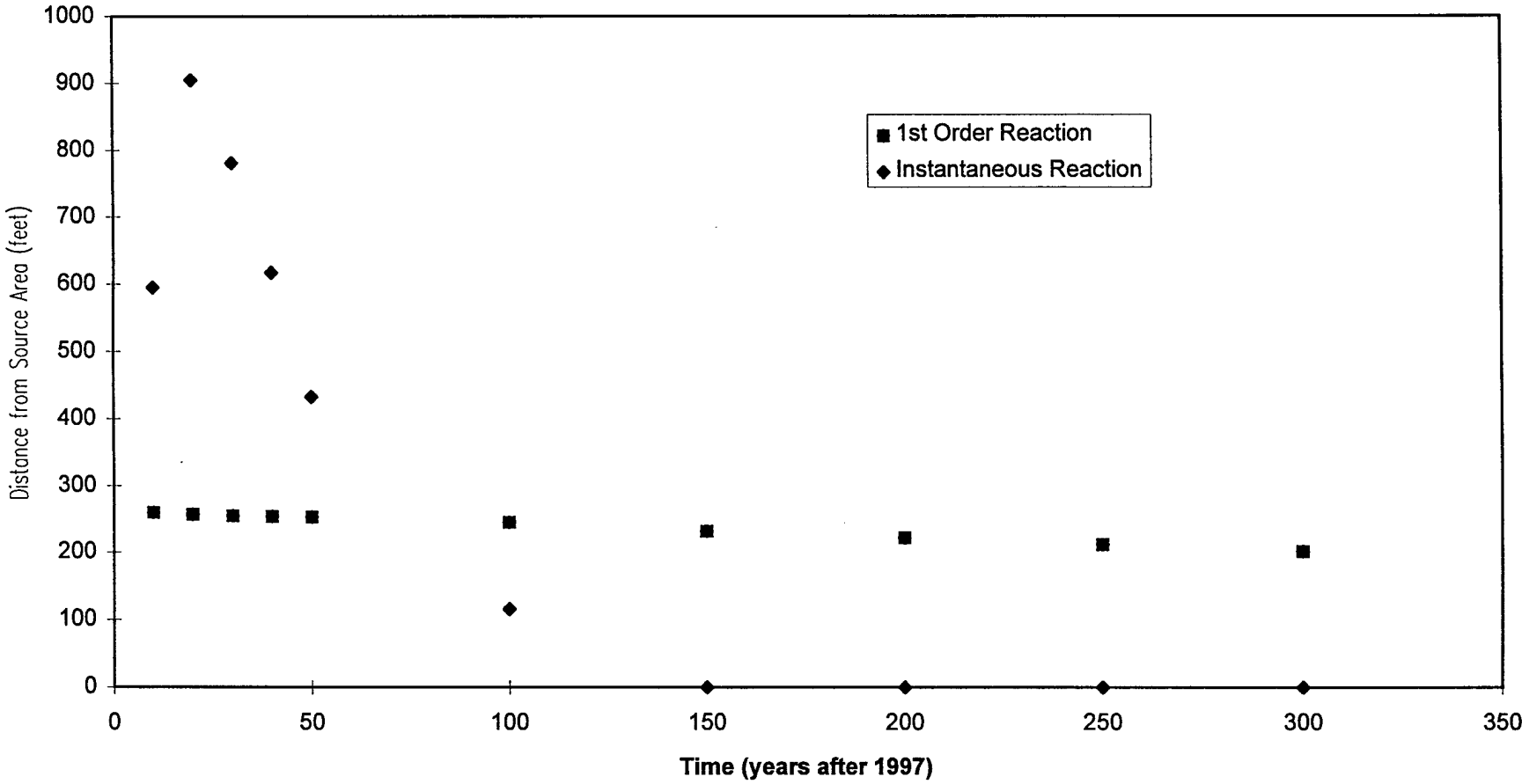
Source Area Dimensions and Concentrations BIOSCREEN assumes a source represented by a vertical plane perpendicular to groundwater flow. This vertical plane was estimated using the dissolved xylene plume dimensions in March 1998.

Source Half-Life BIOSCREEN incorporates an approximation for a declining source concentration over time. The declining source term assumes that the mass of modeled constituent in the source area dissolves slowly as fresh groundwater passes through, and that the change in source zone concentration can be approximated as a first-order decay process. The model will compute an estimated source half-life given the estimated mass of modeled constituent present in the source area. The initial mass of xylene available to be dissolved into groundwater at the site was estimated based on soil contamination data collected in March 1998. Calculations are contained in Appendix E.

6.7.5 Model Results

The maximum predicted migration distance of the xylene plume is shown on Figure 6.5. The First-Order Decay model indicates that the dissolved xylene contamination near MP-2 will migrate to a maximum distance of approximately 390 feet from the source area within 10 years after 1997, after which it will achieve a steady-state condition. The Instantaneous Reaction Model indicates that the dissolved xylene plume will migrate to a maximum distance of approximately 950 feet from the source area approximately 20 years after 1997, after which it will begin to recede. The plume is

Figure 6.5
Maximum Simulated Migration Distance of Xylene Concentrations Above Tier 1 TCL
No Source Removal
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida



S:\ES\shared\hicks\newtables.xls Figure 6.5

not predicted to reach Weekly Pond. BIOSCREEN results from the First-Order Decay Model predict that concentrations of xylenes in excess of 1,000 µg/L will persist in the aquifer for more than 400 years after 1997 (Figure 6.6). Results from the instantaneous reaction model indicate that xylene concentrations will be below 20 µg/L (the Tier 1 TCL) within 150 years. These results assume that hydraulic control is not exerted by the pump-and-treat system currently operating at the site and that no source reduction technology is employed. Model output is presented in Appendix F.

The prediction that the xylenes plume will not reach Weekly Pond is supported by comprehensive studies of dissolved BTEX plumes that have been performed in recent years. Data presented by Lawrence Livermore National Laboratories (LLNL) indicates that for over 1,000 California sites with fuel hydrocarbon releases, 33 percent of the plumes were shrinking, 59 percent were stable, and 8 percent were expanding, with most plumes less than 250 feet long (Rice *et al.*, 1995). Unpublished data provided by Kuehne and Buscheck (1996) indicate similar trends, with 52 percent of plumes contracting, 35 percent stable, and 92 percent of the plumes being less than 200 feet long. Mace *et al.* (1997) present similar evidence for more than 600 sites in Texas.

6.7.6 Simulated Source Removal

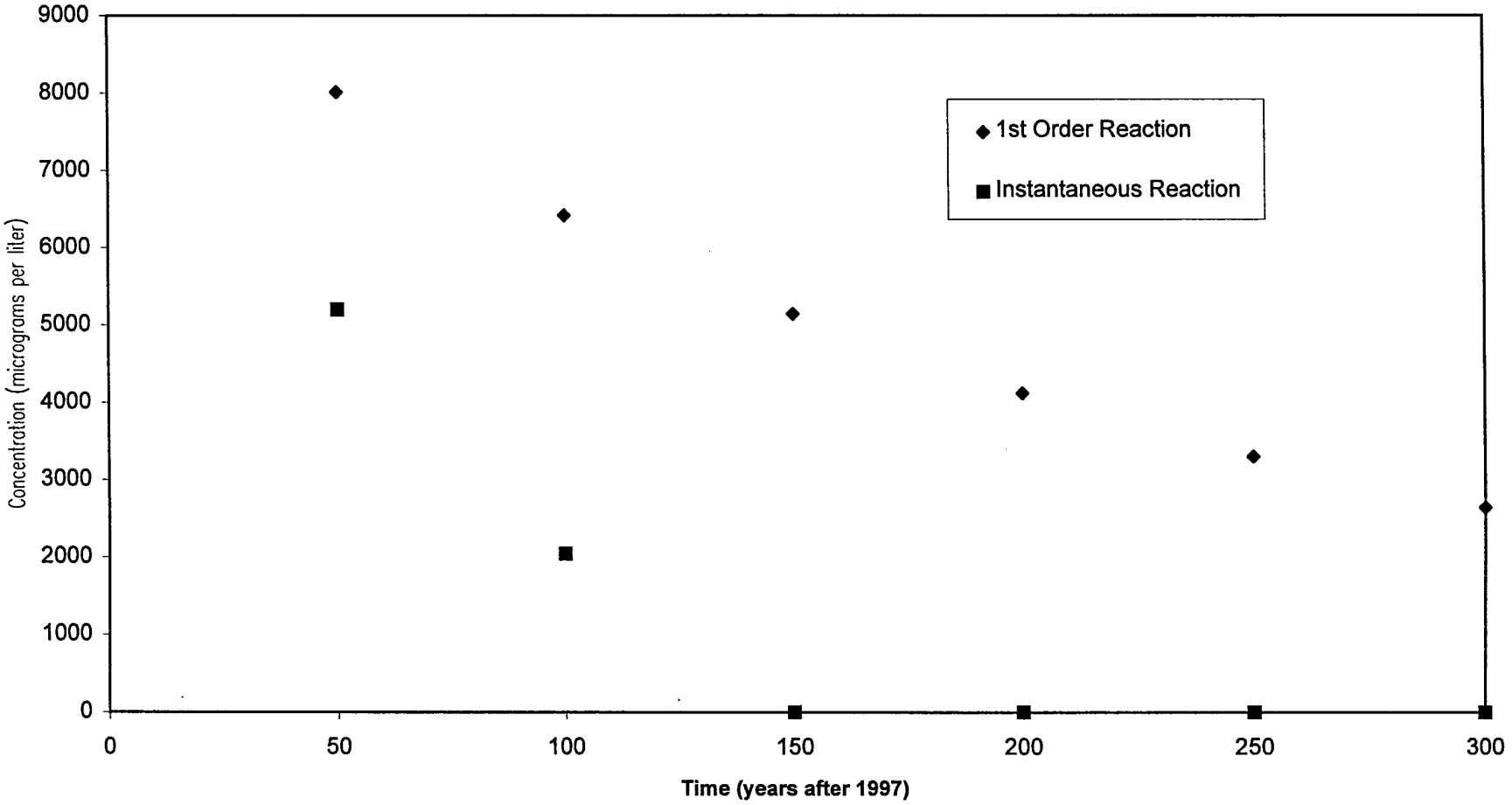
The BIOSCREEN model also was utilized to evaluate the effectiveness of future remedial actions. This task was completed for the dissolved xylene plume at the site. Model input and output is included in Appendix F. The only input parameter that was changed was the estimated mass of xylene in the source area. This model assumes that the future remedial action will remove 80 percent of the source xylenes over 3 years. A source mass of 56 kg was input into the model. The First-order Reaction model predicts that xylene concentrations will decrease to below its Tier 1 TCL (20 µg/L) within 280 years and that the plume will reach its maximum travel distance of 390 feet by the year 2007. The Instantaneous Reaction model predicts that xylene concentrations will decrease to below its Tier 1 TCL (20 µg/L) within 30 years of the completion of source reduction activities, and that the plume will reach its maximum travel distance of approximately 600 feet within 10 to 15 years.

6.7.7 Simulation of Dissolved Benzene

The Bioscreen model also was used to simulate the transport of dissolved benzene (the most soluble and mobile of the BTEX compounds) to predict whether this compound could reach Weekly Pond if the pump and treat system was not operating. The input parameters used to simulate the dissolved xylenes plume also were used for the benzene model, with the following exceptions:

- A retardation coefficient of 1.1 was used (minimal retardation);
- The average benzene concentration in the source area was assumed to be 80 µg/L based on March 1998 analytical results; and

Figure 6.6
Maximum Simulated Xylene Concentrations Vs Time
No Source Removal
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida



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- The benzene source mass was assumed to be 1.1 kg, which is equivalent to an average soil benzene concentration of 500 μg/kg in the source area. Benzene was only detected in one March 1998 soil sample at a concentration of 3.2 μg/kg; however, some of the sample detection limits were elevated.

Use of the same input data for the benzene Instantaneous Reaction model as in the xylenes model is potentially conservative because the relatively mobile benzene plume should migrate faster than many of the less-mobile gasoline constituents. Therefore, the mass of non-benzene hydrocarbons exerting a demand on the available electron acceptors at the downgradient toe of the benzene plume should be relatively small.

Both the Instantaneous Reaction and First-Order Decay models indicate that dissolved benzene will not migrate to Weekly Pond. Model input values and selected output data are contained in Appendix F.

SECTION 7

TIER 2 ANALYSIS AND IDENTIFICATION OF FINAL CHEMICALS OF CONCERN

7.1 OBJECTIVE OF SITE-SPECIFIC EVALUATION

The Tier 1 analysis conducted in this CAP (Section 4) identified ethylbenzene and toluene as COPCs in soil and BTEX, TRPH, lead, and naphthalene as COPCs in groundwater. These analytes are evaluated in detail to better define/assess the potential adverse health effects they may cause in current or future human receptors.

The Tier 1 screening process is considered protective of human health because the Tier 1 risk-based screening criteria are based on conservative exposure assumptions. However, analytes identified as COPCs in Section 4 of this CAP (i.e., analytes with representative site concentrations exceeding Tier 1 TCLs) should not automatically be considered to be present at the site at levels that pose unacceptable threats to human health given the current and future exposure potential at this site. Rather, the exceedences of the conservative screening criteria indicate that further evaluation using more site-specific exposure scenarios is warranted.

Tier 2 of the risk-based analysis is completed in Section 7.2 by comparing appropriate site concentrations (observed current and predicted future) to reasonable matrix-specific SSTLs at receptor exposure points. These SSTLs are described as the Tier 2 risk-based criteria and differ from the generic TCLs in that the conservative exposure assumptions used to derive the generic TCLs (e.g., exposure duration of 25 years) are replaced with more realistic site-specific exposure assumptions (e.g., exposure duration of 1 year). It is important to emphasize that the Tier 2 SSTLs are based on achieving levels of human health protection identical to those of the generic target cleanup levels (i.e., the site-specific criteria are based on a carcinogenic target risk limit of 10^{-6} and a noncarcinogenic hazard quotient of 1). The presence of various analytes at concentrations above the applicable generic TCLs also justifies the need for a Tier 2 evaluation to assist in the development of corrective actions that can achieve the desired level of risk reduction at the site.

Development of site-specific exposure scenarios requires a reevaluation of the preliminary CSM presented in Section 4. The revised CSM for the site, which is presented in Section 7.3, identifies those receptors and exposure pathways that may be completed under current or hypothetical future exposure scenarios considering land uses and the results of the chemical fate and transport assessment presented in Section 6.

In summary, the objectives of developing SSTLs that include exposure assumptions more representative of actual site conditions are 1) to determine whether current or predicted future site concentrations of COPCs present an unacceptable risk to current and future receptors; and 2) to provide the necessary information to assess the cost and time required to lower site concentrations to achieve adequate risk reduction at the site.

7.2 DEVELOPMENT OF SITE-SPECIFIC TARGET LEVELS (SSTLS)

7.2.1 Tier 2 Analysis for Soil

Table 7.1 presents the chemical-specific soil SSTLs for the Seventh Street Service Station. Note that two sets of SSTLs are presented; a reasonable maximum exposure (RME) and a central tendency (CT). The RME SSTLs are designed to illustrate the residual concentration that can persist in onsite groundwater given "high-end" (reasonable maximum) exposure potential, whereas the CT SSTLs better illustrate the residual concentration that can persist in onsite groundwater given mean or average exposure potential. The CT SSTLs are presented for comparative purposes only to provide a less-than-maximum-exposure perspective.

The construction worker exposure assumptions used to derive the SSTLs were developed for use at Eglin AFB, Florida (McLain, 1998), and have been reviewed and accepted by the FDEP. The exposure pathways incorporated in the SSTLs include dermal exposure, incidental ingestion, and inhalation. COPC toxicity values used in the SSTL derivations are based on toxicity data reported in the Integrated Risk Information System (Micromedex, 1998) or used by the FDEP to derive the generic Tier 1 target cleanup levels. No COPC concentration in soil was found to exceed the SSTL. SSTL calculations are presented in Appendix E.

7.2.2 Tier 2 Analysis for Groundwater

Table 7.2 presents the chemical-specific groundwater SSTLs for the Seventh Street Service Station. As with the soil Tier 2 analysis, the RME and CT analyses are presented. The groundwater SSTLs are health-based values calculated to protect onsite intrusive workers from health risks associated with exposure to chemical contamination in groundwater. The generic health-based Tier 1 TCLs are calculated assuming purposeful ingestion of onsite groundwater by onsite workers under residential-type exposure conditions (i.e., 25-year exposure duration, 2 liters per day consumption rate, etc.). In reality, these TCLs would apply only if impacted groundwater from the Seventh Street Service Station migrated to a potable water supply source. As described in Section 7.2.1, the construction worker exposure assumptions derived for use at Eglin AFB (McLain, 1998) were used to compute the SSTLs. The exposure pathways incorporated into the groundwater SSTLs are the same as those for soil and include dermal contact, incidental ingestion of groundwater and vapor inhalation. The approach used to incorporate the inhalation pathway in the SSTL calculations was based on the assumption that an intrusive worker would inhale vapors while in a trench a fraction of the time at the site. In addition, the intrusive worker was assumed to inhale contaminants volatilized from groundwater through a vadose zone into aboveground ambient air. The approach used to assess vapor exposure while in the trench was derived by toxicologists at the University of Florida for a similar site at Homestead

TABLE 7.1
COMPARISON OF MAXIMUM SOIL DETECTIONS TO SITE-SPECIFIC TARGET LEVELS (SSTLs)
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Chemical of Potential Concern	Units	Maximum Detected Concentration	Tier 2 Health-Based SSTL		Maximum Detection Exceeds SSTL?
			RME[a/]	CT[b/]	
Ethylbenzene	mg/kg	710	8,030	28,600	No
Xylenes	mg/kg	1,400	69,200	223,000	No

[a/] RME = reasonable maximum exposure.

[b/] CT = central tendency (average exposure).

TABLE 7.2
COMPARISON OF MAXIMUM GROUNDWATER DETECTIONS TO SITE-SPECIFIC TARGET LEVELS (SSTLs)
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Chemical of Potential Concern	Units	Maximum Detected Concentration	Tier 2 Health-Based SSTL		Maximum Detection Exceeds SSTL
			RME[a/]	CT[b/]	
Benzene	µg/L	86	4,480	29,100	No
Toluene	µg/L	1,600	134,000	1,070,000	No
Ethylbenzene	µg/L	11,000	45,700	358,000	No
Xylenes	µg/L	13,000	866,000	6,940,000	No
Naphthalene	µg/L	510	11,400	52,400	No

[a/] RME = reasonable maximum exposure.

[b/] CT = central tendency (average exposure).

AFB, Florida (University of Florida, 1998). The approach used to assess exposure to contaminants volatilized from groundwater to aboveground ambient air was based on methodology described in a Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites (ASTM, 1996). No COPC concentration in groundwater was found to exceed its SSTL. SSTL calculations are presented in Appendix E.

7.2.3 Lead in Groundwater and Soil

Given that the maximum detected concentration of total (non-filtered) lead in groundwater (19 μg/L) exceeded the Tier 1 TCL of 15 μg/L, it was retained for Tier 2 analysis. However, unlike the other COPCs, there is insufficient toxicity data available to compute a Tier 2 SSTL for lead. Therefore, it was conservatively evaluated for potential effects on the future residential child receptor using the EPA Integrated Exposure Uptake Biokinetic model (USEPA, 1994a). The IEUBK model provides an estimate of potential blood lead levels in residential children associated with exposure to all site media. Results of the IEUBK model run for Area A (ST-06) at Keesler AFB (Parsons ES, 1998b) were assumed to conservatively represent the results that would be achieved using the Seventh Street Service Station data. The Keesler model was run using default (non-site-specific) input data that are also applicable to the Seventh Street Service Station. The only site-specific input parameter was the lead concentration, which was higher at the Keesler site.

Per USEPA (1994a) guidance, the probability of an individual in a population having a blood lead level exceeding 10 micrograms per deciliter (μg/dL) should be less than 5 percent. The results of running the IEUBK lead model for groundwater at Keesler AFB, Mississippi, where the maximum lead concentration was 21 μg/L, indicate that an individual in a population would have only a 3 percent chance of exceeding a blood lead level of 10 μg/dL. This percentage falls below the criteria of 5 percent; therefore, the impacts of lead in site media on potential future residents at the Seventh Street Service Station are not considered to be significant. The input and output of the IEUBK model estimate for Keesler AFB are provided in Appendix E.

7.3 REVISED CONCEPTUAL SITE MODEL

The preliminary CSM presented in Section 4 was used to qualitatively identify potential human and ecological receptors that may be exposed to site-related contaminants and to define the types of these potential exposures at or in the vicinity of the Seventh Street Service Station (Figure 4.1). The preliminary CSM described sources of contamination, release mechanisms, the affected physical media, potentially exposed populations or receptors, and how each receptor group could come into contact with site-related contamination. This preliminary CSM was used to identify which of the exposure assumptions used to develop generic cleanup criteria most closely approximates site conditions. The exposure assumptions incorporated into the generic industrial TCLs (i.e., Table IV Direct-Exposure II TCLs) were identified as generally representative of the types of exposure that could occur at the site, but perhaps greatly overestimated the magnitude of exposure specific to current and expected future site conditions. For example, Tier 1 screening of groundwater assumed unrestricted future use of groundwater. Therefore, the target cleanup criteria presented in Table V (FDEP, 1997) which were developed assuming potable use of groundwater, were used

in the Tier 1 screening. The preliminary CSM exposure pathways are reevaluated in this section using the Tier 2 chemical fate information presented in Section 7.2. It is important to emphasize that the purpose of using the preliminary CSM and the conservative, nonsite-specific TCLs to identify COPCs was to ensure that all subsequent assessment activities beyond the Tier 1 screening evaluation address the full range of contaminants that may present some risk to current of future receptors.

The revised CSM for the site, which is presented on Figure 7.1 and briefly reviewed in the following subsections, identifies those receptors and exposure pathways that realistically may be involved in actual current or hypothetical future exposures. The outcome of the Tier 2 evaluation of site chemicals of potential concern presented in Section 7.2, and the types of exposures likely to occur at this industrial site, are reflected in this revised CSM. Justification for each site-specific exposure assumption is provided in subsequent discussions.

7.3.1 Sources, Release Mechanisms, Affected Media, and Contaminant Transport

Contamination at the site is present as a result of past overfills of and/or leaks from the underground fuel storage tanks and distribution system at the site. The USTs, with the exception of one UST partially buried beneath the treatment system compound cement pad, have been removed from the site. Therefore, direct release is no longer a potential release mechanism. Mobile, light, non-aqueous phase liquid (LNAPL) (free product) was not found at the site in March 1998, indicating that it is not a significant, continuing source of groundwater contamination. Data indicate that the predominant ongoing release mechanism for groundwater COPCs is leaching from capillary fringe soil. Contaminants also may re-sorb to soil from contaminated groundwater.

7.3.2 Potentially Exposed Receptors, Exposure Points, and Exposure Routes

The revised CSM for the site also refines the identification of potentially exposed receptor populations, receptor exposure points, and exposure routes for realistic scenarios based on specific site conditions. These components better reflect the likelihood and extent of human or ecological receptor contact with site-related contaminants. As described in Section 2, the site is entirely within the boundaries of the Base. Therefore, potential receptors are limited to the on-Base population. There are no completed pathways to offbase receptors. Furthermore, the asphalt cover over much of the site limits contact with contaminated soil or groundwater by current Base personnel.

Available information indicates that none of the partially completed pathways are significant. Therefore, only potential future exposures are assessed. Future receptors may be exposed to soil contaminants by dermal contact with and/or incidental ingestion of soil during intrusive activities (e.g., building foundation or utility pipeline excavation). Groundwater may be encountered during future excavation activities. No drinking water supply wells screened within the surficial aquifer are located within one-half mile of the site. Eight irrigation wells used to water Base lawns are screened in the surficial aquifer within one-half mile of the site (EA, 1994) (Figure 1.2), but the contaminant plume is not expected to migrate in the direction of these wells.

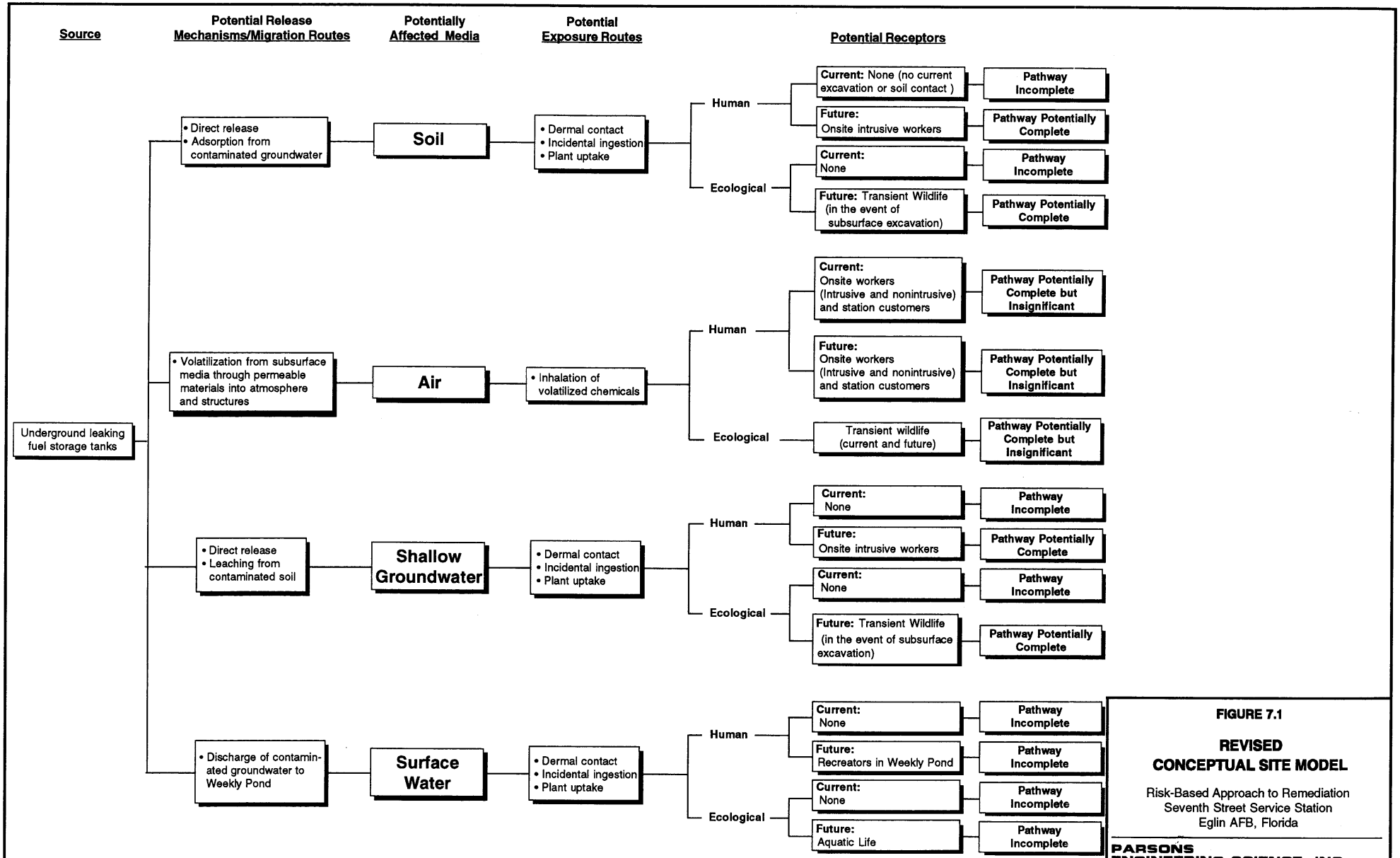


FIGURE 7.1

REVISED CONCEPTUAL SITE MODEL

Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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Results of the Bioscreen model indicate that surface water in Weekly Pond will not be impacted by the dissolved contaminant plume. In addition, plume length observations made at over 1,000 fuel-contaminated sites strongly indicate that the dissolved BTEX plume will not migrate even close to Weekly Pond (Rice *et al.*, 1995; Kuehne and Buschek, 1996; Mace *et al.*, 1997), and that the migration predictions obtained from the Bioscreen Model are sufficiently conservative. The surface water runoff pathway is not considered complete because the site is mostly paved and surface soil is not contaminated. Therefore, surface water runoff, which is channeled into the storm water drainage system, should not contact contaminated soil. The site is expected to continue as a paved, urbanized environment; therefore, future risks to ecological receptors are unlikely. The industrial nature of the site, and the pavement covering much of the site, precludes the existence of suitable wildlife habitat. No resident ecological receptors were identified for which soil and/or groundwater are likely contaminant exposure media.

Using the most conservative exposure assumptions appropriate for the Seventh Street Service Station, the only realistic receptor that could become exposed to significant concentrations of site-related contaminants is the onsite intrusive worker involved in demolition, removal, and/or construction activities. Inhalation of VOCs (partitioning from either contaminated soil or groundwater) in ambient air at the site also could result in a completed pathway for the onsite intrusive worker. However, as described in Sections 4 and 7.2, soil gas concentrations are not expected to pose a significant inhalation risk to aboveground or intrusive workers. Therefore, these exposure pathways are either incomplete or are insignificant.

7.3.3 Summary of Exposure Pathway Completion

Given the current and planned future uses of the Seventh Street Service Station and the outcome of the chemical fate assessment presented in Section 6, there are no current receptors exposed to contamination at the Seventh Street Service Station, though there are receptors which may be exposed in the future. Onsite intrusive workers and transient wildlife could be exposed to site-related contamination in soil, soil gas, and groundwater during future excavation activities.

7.4 SUMMARY OF RISK-REDUCTION REQUIREMENTS

The following conclusions can be drawn:

- Concentrations of target analytes in all sampled media that exceeded applicable health-protective Tier 1 TCLs did not exceed Tier 2 SSTLs; therefore, site contamination does not pose a risk to potential receptors (construction workers) under reasonable current and future land use scenarios.

- Contaminant and geochemical data strongly indicate that biodegradation of fuel hydrocarbons is occurring at the site, primarily via the anaerobic processes of sulfate reduction and methanogenisis.

- Eglin AFB is an active Base where institutional controls can be maintained with a high level of confidence.

- With the exception of potential future exposure to contaminated soil or groundwater by intrusive construction workers during on-site excavation activities, none of the potential exposure pathways described in Section 4.4 are considered complete. Bioscreen results indicate that continued operation of the groundwater pumping system is not required to protect downgradient receptors.

- Fate and transport modeling results indicate that residual concentrations of groundwater COPCs (specifically xylenes) above Tier 1 TCLs (the long-term cleanup goals) will persist for more than 100 years unless additional engineered source reduction activities are implemented.

SECTION 8

REMEDIAL ALTERNATIVES EVALUATION

As described in Section 7, BTEX, TRPH, lead, and naphthalene were detected in groundwater at site monitoring wells at concentrations that exceeded the matrix-specific Tier 1 TCLs; however, Tier 2 SSTLs were not exceeded. Fate and transport modeling results presented in Section 6 suggest that maximum concentrations of xylenes will not decrease to below the Tier 1 TCLs (the long-term cleanup goals for the site) for over 100 years unless some additional type of active source removal is implemented at the site. However, continued operation of the pump and treat system does not appear to be required to protect downgradient receptors. Three potential remedial alternatives are described in this section. Alternative 1 consists of RNA with institutional controls and long-term monitoring (LTM). Alternative 2 consists of all of the elements of Alternative 1, plus *in situ* biosparging and SVE. Alternative 3 consists of installing additional groundwater extraction wells in the source area to lower the water table and allow the SVE/bioventing system to remediate residual LNAPL that is below the average water table.

8.1 REMEDIAL ALTERNATIVE 1 - RNA WITH INSTITUTIONAL CONTROLS AND LTM

Land and groundwater use restrictions are considered necessary components of any corrective action at this site to ensure that the exposure assumptions used to develop the Tier 2 SSTLs are representative of site exposure conditions. Maintaining the light industrial land use at this site, and barring unrestricted access to use of groundwater are consistent with the planned near-term use of this site. Limitations on groundwater use (i.e., groundwater cannot be used as a potable drinking water source until Tier 1 TCLs have been uniformly achieved throughout the site) will not impose additional restrictions on the current or planned future use of this site.

The BIOSCREEN model results presented in Section 6 indicate that groundwater contaminant concentrations may not decrease below Tier 1 TCLs for more than 100 years. Groundwater monitoring should be implemented to track the progress of remediation by natural attenuation and to verify that no unacceptable receptor exposures could occur while remediation is in progress.

The present worth cost of 30 years of LTM at the site is estimated to be approximately $270,000. An annual adjustment factor of 7 percent was assumed in present-worth calculations. The annual adjustment factor is the difference between the rate of inflation and the cost of money (USEPA, 1988). Cost calculations are contained in Appendix G. This cost assumes that 6 wells are sampled biannually (twice per year)

for five years, followed by biennial (every other year) sampling for the remaining 25 years.

8.2 REMEDIAL ALTERNATIVE 2 - RNA WITH INSTITUTIONAL CONTROLS, LTM, AND SOURCE AREA BIOSPARGING/SVE

Available data indicate that residual soil contamination is most prevalent below the water table. Operation of the bioventing/SVE system at the site since 1992 has largely remediated the area above the water table; however, residual contamination in the capillary fringe and saturated zone is affected only during low-water periods when this contaminated interval is dewatered and aerated. Implementation of biosparging in the source area would expedite reductions in contaminant concentrations in capillary fringe and saturated soil in the source area. Biosparging should increase the DO concentration in saturated soil and groundwater to about 1 to 2 mg/L within the source area. Incidental bioventing of vadose zone soil is anticipated as oxygen injected into the subsurface diffuses through the groundwater and capillary fringe soil. The SVE system would be operated concurrently to remove vapor-phase contamination generated by the biosparging system and prevent potential transport to occupied buildings. The reduction of contamination in the source area via the biosparging/SVE system will serve to more rapidly reduce the total mass of contamination in groundwater (i.e., expedite attainment of Tier 1 TCLs).

BIOSCREEN modeling results presented in Section 6 indicate that groundwater contaminant concentrations may uniformly decrease below Tier 1 TCLs within approximately 30 to 35 years if a source removal action is implemented at the site. This prediction is based on the assumption that the results of the Instantaneous Reaction Model are more realistic than the results of the First-Order Decay Model. Some support for this assumption is provided in the BIOSCREEN user's manual (Newell *et al.*, 1996), which states that the First-Order Decay Model does not account for site-specific information such as the availability of electron acceptors, and does not assume any biodegradation of dissolved constituents in the source zone. The present worth cost of three years of biosparging and SVE, combined with the long-term monitoring plan proposed in Alternative 1, is estimated to be $490,000. Cost calculations are contained in Appendix F. The cost assumes installation of 25 sparging wells at a 15-foot spacing and installation of two additional SVE wells at the site.

8.3 REMEDIAL ALTERNATIVE 3 - RNA WITH INSTITUTIONAL CONTROLS, LTM, AND GROUNDWATER EXTRACTION/SVE IN THE SOURCE AREA

Another approach that would expedite reductions in contaminant concentrations in vadose zone, capillary fringe, and saturated soil in the source area consists of more aggressive groundwater extraction and SVE in the source area. Three additional groundwater recovery wells would be installed in the source area and would be pumped along with two existing source area recovery wells (FPRW-1 and FPRW-2). The remaining groundwater recovery wells would be deactivated. Pumping from additional recovery wells placed in areas of soil contamination would lower the water table in that area so that contaminated soil currently below the water table would be exposed to the effects of an enhanced SVE/bioventing system. The hydraulic control resulting from

groundwater extraction would also prevent migration of dissolved contaminants from the source area during system operation. Bioscreen modeling results presented in Section 6 indicate that groundwater contaminant concentrations may uniformly decrease to below Tier 1 TCLs within approximately 30 to 35 years if a source removal action similar to the one described above is implemented at the site.

The present worth cost of this alternative is estimated to be $540,000. Cost calculations are contained in Appendix G. The cost assumes operation of a 5-well groundwater recovery system (3 new and 2 existing wells) and a 4-well SVE/bioventing system (2 new and 2 existing vapor extraction wells) for three years. The cost also assumes that FPRW-1 and FPRW-2 are adequately constructed to operate as groundwater extraction wells, the existing air stripper and piping network can handle the flow from the five pumping wells, and that the pumps in the existing wells are adequate to dewater the contaminated zone.

8.4 RECOMMENDED REMEDIAL ALTERNATIVE

The Tier 2 analysis presented in Section 7 indicates that contaminant concentrations at the site do not pose a significant risk to potential receptors (construction workers) based on reasonable exposure scenarios. Consequently, implementation of additional engineered remediation to reduce dissolved contaminant concentrations in soil and groundwater is not required to protect human receptors and underlying groundwater quality, given the types of exposure likely to occur at this site. However, the predicted time frame to achieve the ultimate cleanup goals (Tier 1 groundwater TCLs) and unrestricted land and groundwater use at the site may be unacceptably long (more than 100 years) unless additional engineered source removal is performed.

Based on the information presented above, both Alternatives 2 and 3 would provide a similar degree of risk reduction for a similar cost. Alternative 3 is projected to be more expensive than Alternative 2, but would make the most use of existing infrastructure (the existing groundwater extraction and treatment system). Implementation of Alternative 2 would disrupt the site to a greater degree during installation of the biosparging system. If this disruption is acceptable to the Air Force, then Alternative 2 is recommended on the basis that it would provide the best combination of risk reduction and cost effectiveness. If this disruption is not acceptable, and the Air Force desires to continue using existing remediation infrastructure, then Alternative 3 is recommended. In either case, the progress of source removal and RNA will be monitored using the existing network of monitoring wells and one additional proposed monitoring well. Additional details on the well location and the frequency and types of groundwater analysis recommended to confirm the effectiveness of source removal and ongoing natural processes and to verify the completion of a cleanup appropriate for an industrial site are presented in the LTM plan included in Section 10.

SECTION 9

SUMMARY AND CONCLUSIONS

Comparison of the COPC, electron acceptor, and biodegradation byproduct data for the Seventh Street Service Station provides strong qualitative evidence of biodegradation of dissolved COPCs. Geochemical data strongly indicate that biodegradation of fuel hydrocarbons is occurring at the site, primarily via the processes of aerobic degradation, sulfate reduction, and methanogenesis. The groundwater system appears to have sufficient capacity to facilitate biodegradation of all available contaminant mass dissolved in the groundwater and adsorbed to soil particles in the saturated zone. As the contaminant source (residual LNAPL adsorbed to soil particles) is reduced over time due to biodegradation and SVE, dissolved contaminant concentrations in the source area also are reduced. The downgradient migration of the dissolved contaminants is restricted due to natural biodegradation, and the plume should not impact potential downgradient receptors if the groundwater extraction system is turned off. Available data indicate that the plume is entirely contained within the existing monitoring well network. Current onsite receptor exposure pathways are incomplete; therefore, the existing contamination does not pose a risk to current receptors. Potential future receptors, including intrusive site construction workers, can be protected with additional source removal. Bioscreen model results indicate that the addition of either Alternatives 2 or 3 will substantially decrease the time required to uniformly achieve Tier 1 groundwater TCLs.

SECTION 10

LONG-TERM MONITORING PLAN

10.1 OVERVIEW

At the Seventh Street Service Station, LTM combined with RNA, institutional controls, and additional engineered source reduction is recommended. The objectives of the LTM are as follows:

- To assess site conditions over time;
- To confirm the effectiveness of naturally occurring processes at reducing contaminant mass and minimizing contaminant migration;
- To evaluate the need for additional remediation.

The LTM plan consists of identifying groundwater sampling locations and developing a sampling and analysis strategy. The strategy described in this section is designed to assess the effectiveness of RNA through measurement of the reduction of contaminant mass, and the rate of groundwater remediation. In the event that data collected under this LTM program indicate that RNA with source reduction is insufficient to be protective of human health and the environment, additional engineered controls to augment the beneficial effects of RNA may be necessary. A site-specific groundwater SAP and institutional control plan should be prepared prior to initiating the LTM program.

10.2 LONG-TERM GROUNDWATER MONITORING WELLS

Seven monitoring wells should initially be included in the LTM program. These wells include six existing wells (MW-1, MW-2, MW-3, MW-4, MW-8, MW-C) and one additional proposed monitoring well (to replace MP-2) (Figure 10.1). Periodic sampling of MW-4 will aid in assessing the downgradient extent of the dissolved BTEX plume. If contamination is detected in MW-4 at concentrations exceeding Tier 1 TCLs, then MW-6 can be sampled to monitor the downgradient expansion of the plume. If contamination is detected in MW-6, then additional point-of-compliance wells can be installed further downgradient as required. The wells targeted for sampling should be reevaluated as additional LTM data are collected, and wells should be added to or dropped from the LTM program as appropriate.

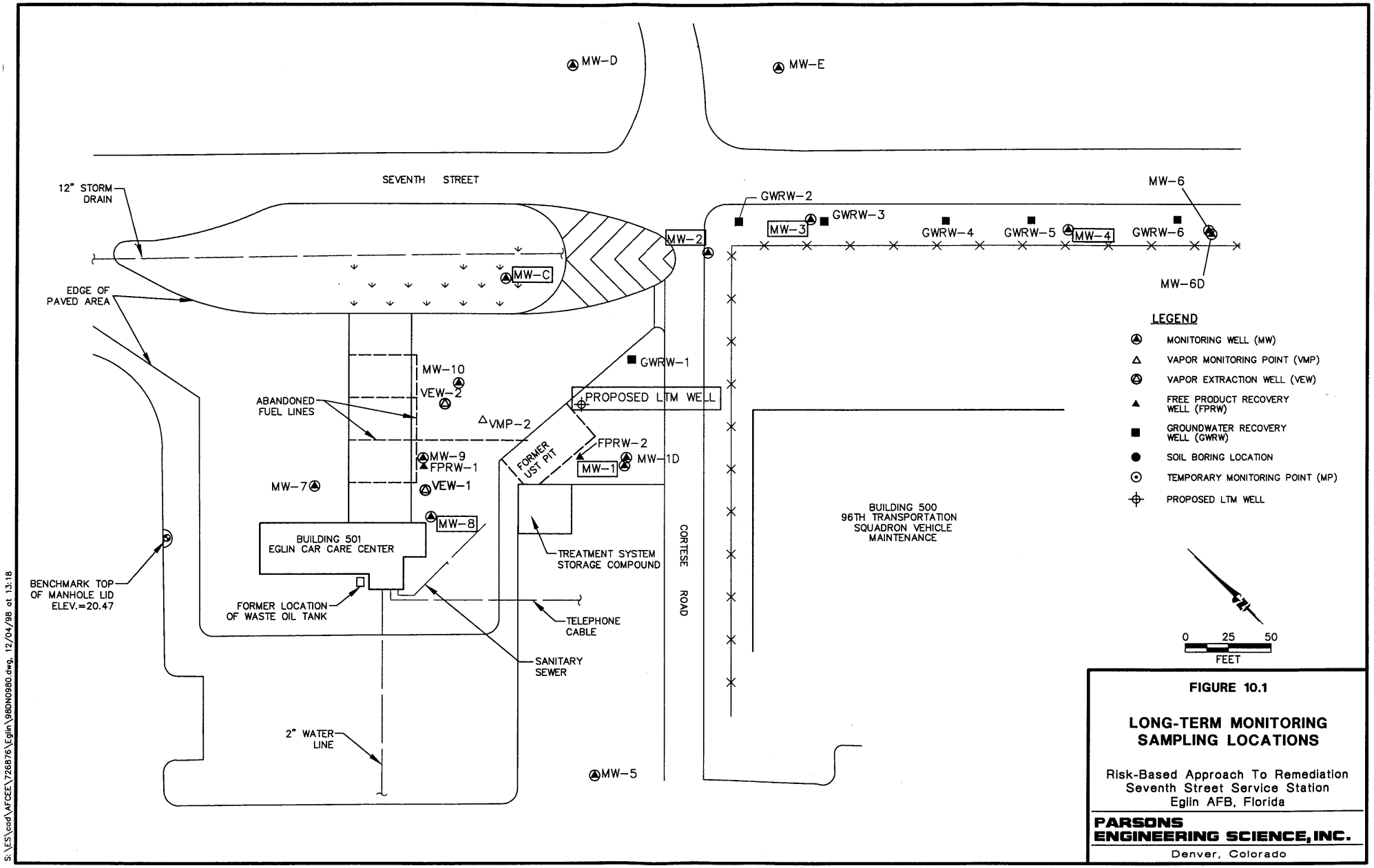


FIGURE 10.1

LONG-TERM MONITORING SAMPLING LOCATIONS

Risk-Based Approach To Remediation
Seventh Street Service Station
Eglin AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

S:\ES\cad\AFCEE\726876\Eglin\98DN0980.dwg, 12/04/98 at 13:18

10.3 SAMPLING DURATION AND FREQUENCY

Approximately 30 years of monitoring may be required to accomplish the LTM objectives listed in Section 10.1. As described in Section 6.3.2, this is the estimated time frame for maximum dissolved xylenes concentrations to decrease below the Tier 1 TCL for this compound once source reduction activities have been completed. Each of the LTM wells would be sampled biannually for the first five years to ensure that potential downgradient receptors (e.g., aquatic life in Weekly Pond) are not endangered by discontinuation of groundwater recovery and biennially (every other year) for the following 25 years. If the data collected during this time period support the effectiveness of the selected remedial alternative at this site, it may be possible to reduce or eliminate sampling. If the data collected at any time during the monitoring period indicate the need for additional remedial activities at the site, sampling frequency should be adjusted accordingly.

10.4 ANALYTICAL PROTOCOL

All LTM wells will be sampled and analyzed to verify the effectiveness of naturally-occurring remediation processes at the site. At the beginning of each sampling event, water levels should be measured in all site monitoring wells. Groundwater samples collected from the LTM wells should be analyzed for the parameters listed in Table 10.1. Biannual analysis of geochemical parameters (i.e., ferrous iron, sulfate, nitrate, and methane) is not required during the first five years of LTM; these parameters can be analyzed for annually.

TABLE 10.1
ANALYTICAL PROTOCOL FOR LONG-TERM GROUNDWATER MONITORING PROGRAM
Risk-Based Approach to Remediation
Seventh Street Service Station
Eglin AFB, Florida

Analyte	Recommended Method	Where Analyzed
Ferrous Iron (Fe^{+2})	Colorimetric, Hach Method 8146	Field
Sulfate (SO_4^{-2})	Colorimetric, Hach Method 8051	Field
Conductivity	Direct reading meter	Field
Oxygen	Direct reading meter	Field
PH	Direct reading meter	Field
Redox Potential	Direct reading meter	Field
Temperature	Direct reading meter	Field
BTEX[a/] and naphthalene	SW8260B	Fixed base lab
TRPH	FL-PRO (C8-C40)	Fixed base lab
Lead	SW7421 or Trace ICP	Fixed base lab
Nitrate as Nitrogen (NO_3^{-1} - N)	E300.0/SW9056	Fixed base lab
Methane (CH_4)	RSK-175	Fixed base lab

Notes:

a/ BTEX = benzene, toluene, ethylbenzene, and total xylenes.

SECTION 11

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APPENDIX A

LABORATORY ANALYTICAL DATA

3/25/98 1

PROJECT NAME Eglin AFB, Florida NOTEBOOK NO. _____

Record of field analysis of groundwater samples at the BX Service Station (7th St. Service Station)

Well	Analyte	Method	Concentration (mg/L)	Sample Time ~~0730~~
GWRW-6	ferrous iron	HACH Colorimetric DR/700 V. 50.01	0.00 mg/L	0730
GWRW-6	sulfate	HACH Colorimetric DR/700 V. 45.000	131 mg/L	0730
MW-4	ferrous iron		0.03 mg/L	0900
	sulfate		71 mg/L	0900
GWRW-4	ferrous iron		0.08 mg/L	0800
	sulfate		161 mg/L	0800
MW-2	ferrous iron		0.13 mg/L	1200
	sulfate		27 mg/L	
MW-2 (dup)	ferrous iron		0.12 mg/L	1200
	sulfate		36 mg/L	
MW-1	ferrous iron		0.20 mg/L	1330
	sulfate		167 mg/L	
MW-C	ferrous iron		0.01 mg/L	1600
	sulfate		45 mg/L	

SIGNATURE Cindy Nagel DATE March 25 19 98

READ AND UNDERSTOOD _____ DATE _____ 19 ____

3/26/98 2 | PROJECT NAME Eglin AFB | NOTEBOOK NO. ___

Record of field analysis of ground water samples.

Using HACH colorimeter to analyze for
ferrous iron (DR/700 Method 50.01) and
sulfate (DR/700 Method 45.000)

By Service Station

0630	MW-7	ferrous iron	0.01 mg/L
		sulfate	155 mg/L
0730	MW-D	ferrous iron	0.07 mg/L
		sulfate	89 mg/L
1230	MP-2	ferrous iron	0.55 mg/L
		sulfate	152 mg/L
	MP-2 duplicate	ferrous iron	0.56 mg/L
		sulfate	150 mg/L
1330	MP-1	ferrous iron	0.00 mg/L
		sulfate	236 mg/L

Military Gas Station

1445	EA-4	ferrous iron	0.40 mg/L
		sulfate	67 mg/L
	EA-4 dup	ferrous iron	0.40 mg/L
		sulfate	89 mg/L

SIGNATURE Cindy Nagel DATE 3/26 19
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3/31/98 4 PROJECT NAME Eglin AFB, Florida NOTEBOOK NO.

Record of field analysis for groundwater samples.

Using HACH colorimeter
Method DR/700 50.01 ferrous iron
Method DR/700 45.000 sulfate

BX Service Station SB-15/MP3
ferrous iron 3.2 mg/L
sulfate 340 mg/L

NOTE: Other field parameters (dissolved oxygen, temp., pH, conductivity, redox) are summarized on field forms in Appendix C.

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Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MW-1 (0.00,0.00)
LAB ID: 059721-0012-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 50

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	23	JM	100	2.8	ug/L
Toluene	1000	M	100	7.5	ug/L
Ethylbenzene	500	d	100	2.7	ug/L
Xylenes (total)	6600	M	100	7.5	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	92	%	44 - 165
Fluorobenzene	86	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MW-1 (0.00,0.00)
LAB ID: 059721-0012-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 50

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	23	Jd	100	2.8	ug/L
Toluene	1000	d	100	7.5	ug/L
Ethylbenzene	490	M	100	2.7	ug/L
Xylenes (total)	6600	d	100	7.5	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	95	%	44 - 165
Fluorobenzene	88	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MW-2 (0.00,0.00)
LAB ID: 059721-0001-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 200

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	60	Jd	400	11	ug/L
Toluene	8400	M	400	30	ug/L
Ethylbenzene	680	d	400	11	ug/L
Xylenes (total)	6300	d	400	30	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	101	%	44 - 165
Fluorobenzene	91	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A (Second Column)
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-2 (0.00,0.00)		
LAB ID:	059721-0001-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 06 APR 98
Instrument:	GCPID-H	Dilution: 200	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	42	JM	400	11	ug/L
Toluene	8400	d	400	30	ug/L
Ethylbenzene	660	M	400	11	ug/L
Xylenes (total)	6300	M	400	30	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	101	%	44 - 165
Fluorobenzene	92	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MW-20 (0.00,0.00)
LAB ID: 059721-0002-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 200

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	59	JM	400	11	ug/L
Toluene	8600	d	400	30	ug/L
Ethylbenzene	690	d	400	11	ug/L
Xylenes (total)	6500	d	400	30	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	98	%	44 - 165
Fluorobenzene	91	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A (Second Column)
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-20	(0.00,0.00)	
LAB ID:	059721-0002-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 06 APR 98
Instrument:	GCPID-H	Dilution: 200	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	68	Jd	400	11	ug/L
Toluene	8600	M	400	30	ug/L
Ethylbenzene	690	M	400	11	ug/L
Xylenes (total)	6500	M	400	30	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	44 - 165
Fluorobenzene	91	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MW-4 (0.00,0.00)
LAB ID: 059602-0005-SA
Matrix: GRND-H2O Sampled: 25 MAR 98 Received: 26 MAR 98
Authorized: 26 MAR 98 Prepared: 31 MAR 98 Analyzed: 31 MAR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.0	0.055	ug/L
Toluene	ND		2.0	0.065	ug/L
Chlorobenzene	ND		2.0	0.050	ug/L
Ethylbenzene	ND		2.0	0.053	ug/L
Xylenes (total)	ND		2.0	0.32	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	98	%	44 - 165
Fluorobenzene	90	%	44 - 165

ND = Not Detected

Reported By: Shawn Hadley

Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MW-07 (0.00,0.00)
LAB ID: 059619-0002-SA
Matrix: GRND-H2O Sampled: 26 MAR 98 Received: 27 MAR 98
Authorized: 27 MAR 98 Prepared: 28 MAR 98 Analyzed: 28 MAR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.0	0.055	ug/L
Toluene	ND		2.0	0.065	ug/L
Chlorobenzene	ND		2.0	0.050	ug/L
Ethylbenzene	ND		2.0	0.053	ug/L
Xylenes (total)	ND		2.0	0.32	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	44 - 165
Fluorobenzene	89	%	44 - 165

ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

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Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MW-C (0.00,0.00)
LAB ID: 059619-0001-SA
Matrix: GRND-H2O Sampled: 25 MAR 98 Received: 27 MAR 98
Authorized: 27 MAR 98 Prepared: 28 MAR 98 Analyzed: 28 MAR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.0	0.055	ug/L
Toluene	ND		2.0	0.065	ug/L
Chlorobenzene	ND		2.0	0.050	ug/L
Ethylbenzene	ND		2.0	0.053	ug/L
Xylenes (total)	ND		2.0	0.32	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	44 - 165
Fluorobenzene	91	%	44 - 165

ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-D (0.00,0.00)		
LAB ID:	059721-0006-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 06 APR 98
Instrument:	GCPID-H	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.0	0.055	ug/L
Toluene	ND		2.0	0.065	ug/L
Ethylbenzene	ND		2.0	0.053	ug/L
Xylenes (total)	ND		2.0	0.32	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	97	%	44 - 165
Fluorobenzene	90	%	44 - 165

ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-GWRW-4 (0.00,0.00)
LAB ID: 059721-0005-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 25

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	24	Jd	50	1.4	ug/L
Toluene	590	M	50	1.6	ug/L
Ethylbenzene	81	d	50	1.3	ug/L
Xylenes (total)	650	M	50	8.0	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	44 - 165
Fluorobenzene	94	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-GWRW-4 (0.00,0.00)		
LAB ID:	059721-0005-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 06 APR 98
Instrument:	GCPID-H	Dilution: 25	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	23	JM	50	1.4	ug/L
Toluene	590	d	50	3.8	ug/L
Ethylbenzene	80	M	50	1.4	ug/L
Xylenes (total)	650	d	50	3.8	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	44 - 165
Fluorobenzene	94	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-GWRW-6	(0.00,0.00)	
LAB ID:	059602-0004-SA		
Matrix:	GRND-H2O	Sampled: 25 MAR 98	Received: 26 MAR 98
Authorized:	26 MAR 98	Prepared: 31 MAR 98	Analyzed: 31 MAR 98
Instrument:	GCPID-H	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.0	0.055	ug/L
Toluene	ND		2.0	0.065	ug/L
Chlorobenzene	ND		2.0	0.050	ug/L
Ethylbenzene	ND		2.0	0.053	ug/L
Xylenes (total)	ND		2.0	0.32	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	44 - 165
Fluorobenzene	90	%	44 - 165

ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics by Method 8020A
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MP-1 (0.00,0.00)
LAB ID: 059721-0013-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.0	0.055	ug/L
Toluene	ND		2.0	0.065	ug/L
Ethylbenzene	ND		2.0	0.053	ug/L
Xylenes (total)	ND		2.0	0.32	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	44 - 165
Fluorobenzene	85	%	44 - 165

ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059721-0004-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 500

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	140	Jd	1000	28	ug/L
Toluene	11000	M	1000	75	ug/L
Ethylbenzene	1700	d	1000	27	ug/L
Xylenes (total)	14000	d	1000	75	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	94	%	44 - 165
Fluorobenzene	85	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059721-0004-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 500

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	86	JM	1000	28	ug/L
Toluene	11000	d	1000	75	ug/L
Ethylbenzene	1600	M	1000	27	ug/L
Xylenes (total)	13000	M	1000	75	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	96	%	44 - 165
Fluorobenzene	85	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A with MTBE & TMBs
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB15 MP-3 (0.00,0.00)
LAB ID: 059721-0007-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	5.8	JM	20	0.55	ug/L
Toluene	180	d	20	0.65	ug/L
Ethylbenzene	160	d	20	0.53	ug/L
Xylenes (total)	720	d	20	3.2	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	94	%	44 - 165
Fluorobenzene	88	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic VOAs by Method 8020A (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB15 MP-3 (0.00,0.00)
LAB ID: 059721-0007-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 06 APR 98
Instrument: GCPID-H Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	6.2	Jd	20	0.55	ug/L
Toluene	180	M	20	0.65	ug/L
Ethylbenzene	160	M	20	0.53	ug/L
Xylenes (total)	720	M	20	3.2	ug/L

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	97	%	44 - 165
Fluorobenzene	88	%	44 - 165

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

Method 504 - EDB
Method 504

Client Name: Parsons Engineering Science
Client ID: BX-MW-1 (0.00,0.00)
LAB ID: 059721-0012-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 13 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
EDB (1,2-Dibromoethane)	ND		0.020	0.0060	ug/L

Surrogate	Recovery		Acceptable Range
1,1,1,2-Tetrachloroethane	118	%	80 - 120

ND = Not Detected

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method 504 - EDB
Method 504

Client Name: Parsons Engineering Science
Client ID: BX-MW-2 (0.00,0.00)
LAB ID: 059721-0001-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 13 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
EDB (1,2-Dibromoethane)	ND		0.020	0.0060	ug/L

Surrogate	Recovery		Acceptable Range
1,1,1,2-Tetrachloroethane	114	%	80 - 120

ND = Not Detected

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

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Quanterra
Environmental Services

Method 504 - EDB
Method 504

Client Name: Parsons Engineering Science
Client ID: BX-MW-20 (0.00,0.00)
LAB ID: 059721-0002-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 13 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
EDB (1,2-Dibromoethane)	ND		0.020	0.0060	ug/L

Surrogate	Recovery		Acceptable Range
1,1,1,2-Tetrachloroethane	98.0	%	80 - 120

ND = Not Detected

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method 504 - EDB
Method 504

Client Name: Parsons Engineering Science
Client ID: BX-MW-4 (0.00,0.00)
LAB ID: 059638-0001-SA
Matrix: GRND-H2O Sampled: 27 MAR 98 Received: 28 MAR 98
Authorized: 28 MAR 98 Prepared: 03 APR 98 Analyzed: 04 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
EDB (1,2-Dibromoethane)	ND		0.020	0.0060	ug/L

Surrogate	Recovery		Acceptable Range
1,1,1,2-Tetrachloroethane	106	%	80 - 120

ND = Not Detected

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method 504 - EDB
Method 504

Client Name: Parsons Engineering Science
Client ID: BX-GWRW-4 (0.00,0.00)
LAB ID: 059721-0005-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 13 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
EDB (1,2-Dibromoethane)	ND		0.020	0.0060	ug/L

Surrogate	Recovery		Acceptable Range
1,1,1,2-Tetrachloroethane	101	%	80 - 120

ND = Not Detected

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method 504 - EDB
Method 504

Client Name:	Parsons Engineering Science		
Client ID:	BX-GWRW-6	(0.00,0.00)	
LAB ID:	059602-0004-SA		
Matrix:	GRND-H2O	Sampled: 25 MAR 98	Received: 26 MAR 98
Authorized:	26 MAR 98	Prepared: 31 MAR 98	Analyzed: 31 MAR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
EDB (1,2-Dibromoethane)	ND		0.020	0.0060	ug/L

Surrogate	Recovery		Acceptable Range
1,1,1,2-Tetrachloroethane	104	%	80 - 120

ND = Not Detected

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method 504 - EDB
Method 504

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059721-0004-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 13 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
EDB (1,2-Dibromoethane)	ND		0.020	0.0060	ug/L

Surrogate	Recovery		Acceptable Range
1,1,1,2-Tetrachloroethane	112	%	80 - 120

ND = Not Detected

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Second Column)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MW-1 (0.00,0.00)
LAB ID: 059721-0012-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		10	0.96	ug/L
Acenaphthylene	ND		10	0.41	ug/L
Anthracene	0.57	Jd	1.0	0.31	ug/L
Benzo(a)anthracene	ND		1.3	0.62	ug/L
Benzo(a)pyrene	ND		2.4	0.67	ug/L
Benzo(b)fluoranthene	ND		1.9	0.61	ug/L
Benzo(g,h,i)perylene	ND		2.1	0.73	ug/L
Benzo(k)fluoranthene	ND		1.8	0.61	ug/L
Chrysene	ND		2.1	0.75	ug/L
Dibenz(a,h)anthracene	ND		3.1	0.78	ug/L
Fluorene	ND		2.1	0.36	ug/L
Fluoranthene	1.6	JM	2.1	0.37	ug/L
Indeno(1,2,3-cd)pyrene	ND		4.4	0.57	ug/L
Naphthalene	370	M	10	0.61	ug/L
Phenanthrene	0.85	JM	2.1	0.31	ug/L
Pyrene	1.7	JM	2.1	0.44	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MW-1 (0.00,0.00)
LAB ID: 059721-0012-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		10	0.96	ug/L
Acenaphthylene	ND		10	0.41	ug/L
Anthracene	0.57	JM	1.0	0.31	ug/L
Benzo(a)anthracene	ND		1.3	0.62	ug/L
Benzo(a)pyrene	ND		2.4	0.67	ug/L
Benzo(b)fluoranthene	ND		1.9	0.61	ug/L
Benzo(g,h,i)perylene	ND		2.1	0.73	ug/L
Benzo(k)fluoranthene	ND		1.8	0.61	ug/L
Chrysene	ND		2.1	0.75	ug/L
Dibenz(a,h)anthracene	ND		3.1	0.78	ug/L
Fluorene	ND		2.1	0.36	ug/L
Fluoranthene	2.6	d	2.1	0.37	ug/L
Indeno(1,2,3-cd)pyrene	ND		4.4	0.57	ug/L
Naphthalene	400	d	10	0.61	ug/L
Phenanthrene	2.7	d	2.1	0.31	ug/L
Pyrene	1.8	Jd	2.1	0.44	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MW-2 (0.00,0.00)
LAB ID: 059721-0001-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		10	0.93	ug/L
Acenaphthylene	ND		10	0.40	ug/L
Anthracene	ND		1.0	0.30	ug/L
Benzo(a)anthracene	ND		1.3	0.60	ug/L
Benzo(a)pyrene	ND		2.3	0.65	ug/L
Benzo(b)fluoranthene	ND		1.8	0.59	ug/L
Benzo(g,h,i)perylene	ND		2.0	0.71	ug/L
Benzo(k)fluoranthene	ND		1.7	0.59	ug/L
Chrysene	ND		2.0	0.73	ug/L
Dibenz(a,h)anthracene	ND		3.0	0.76	ug/L
Fluorene	ND		2.0	0.35	ug/L
Fluoranthene	ND		2.0	0.36	ug/L
Indeno(1,2,3-cd)pyrene	ND		4.3	0.55	ug/L
Naphthalene	330	d	10	0.59	ug/L
Phenanthrene	ND		2.0	0.30	ug/L
Pyrene	ND		2.0	0.43	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

d = See Preferred Result on Other Column
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Second Column)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MW-2 (0.00,0.00)
LAB ID: 059721-0001-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		10	0.93	ug/L
Acenaphthylene	ND		10	0.40	ug/L
Anthracene	ND		1.0	0.30	ug/L
Benzo(a)anthracene	ND		1.3	0.60	ug/L
Benzo(a)pyrene	ND		2.3	0.65	ug/L
Benzo(b)fluoranthene	ND		1.8	0.59	ug/L
Benzo(g,h,i)perylene	ND		2.0	0.71	ug/L
Benzo(k)fluoranthene	ND		1.7	0.59	ug/L
Chrysene	ND		2.0	0.73	ug/L
Dibenz(a,h)anthracene	ND		3.0	0.76	ug/L
Fluorene	ND		2.0	0.35	ug/L
Fluoranthene	ND		2.0	0.36	ug/L
Indeno(1,2,3-cd)pyrene	ND		4.3	0.55	ug/L
Naphthalene	280	M	10	0.59	ug/L
Phenanthrene	ND		2.0	0.30	ug/L
Pyrene	ND		2.0	0.43	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

M = Preferred Result
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MW-20 (0.00,0.00)
LAB ID: 059721-0002-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		10	0.95	ug/L
Acenaphthylene	ND		10	0.41	ug/L
Anthracene	ND		1.0	0.31	ug/L
Benzo(a)anthracene	ND		1.3	0.61	ug/L
Benzo(a)pyrene	ND		2.3	0.66	ug/L
Benzo(b)fluoranthene	ND		1.8	0.60	ug/L
Benzo(g,h,i)perylene	ND		2.0	0.72	ug/L
Benzo(k)fluoranthene	ND		1.7	0.60	ug/L
Chrysene	ND		2.0	0.74	ug/L
Dibenz(a,h)anthracene	ND		3.1	0.78	ug/L
Fluorene	ND		2.0	0.36	ug/L
Fluoranthene	ND		2.0	0.37	ug/L
Indeno(1,2,3-cd)pyrene	ND		4.4	0.56	ug/L
Naphthalene	310	d	10	0.60	ug/L
Phenanthrene	ND		2.0	0.31	ug/L
Pyrene	ND		2.0	0.44	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

d = See Preferred Result on Other Column
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Second Column)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MW-20 (0.00,0.00)
LAB ID: 059721-0002-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		10	0.95	ug/L
Acenaphthylene	ND		10	0.41	ug/L
Anthracene	ND		1.0	0.31	ug/L
Benzo(a)anthracene	ND		1.3	0.61	ug/L
Benzo(a)pyrene	ND		2.3	0.66	ug/L
Benzo(b)fluoranthene	ND		1.8	0.60	ug/L
Benzo(g,h,i)perylene	ND		2.0	0.72	ug/L
Benzo(k)fluoranthene	ND		1.7	0.60	ug/L
Chrysene	ND		2.0	0.74	ug/L
Dibenz(a,h)anthracene	ND		3.1	0.78	ug/L
Fluorene	ND		2.0	0.36	ug/L
Fluoranthene	ND		2.0	0.37	ug/L
Indeno(1,2,3-cd)pyrene	ND		4.4	0.56	ug/L
Naphthalene	270	M	10	0.60	ug/L
Phenanthrene	ND		2.0	0.31	ug/L
Pyrene	ND		2.0	0.44	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

M = Preferred Result
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MW-4 (0.00,0.00)
LAB ID: 059602-0005-SA
Matrix: GRND-H2O Sampled: 25 MAR 98 Received: 26 MAR 98
Authorized: 26 MAR 98 Prepared: 01 APR 98 Analyzed: 18 APR 98
Instrument: HPLC-Q Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		1.0	0.095	ug/L
Acenaphthylene	ND		1.0	0.041	ug/L
Anthracene	ND		0.10	0.031	ug/L
Benzo(a)anthracene	ND		0.13	0.062	ug/L
Benzo(a)pyrene	ND		0.24	0.067	ug/L
Benzo(b)fluoranthene	ND		0.18	0.061	ug/L
Benzo(g,h,i)perylene	ND		0.21	0.073	ug/L
Benzo(k)fluoranthene	ND		0.17	0.061	ug/L
Chrysene	ND		0.21	0.075	ug/L
Dibenz(a,h)anthracene	ND		0.31	0.078	ug/L
Fluorene	ND		0.21	0.036	ug/L
Fluoranthene	ND		0.21	0.037	ug/L
Indeno(1,2,3-cd)pyrene	ND		0.44	0.056	ug/L
Naphthalene	ND		1.0	0.061	ug/L
Phenanthrene	ND		0.21	0.031	ug/L
Pyrene	ND		0.21	0.044	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	107	%	25 - 157

ND = Not Detected

Reported By: Blake Besser

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-GWRW-4 (0.00,0.00)
LAB ID: 059721-0005-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 22 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		1.0	0.093	ug/L
Acenaphthylene	ND		1.0	0.040	ug/L
Anthracene	ND		0.10	0.030	ug/L
Benzo(a)anthracene	ND		0.13	0.060	ug/L
Benzo(a)pyrene	ND		0.23	0.065	ug/L
Benzo(b)fluoranthene	ND		0.18	0.059	ug/L
Benzo(g,h,i)perylene	ND		0.20	0.071	ug/L
Benzo(k)fluoranthene	ND		0.17	0.059	ug/L
Chrysene	ND		0.20	0.073	ug/L
Dibenz(a,h)anthracene	ND		0.30	0.076	ug/L
Fluorene	ND		0.20	0.035	ug/L
Fluoranthene	ND		0.20	0.036	ug/L
Indeno(1,2,3-cd)pyrene	ND		0.43	0.055	ug/L
Naphthalene	35	d	1.0	0.059	ug/L
Phenanthrene	ND		0.20	0.030	ug/L
Pyrene	ND		0.20	0.043	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	111	%	25 - 157

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Second Column)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-GWRW-4 (0.00,0.00)
LAB ID: 059721-0005-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 22 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		1.0	0.093	ug/L
Acenaphthylene	ND		1.0	0.040	ug/L
Anthracene	ND		0.10	0.030	ug/L
Benzo(a)anthracene	ND		0.13	0.060	ug/L
Benzo(a)pyrene	ND		0.23	0.065	ug/L
Benzo(b)fluoranthene	ND		0.18	0.059	ug/L
Benzo(g,h,i)perylene	ND		0.20	0.071	ug/L
Benzo(k)fluoranthene	ND		0.17	0.059	ug/L
Chrysene	ND		0.20	0.073	ug/L
Dibenz(a,h)anthracene	ND		0.30	0.076	ug/L
Fluorene	ND		0.20	0.035	ug/L
Fluoranthene	ND		0.20	0.036	ug/L
Indeno(1,2,3-cd)pyrene	ND		0.43	0.055	ug/L
Naphthalene	32	M	1.0	0.059	ug/L
Phenanthrene	ND		0.20	0.030	ug/L
Pyrene	ND		0.20	0.043	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	113	%	25 - 157

M = Preferred Result
ND = Not Detected

Reported By: Blake Besser

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-GWRW-6 (0.00,0.00)
LAB ID: 059602-0004-SA
Matrix: GRND-H2O Sampled: 25 MAR 98 Received: 26 MAR 98
Authorized: 26 MAR 98 Prepared: 01 APR 98 Analyzed: 18 APR 98
Instrument: HPLC-Q Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		1.0	0.093	ug/L
Acenaphthylene	ND		1.0	0.040	ug/L
Anthracene	ND		0.10	0.030	ug/L
Benzo(a)anthracene	ND		0.13	0.060	ug/L
Benzo(a)pyrene	ND		0.23	0.065	ug/L
Benzo(b)fluoranthene	ND		0.18	0.059	ug/L
Benzo(g,h,i)perylene	ND		0.20	0.071	ug/L
Benzo(k)fluoranthene	ND		0.17	0.059	ug/L
Chrysene	ND		0.20	0.073	ug/L
Dibenz(a,h)anthracene	ND		0.30	0.076	ug/L
Fluorene	ND		0.20	0.035	ug/L
Fluoranthene	ND		0.20	0.036	ug/L
Indeno(1,2,3-cd)pyrene	ND		0.43	0.055	ug/L
Naphthalene	ND		1.0	0.059	ug/L
Phenanthrene	ND		0.20	0.030	ug/L
Pyrene	ND		0.20	0.043	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	102	%	25 - 157

ND = Not Detected

Reported By: Blake Besser

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059721-0004-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		20	1.9	ug/L
Acenaphthylene	ND		20	0.81	ug/L
Anthracene	ND		2.0	0.61	ug/L
Benzo(a)anthracene	ND		2.6	1.2	ug/L
Benzo(a)pyrene	ND		4.6	1.3	ug/L
Benzo(b)fluoranthene	ND		3.6	1.2	ug/L
Benzo(g,h,i)perylene	ND		4.0	1.4	ug/L
Benzo(k)fluoranthene	ND		3.4	1.2	ug/L
Chrysene	ND		4.0	1.5	ug/L
Dibenz(a,h)anthracene	ND		6.1	1.5	ug/L
Fluorene	ND		4.0	0.71	ug/L
Fluoranthene	ND		4.0	0.73	ug/L
Indeno(1,2,3-cd)pyrene	ND		8.7	1.1	ug/L
Naphthalene	600	d	20	1.2	ug/L
Phenanthrene	ND		4.0	0.61	ug/L
Pyrene	ND		4.0	0.87	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

d = See Preferred Result on Other Column
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Second Column)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059721-0004-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 28 APR 98
Instrument: HPLC-Y Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		20	1.9	ug/L
Acenaphthylene	ND		20	0.81	ug/L
Anthracene	ND		2.0	0.61	ug/L
Benzo(a)anthracene	ND		2.6	1.2	ug/L
Benzo(a)pyrene	ND		4.6	1.3	ug/L
Benzo(b)fluoranthene	ND		3.6	1.2	ug/L
Benzo(g,h,i)perylene	ND		4.0	1.4	ug/L
Benzo(k)fluoranthene	ND		3.4	1.2	ug/L
Chrysene	ND		4.0	1.5	ug/L
Dibenz(a,h)anthracene	ND		6.1	1.5	ug/L
Fluorene	ND		4.0	0.71	ug/L
Fluoranthene	ND		4.0	0.73	ug/L
Indeno(1,2,3-cd)pyrene	ND		8.7	1.1	ug/L
Naphthalene	510	M	20	1.2	ug/L
Phenanthrene	ND		4.0	0.61	ug/L
Pyrene	ND		4.0	0.87	ug/L

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	NC	%	25 - 157

M = Preferred Result
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Reported By: Blake Besser Approved By: Barbara Sullivan

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-MW-1 (0.00,0.00)
LAB ID: 059721-0012-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 08 APR 98
Instrument: GCFID-I Dilution: 2.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	22		1.0	0.38	mg/L

Surrogate	Recovery		Acceptable Range
o-Terphenyl	94	%	33 - 162
Nonatriacontane	102	%	10 - 109

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-MW-2 (0.00,0.00)
LAB ID: 059721-0001-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 08 APR 98
Instrument: GCFID-I Dilution: 2.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	25		1.0	0.38	mg/L

Surrogate	Recovery		Acceptable Range
o-Terphenyl	105	%	33 - 162
Nonatriacontane	110	%	10 - 109

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-20 (0.00,0.00)		
LAB ID:	059721-0002-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 08 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	16		0.50	0.19	mg/L

Surrogate	Recovery		Acceptable Range
o-Terphenyl	88	%	33 - 162
Nonatriacontane	75	%	10 - 109

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-MP-2	(0.00,0.00)	
LAB ID:	059721-0004-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 08 APR 98
Instrument:	GCFID-I	Dilution: 4.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	38		2.0	0.76	mg/L

Surrogate	Recovery		Acceptable Range
o-Terphenyl	89	%	33 - 162
Nonatriacontane	91	%	10 - 109

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method EPA-9 RSK-175 by GC/FID
Method EPA-9 RSK-175

Client Name: Parsons Engineering Science
Client ID: BX-MW-1 (0.00,0.00)
LAB ID: 059721-0012-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: N/A Analyzed: 13 APR 98
Instrument: GCFID-K1A Dilution: 50

Parameter	Result	Qualifier	RL	MDL	Units
Methane	2400	B	25	2.6	ug/L

B = Compound is also detected in the blank.

Reported By: Quanterra-Austin Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method EPA-9 RSK-175 by GC/FID
Method EPA-9 RSK-175

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-2	(0.00,0.00)	
LAB ID:	059721-0001-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: N/A	Analyzed: 13 APR 98
Instrument:	GCFID-K1A	Dilution: 5.0	

Parameter	Result	Qualifier	RL	MDL	Units
Methane	200	B	2.5	0.26	ug/L

B = Compound is also detected in the blank.

Reported By: Quanterra-Austin Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method EPA-9 RSK-175 by GC/FID
Method EPA-9 RSK-175

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-20 (0.00,0.00)		
LAB ID:	059721-0002-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: N/A	Analyzed: 13 APR 98
Instrument:	GCFID-K1A	Dilution: 5.0	

Parameter	Result	Qualifier	RL	MDL	Units
Methane	180	B	2.5	0.26	ug/L

B = Compound is also detected in the blank.

Reported By: Quanterra-Austin Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method EPA-9 RSK-175 by GC/FID
Method EPA-9 RSK-175

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-07	(0.00,0.00)	
LAB ID:	059619-0002-SA		
Matrix:	GRND-H2O	Sampled: 26 MAR 98	Received: 27 MAR 98
Authorized:	27 MAR 98	Prepared: N/A	Analyzed: 06 APR 98
Instrument:	GCFID-K1A	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Methane	0.24	JB	0.50	0.052	ug/L

B = Compound is also detected in the blank.
J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Austin

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method EPA-9 RSK-175 by GC/FID
Method EPA-9 RSK-175

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-C (0.00,0.00)		
LAB ID:	059619-0001-SA		
Matrix:	GRND-H2O	Sampled: 25 MAR 98	Received: 27 MAR 98
Authorized:	27 MAR 98	Prepared: N/A	Analyzed: 06 APR 98
Instrument:	GCFID-K1A	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Methane	2.1	B	0.50	0.052	ug/L

B = Compound is also detected in the blank.

Reported By: Quanterra-Austin Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method EPA-9 RSK-175 by GC/FID
Method EPA-9 RSK-175

Client Name:	Parsons Engineering Science		
Client ID:	BX-MW-D	(0.00,0.00)	
LAB ID:	059721-0006-SA		
Matrix:	GRND-H2O	Sampled: 31 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: N/A	Analyzed: 13 APR 98
Instrument:	GCFID-K1A	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Methane	0.15	JB	0.50	0.052	ug/L

B = Compound is also detected in the blank.
J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Austin Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method EPA-9 RSK-175 by GC/FID
Method EPA-9 RSK-175

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059721-0004-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: N/A Analyzed: 13 APR 98
Instrument: GCFID-K1A Dilution: 50

Parameter	Result	Qualifier	RL	MDL	Units
Methane	2000	B	25	2.6	ug/L

B = Compound is also detected in the blank.

Reported By: Quanterra-Austin Approved By: Cynthia Prentice

Quanterra
Environmental Services

General Inorganics

Client Name: Parsons Engineering Science
Client ID: BX-MW-07 (0.00,0.00)
LAB ID: 059619-0002-SA
Matrix: GRND-H2O Sampled: 26 MAR 98 Received: 27 MAR 98
Authorized: 27 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Nitrate as N	1.9		1.0	0.040	0.50	mg/L	9056	NA	27 MAR 98

Reported By: Patty Jungk

Approved By: Jan Ecos

Quanterra
Environmental Services

General Inorganics

Client Name: Parsons Engineering Science
Client ID: BX-MW-C (0.00,0.00)
LAB ID: 059602-0003-SA
Matrix: GRND-H2O Sampled: 25 MAR 98 Received: 26 MAR 98
Authorized: 26 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Nitrate as N	0.14	J	1.0	0.040	0.50	mg/L	9056	NA	26 MAR 98

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Patty Jungk Approved By: Linda Sullivan

Quanterra
Environmental Services

General Inorganics

Client Name: Parsons Engineering Science
Client ID: BX-MW-D (0.00,0.00)
LAB ID: 059619-0003-SA
Matrix: GRND-H2O Sampled: 26 MAR 98 Received: 27 MAR 98
Authorized: 27 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Nitrate as N	0.84		1.0	0.040	0.50	mg/L	9056	NA	27 MAR 98

Reported By: Patty Jungk

Approved By: Jan Ecos

Quanterra
Environmental Services

General Inorganics

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059619-0005-SA
Matrix: GRND-H2O Sampled: 26 MAR 98 Received: 27 MAR 98
Authorized: 27 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Nitrate as N	ND		1.0	0.040	0.50	mg/L	9056	NA	27 MAR 98

ND = Not Detected

Reported By: Patty Jungk Approved By: Jan Ecos

SAMPLE DESCRIPTION INFORMATION
for
Parsons Engineering Science

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
059602-0001-SA	BX-MW1	GRND-H2O	25 MAR 98	13:30	26 MAR 98
059602-0001-MS	BX-MW1	GRND-H2O	25 MAR 98	13:45	26 MAR 98
059602-0001-SD	BX-MW1	GRND-H2O	25 MAR 98	14:00	26 MAR 98
059602-0002-TB	TRIP BLANK	WATER-QA	25 MAR 98		26 MAR 98
059602-0003-SA	BX-MW-C	GRND-H2O	25 MAR 98	16:00	26 MAR 98
059602-0004-SA	BX-GWRW-6	GRND-H2O	25 MAR 98	07:30	26 MAR 98
059602-0005-SA	BX-MW-4	GRND-H2O	25 MAR 98	09:00	26 MAR 98
059602-0006-SA	BX-GWRW-4	GRND-H2O	25 MAR 98	08:00	26 MAR 98
059602-0007-SA	BX-MW-2	GRND-H2O	25 MAR 98	12:00	26 MAR 98
059602-0008-SA	BX-MW-20	GRND-H2O	25 MAR 98	18:00	26 MAR 98
059602-0009-TB	TRIP BLANK	WATER-QA	25 MAR 98		26 MAR 98

ION CHROMATOGRAPHY ANALYST RTrujillo DATE 3 series = S1 SOP DEN-WC-0020

Sample Name	Dilution Factor	FLUORIDE Conc	NITRITE Conc (MDL=0.05)	NITRATE Conc (MDL=0.05 mg/L)	PHOSPHATE C
ICV 03/24/98	1	1.98006	1.97316	1.98947	1.93739
ICB 03/26	1	ND	ND	ND	ND
DCS-1/LCS 03/24/98 17:19	1	4.79643	5.0036	5.21521	5.05282
DCS-2 17:28	1	4.73747	5.14394	5.29075	5.07392
BLANK S1 17:38	1	ND	ND	ND	ND
59602-01 17:47	1	ND	J 0.146719	J 0.218882	ND
59602-01 MS2X 17:57	2	4.89828	4.80423	5.29736	4.88841
59602-01 SD2X 18:07	2	5.24726	4.85754	5.2496	5.05245
59602-03 18:16	1	ND	ND	J 0.144683	0.140151
59602-07 18:26	1	0.30261	ND	1.61716	ND
59602-08 18:35	1	0.277886	ND	1.69863	ND
59606-01 18:45	1	ND	ND	ND	ND
CCV 03/24/98	1	1.95362	1.96496	1.96608	2.01983
CCB	1	ND	ND	ND	ND

MS/SD = (½ sample + ½ DCS) x2 = 5.0 ppm NO_3, NO_2

Units = mg/L

[redacted]

Facsimile Transmittal

Quanterra Incorporated
4955 Yarrow Street
Arvada, CO 80002
Phone: (303)421-6611
Fax: (303)431-7171
www.quanterra.com

Quanterra®

Date: 6/1/98

Deliver To: John Hicks

Company: Parsons

Fax Number: 831-8201

From: Ellen La Riviere

Number of Pages Including This Page: 3 *(If you did not receive all pages, please call (303)421-6611.)*

Comments:

Nitrate and Nitrite data for Eglin.

Ellen

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Quanterra
Environmental Services

AFCEE
Total Metals

Client Name: Parsons Engineering Science
Client ID: BX MW1 (0.00,0.00)
LAB ID: 059602-0001-SA
Matrix: GRND-H2O Sampled: 25 MAR 98 Received: 26 MAR 98
Authorized: 26 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	0.012		1.0	0.0010	0.0050	mg/L	SW7421	03 APR 98	06 APR 98

Reported By: Robin Proctor Approved By: Richard Persichitte

Quanterra
Environmental Services

AFCEE
Total Metals

Client Name: Parsons Engineering Science
Client ID: BX-MW-2 (0.00,0.00)
LAB ID: 059602-0007-SA
Matrix: GRND-H2O
Authorized: 26 MAR 98

Sampled: 25 MAR 98
Prepared: See Below

Received: 26 MAR 98
Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	ND	W	1.0	0.0010	0.0050	mg/L	SW7421	03 APR 98	06 APR 98

W = Post-digestion spike for furnace AA out of control limits while sample absorbance is less than 50% of spike absorbance
ND = Not Detected

Reported By: Robin Proctor

Approved By: Richard Persichitte

Quanterra
Environmental Services

AFCEE
Total Metals

Client Name: Parsons Engineering Science
Client ID: BX-MW-20 (0.00,0.00)
LAB ID: 059602-0008-SA
Matrix: GRND-H2O Sampled: 25 MAR 98 Received: 26 MAR 98
Authorized: 26 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	0.0033	JW	1.0	0.0010	0.0050	mg/L	SW7421	03 APR 98	06 APR 98

J = Result is detected below the reporting limit or is an estimated concentration.
W = Post-digestion spike for furnace AA out of control limits while sample absorbance is less than 50% of spike absorbance

Reported By: Robin Proctor Approved By: Richard Persichitte

Quanterra
Environmental Services

AFCEE
Total Metals

Client Name: Parsons Engineering Science
Client ID: BX-MW-D (0.00,0.00)
LAB ID: 059721-0006-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	0.0012	JW	1.0	0.0010	0.0050	mg/L	SW7421	06 APR 98	07 APR 98

J = Result is detected below the reporting limit or is an estimated concentration.
W = Post-digestion spike for furnace AA out of control limits while sample absorbance is less than 50% of spike absorbance

Reported By: Robin Proctor Approved By: Kathy Wakeman

Quanterra
Environmental Services

AFCEE
Total Metals

Client Name: Parsons Engineering Science
Client ID: BX-GWRW-4 (0.00,0.00)
LAB ID: 059721-0005-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	0.0021	JW	1.0	0.0010	0.0050	mg/L	SW7421	06 APR 98	07 APR 98

J = Result is detected below the reporting limit or is an estimated concentration.
W = Post-digestion spike for furnace AA out of control limits while sample absorbance is less than 50% of spike absorbance

Reported By: Robin Proctor Approved By: Kathy Wakeman

Quanterra
Environmental Services

AFCEE
Total Metals

Client Name: Parsons Engineering Science
Client ID: BX-MP-1 (0.00,0.00)
LAB ID: 059721-0013-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	0.0011	J	1.0	0.0010	0.0050	mg/L	SW7421	06 APR 98	07 APR 98

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Robin Proctor Approved By: Kathy Wakeman

Quanterra
Environmental Services

AFCEE
Total Metals

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059619-0005-SA
Matrix: GRND-H2O Sampled: 26 MAR 98 Received: 27 MAR 98
Authorized: 27 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	0.019		1.0	0.0010	0.0050	mg/L	SW7421	31 MAR 98	01 APR 98

Reported By: Robin Proctor Approved By: Jan Ecos

Quanterra
Environmental Services

AFCEE
Dissolved Metals

Client Name: Parsons Engineering Science
Client ID: BX-MW-D (0.00,0.00)
LAB ID: 059721-0006-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	ND		1.0	0.0010	0.0050	mg/L	SW7421	03 APR 98	06 APR 98

ND = Not Detected

Reported By: Robin Proctor Approved By: Kathy Wakeman

Quanterra
Environmental Services

AFCEE
Dissolved Metals

Client Name: Parsons Engineering Science
Client ID: BX-GWRW-4 (0.00,0.00)
LAB ID: 059721-0005-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	ND		1.0	0.0010	0.0050	mg/L	SW7421	03 APR 98	06 APR 98

ND = Not Detected

Reported By: Robin Proctor Approved By: Kathy Wakeman

Quanterra
Environmental Services

AFCEE
Dissolved Metals

Client Name: Parsons Engineering Science
Client ID: BX-MP-1 (0.00,0.00)
LAB ID: 059721-0013-SA
Matrix: GRND-H2O Sampled: 31 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	ND		1.0	0.0010	0.0050	mg/L	SW7421	03 APR 98	06 APR 98

ND = Not Detected

Reported By: Robin Proctor

Approved By: Kathy Wakeman

Quanterra
Environmental Services

AFCEE
Dissolved Metals

Client Name: Parsons Engineering Science
Client ID: BX-MP-2 (0.00,0.00)
LAB ID: 059619-0005-SA
Matrix: GRND-H2O Sampled: 26 MAR 98 Received: 27 MAR 98
Authorized: 27 MAR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Lead	0.0011	JW	1.0	0.0010	0.0050	mg/L	SW7421	03 APR 98	06 APR 98

J = Result is detected below the reporting limit or is an estimated concentration.
W = Post-digestion spike for furnace AA out of control limits while sample absorbance is less than 50% of spike absorbance

Reported By: Robin Proctor Approved By: Jan Ecos

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S3 (0.00,0.00)
LAB ID: 059724-0020-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		1.2	0.12	mg/kg
Toluene	ND		1.2	0.29	mg/kg
Ethylbenzene	4.1	BM	0.48	0.12	mg/kg
Xylenes (total)	13	M	1.2	0.36	mg/kg
Methyl-tert-butyl ether	ND		1.2	0.36	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 17.1%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S3 (0.00,0.00)
LAB ID: 059724-0020-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		1.2	0.12	mg/kg
Toluene	ND		1.2	0.29	mg/kg
Ethylbenzene	4.2	Bd	0.48	0.12	mg/kg
Xylenes (total)	13	d	1.2	0.36	mg/kg
Methyl-tert-butyl ether	ND		1.2	0.36	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 17.1%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S4 (0.00,0.00)
LAB ID: 059724-0021-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		1.1	0.11	mg/kg
Toluene	ND		1.1	0.26	mg/kg
Ethylbenzene	1.2	BM	0.44	0.11	mg/kg
Xylenes (total)	4.3	M	1.1	0.33	mg/kg
Methyl-tert-butyl ether	ND		1.1	0.33	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 8.2%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S4 (0.00,0.00)
LAB ID: 059724-0021-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 10

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		1.1	0.11	mg/kg
Toluene	ND		1.1	0.26	mg/kg
Ethylbenzene	1.2	Bd	0.44	0.11	mg/kg
Xylenes (total)	4.4	d	1.1	0.33	mg/kg
Methyl-tert-butyl ether	ND		1.1	0.33	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 8.2%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S7 (0.00,0.00)
LAB ID: 059724-0022-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 500

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		59	5.9	mg/kg
Toluene	83	M	59	14	mg/kg
Ethylbenzene	710	BM	24	5.9	mg/kg
Xylenes (total)	1400	M	59	18	mg/kg
Methyl-tert-butyl ether	ND		59	18	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 14.9%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S7 (0.00,0.00)
LAB ID: 059724-0022-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 500

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		59	5.9	mg/kg
Toluene	100	d	59	14	mg/kg
Ethylbenzene	740	Bd	24	5.9	mg/kg
Xylenes (total)	1500	d	59	18	mg/kg
Methyl-tert-butyl ether	ND		59	18	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 14.9%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BXSB07S4.5 (0.00,0.00)
LAB ID: 059724-0001-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0055	0.00055	mg/kg
Toluene	0.020	M	0.0055	0.0013	mg/kg
Ethylbenzene	0.047	M	0.0022	0.00055	mg/kg
Xylenes (total)	0.11	M	0.0055	0.0017	mg/kg
Methyl-tert-butyl ether	ND		0.0055	0.0017	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	104	%	34 - 175
Fluorobenzene	101	%	34 - 175

Percent moisture is 9.3%. All results and limits are reported on a dry weight basis.

M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BXSB07S4.5 (0.00,0.00)
LAB ID: 059724-0001-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0055	0.00055	mg/kg
Toluene	0.025	d	0.0055	0.0013	mg/kg
Ethylbenzene	0.048	d	0.0022	0.00055	mg/kg
Xylenes (total)	0.11	d	0.0055	0.0017	mg/kg
Methyl-tert-butyl ether	ND		0.0055	0.0017	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	104	%	34 - 175
Fluorobenzene	104	%	34 - 175

Percent moisture is 9.3%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB07-S7 (0.00,0.00)
LAB ID: 059724-0002-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0058	0.00058	mg/kg
Toluene	ND		0.0058	0.0014	mg/kg
Ethylbenzene	ND		0.0023	0.00058	mg/kg
Xylenes (total)	ND		0.0058	0.0017	mg/kg
Methyl-tert-butyl ether	ND		0.0058	0.0017	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	103	%	34 - 175
Fluorobenzene	103	%	34 - 175

Percent moisture is 13.6%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB08-S5 (0.00,0.00)
LAB ID: 059724-0003-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0053	0.00053	mg/kg
Toluene	ND		0.0053	0.0013	mg/kg
Ethylbenzene	ND		0.0021	0.00053	mg/kg
Xylenes (total)	ND		0.0053	0.0016	mg/kg
Methyl-tert-butyl ether	ND		0.0053	0.0016	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	99	%	34 - 175
Fluorobenzene	100	%	34 - 175

Percent moisture is 6.0%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB09-S8 (0.00,0.00)
LAB ID: 059724-0004-SA
Matrix: SOIL Sampled: 29 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.4	0.24	mg/kg
Toluene	13	d	2.4	0.57	mg/kg
Ethylbenzene	3.7	Bd	0.95	0.24	mg/kg
Xylenes (total)	48	d	2.4	0.71	mg/kg
Methyl-tert-butyl ether	ND		2.4	0.71	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 15.8%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB09-S8 (0.00,0.00)
LAB ID: 059724-0004-SA
Matrix: SOIL Sampled: 29 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.4	0.24	mg/kg
Toluene	9.9	M	2.4	0.57	mg/kg
Chlorobenzene	ND		0.95	0.24	mg/kg
Ethylbenzene	3.5	BM	0.95	0.24	mg/kg
Xylenes (total)	45	M	2.4	0.71	mg/kg
1,3-Dichlorobenzene	ND		1.9	0.24	mg/kg
1,4-Dichlorobenzene	ND		1.8	0.24	mg/kg
1,2-Dichlorobenzene	ND		1.9	0.24	mg/kg
Methyl-tert-butyl ether	ND		2.4	0.71	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 15.8%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB11-S5 (0.00,0.00)
LAB ID: 059724-0005-SA
Matrix: SOIL Sampled: 29 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0054	0.00054	mg/kg
Toluene	0.0035	JM	0.0054	0.0013	mg/kg
Ethylbenzene	0.0016	JM	0.0022	0.00054	mg/kg
Xylenes (total)	0.0039	JM	0.0054	0.0016	mg/kg
Methyl-tert-butyl ether	ND		0.0054	0.0016	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	102	%	34 - 175
Fluorobenzene	108	%	34 - 175

Percent moisture is 7.3%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE (Second Column)
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB11-S5 (0.00,0.00)		
LAB ID:	059724-0005-SA		
Matrix:	SOIL	Sampled: 29 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 07 APR 98
Instrument:	GCPID-H	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0054	0.00054	mg/kg
Toluene	0.0035	Jd	0.0054	0.0013	mg/kg
Ethylbenzene	0.0017	Jd	0.0022	0.00054	mg/kg
Xylenes (total)	0.0039	Jd	0.0054	0.0016	mg/kg
Methyl-tert-butyl ether	ND		0.0054	0.0016	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	102	%	34 - 175
Fluorobenzene	108	%	34 - 175

Percent moisture is 7.3%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB12-S7 (0.00,0.00)
LAB ID: 059724-0006-SA
Matrix: SOIL Sampled: 30 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0059	0.00059	mg/kg
Toluene	ND		0.0059	0.0014	mg/kg
Ethylbenzene	ND		0.0024	0.00059	mg/kg
Xylenes (total)	ND		0.0059	0.0018	mg/kg
Methyl-tert-butyl ether	ND		0.0059	0.0018	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	104	%	34 - 175
Fluorobenzene	102	%	34 - 175

Percent moisture is 15.6%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB14-S7 (0.00,0.00)		
LAB ID:	059724-0007-SA		
Matrix:	SOIL	Sampled: 30 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 07 APR 98
Instrument:	GCPID-H	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0058	0.00058	mg/kg
Toluene	0.0014	JM	0.0058	0.0014	mg/kg
Ethylbenzene	0.00070	JM	0.0023	0.00058	mg/kg
Xylenes (total)	ND		0.0058	0.0017	mg/kg
Methyl-tert-butyl ether	ND		0.0058	0.0017	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	100	%	34 - 175
Fluorobenzene	104	%	34 - 175

Percent moisture is 14.2%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-SB14-S7 (0.00,0.00)
LAB ID: 059724-0007-SA
Matrix: SOIL Sampled: 30 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0058	0.00058	mg/kg
Toluene	0.0021	Jd	0.0058	0.0014	mg/kg
Ethylbenzene	0.00082	Jd	0.0023	0.00058	mg/kg
Xylenes (total)	ND		0.0058	0.0017	mg/kg
Methyl-tert-butyl ether	ND		0.0058	0.0017	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	101	%	34 - 175
Fluorobenzene	105	%	34 - 175

Percent moisture is 14.2%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MP02-S3 (0.00,0.00)
LAB ID: 059724-0011-SA
Matrix: SOIL Sampled: 26 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0055	0.00055	mg/kg
Toluene	0.0034	JM	0.0055	0.0013	mg/kg
Ethylbenzene	0.0012	JM	0.0022	0.00055	mg/kg
Xylenes (total)	ND		0.0055	0.0016	mg/kg
Methyl-tert-butyl ether	ND		0.0055	0.0016	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	110	%	34 - 175
Fluorobenzene	119	%	34 - 175

Percent moisture is 8.6%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-MP02-S3 (0.00,0.00)
LAB ID: 059724-0011-SA
Matrix: SOIL Sampled: 26 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0055	0.00055	mg/kg
Toluene	0.0055	Jd	0.0055	0.0013	mg/kg
Ethylbenzene	0.0012	Jd	0.0022	0.00055	mg/kg
Xylenes (total)	ND		0.0055	0.0016	mg/kg
Methyl-tert-butyl ether	ND		0.0055	0.0016	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	109	%	34 - 175
Fluorobenzene	120	%	34 - 175

Percent moisture is 8.6%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-MP02-S5	(0.00,0.00)	
LAB ID:	059724-0012-SA		
Matrix:	SOIL	Sampled: 26 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 08 APR 98
Instrument:	GCPID-H	Dilution: 20	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.3	0.23	mg/kg
Toluene	ND		2.3	0.56	mg/kg
Ethylbenzene	ND		0.93	0.23	mg/kg
Xylenes (total)	4.2	M	2.3	0.70	mg/kg
Methyl-tert-butyl ether	ND		2.3	0.70	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 14.4%. All results and limits are reported on a dry weight basis.

M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-MP02-S5	(0.00,0.00)	
LAB ID:	059724-0012-SA		
Matrix:	SOIL	Sampled: 26 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 08 APR 98
Instrument:	GCPID-H	Dilution: 20	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.3	0.23	mg/kg
Toluene	ND		2.3	0.56	mg/kg
Ethylbenzene	ND		0.93	0.23	mg/kg
Xylenes (total)	4.7	d	2.3	0.70	mg/kg
Methyl-tert-butyl ether	ND		2.3	0.70	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 14.4%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S3 (0.00,0.00)
LAB ID: 059724-0013-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.2	0.22	mg/kg
Toluene	ND		2.2	0.54	mg/kg
Ethylbenzene	ND		0.89	0.22	mg/kg
Xylenes (total)	12	M	2.2	0.67	mg/kg
Methyl-tert-butyl ether	ND		2.2	0.67	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 10.6%. All results and limits are reported on a dry weight basis.

M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-VMP2-S3	(0.00,0.00)	
LAB ID:	059724-0013-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 08 APR 98
Instrument:	GCPID-H	Dilution: 20	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.2	0.22	mg/kg
Toluene	ND		2.2	0.54	mg/kg
Ethylbenzene	ND		0.89	0.22	mg/kg
Xylenes (total)	13	d	2.2	0.67	mg/kg
Methyl-tert-butyl ether	ND		2.2	0.67	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 10.6%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S5 (0.00,0.00)
LAB ID: 059724-0014-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.3	0.23	mg/kg
Toluene	ND		2.3	0.56	mg/kg
Ethylbenzene	ND		0.94	0.23	mg/kg
Xylenes (total)	18	M	2.3	0.70	mg/kg
Methyl-tert-butyl ether	ND		2.3	0.70	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 14.6%. All results and limits are reported on a dry weight basis.

M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S5 (0.00,0.00)
LAB ID: 059724-0014-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.3	0.23	mg/kg
Toluene	ND		2.3	0.56	mg/kg
Ethylbenzene	ND		0.94	0.23	mg/kg
Xylenes (total)	21	d	2.3	0.70	mg/kg
Methyl-tert-butyl ether	ND		2.3	0.70	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 14.6%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S7 (0.00,0.00)
LAB ID: 059724-0015-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	0.011	d	0.0059	0.00059	mg/kg
Toluene	0.019	M	0.0059	0.0014	mg/kg
Ethylbenzene	0.0039	M	0.0023	0.00059	mg/kg
Xylenes (total)	0.36	d	0.0059	0.0018	mg/kg
Methyl-tert-butyl ether	ND		0.0059	0.0018	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	97	%	34 - 175
Fluorobenzene	106	%	34 - 175

Percent moisture is 14.7%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE (Second Column)
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-VMP2-S7	(0.00,0.00)	
LAB ID:	059724-0015-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 07 APR 98
Instrument:	GCPID-H	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	0.0032	JM	0.0059	0.00059	mg/kg
Toluene	0.032	d	0.0059	0.0014	mg/kg
Ethylbenzene	0.0049	d	0.0023	0.00059	mg/kg
Xylenes (total)	0.35	M	0.0059	0.0018	mg/kg
Methyl-tert-butyl ether	ND		0.0059	0.0018	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	80	%	34 - 175
Fluorobenzene	105	%	34 - 175

Percent moisture is 14.7%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S5 (0.00,0.00)
LAB ID: 059724-0017-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.4	0.24	mg/kg
Toluene	ND		2.4	0.57	mg/kg
Ethylbenzene	2.6	Bd	0.95	0.24	mg/kg
Xylenes (total)	28	M	2.4	0.72	mg/kg
Methyl-tert-butyl ether	ND		2.4	0.72	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 16.1%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S5 (0.00,0.00)
LAB ID: 059724-0017-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 20

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		2.4	0.24	mg/kg
Toluene	ND		2.4	0.57	mg/kg
Ethylbenzene	2.4	BM	0.95	0.24	mg/kg
Xylenes (total)	30	d	2.4	0.72	mg/kg
Methyl-tert-butyl ether	ND		2.4	0.72	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 16.1%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S7 (0.00,0.00)
LAB ID: 059724-0018-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 08 APR 98
Instrument: GCPID-H Dilution: 50

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		5.7	0.57	mg/kg
Toluene	ND		5.7	1.4	mg/kg
Ethylbenzene	9.6	Bd	2.3	0.57	mg/kg
Xylenes (total)	28	M	5.7	1.7	mg/kg
Methyl-tert-butyl ether	ND		5.7	1.7	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 13.0%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MBTE (Second Column)
Method 8020A

Client Name:	Parsons Engineering Science		
Client ID:	BX-VEW1-S7	(0.00,0.00)	
LAB ID:	059724-0018-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 08 APR 98
Instrument:	GCPID-H	Dilution: 50	

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		5.7	0.57	mg/kg
Toluene	ND		5.7	1.4	mg/kg
Ethylbenzene	8.0	BM	2.3	0.57	mg/kg
Xylenes (total)	33	d	5.7	1.7	mg/kg
Methyl-tert-butyl ether	ND		5.7	1.7	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	ND	%	34 - 175
Fluorobenzene	ND	%	34 - 175

Percent moisture is 13.0%. All results and limits are reported on a dry weight basis.

B = Compound is also detected in the blank.
d = See Preferred Result on Other Column
M = Preferred Result
ND = Not Detected

Reported By: Shawn Hadley

Approved By: Barbara Sullivan

Quanterra
Environmental Services

AFCEE^Aromatic Volatile Organics with MTBE
Method 8020A

Client Name: Parsons Engineering Science
Client ID: BXVEW2S5.5 (0.00,0.00)
LAB ID: 059724-0019-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 07 APR 98
Instrument: GCPID-H Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Benzene	ND		0.0058	0.00058	mg/kg
Toluene	ND		0.0058	0.0014	mg/kg
Ethylbenzene	ND		0.0023	0.00058	mg/kg
Xylenes (total)	ND		0.0058	0.0017	mg/kg
Methyl-tert-butyl ether	ND		0.0058	0.0017	mg/kg

Surrogate	Recovery		Acceptable Range
a,a,a-Trifluorotoluene	98	%	34 - 175
Fluorobenzene	95	%	34 - 175

Percent moisture is 13.8%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Shawn Hadley Approved By: Barbara Sullivan

A 80

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S3 (0.00,0.00)
LAB ID: 059724-0020-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.043	mg/kg
Acenaphthylene	ND		0.24	0.059	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0041	mg/kg
Benzo(a)pyrene	ND		0.018	0.0027	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0030	mg/kg
Benzo(g,h,i)perylene	ND		0.060	0.0036	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0042	mg/kg
Chrysene	ND		0.048	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0041	mg/kg
Fluorene	ND		0.048	0.0077	mg/kg
Fluoranthene	ND		0.048	0.0029	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.036	0.0036	mg/kg
Naphthalene	0.22	Jd	0.24	0.056	mg/kg
Phenanthrene	ND		0.048	0.0066	mg/kg
Pyrene	ND		0.048	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	86	%	22 - 167

Percent moisture is 17.1%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S3 (0.00,0.00)
LAB ID: 059724-0020-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.043	mg/kg
Acenaphthylene	ND		0.24	0.059	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0041	mg/kg
Benzo(a)pyrene	ND		0.018	0.0027	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0030	mg/kg
Benzo(g,h,i)perylene	ND		0.060	0.0036	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0042	mg/kg
Chrysene	ND		0.048	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0041	mg/kg
Fluorene	ND		0.048	0.0077	mg/kg
Fluoranthene	ND		0.048	0.0029	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.036	0.0036	mg/kg
Naphthalene	0.19	JM	0.24	0.056	mg/kg
Phenanthrene	ND		0.048	0.0066	mg/kg
Pyrene	ND		0.048	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	77	%	22 - 167

Percent moisture is 17.1%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S4 (0.00,0.00)
LAB ID: 059724-0021-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.039	mg/kg
Acenaphthylene	ND		0.22	0.053	mg/kg
Anthracene	ND		0.022	0.0028	mg/kg
Benzo(a)anthracene	ND		0.022	0.0037	mg/kg
Benzo(a)pyrene	ND		0.016	0.0024	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	ND		0.054	0.0033	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0038	mg/kg
Chrysene	ND		0.044	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0037	mg/kg
Fluorene	ND		0.044	0.0070	mg/kg
Fluoranthene	ND		0.044	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.033	0.0033	mg/kg
Naphthalene	0.19	Jd	0.22	0.050	mg/kg
Phenanthrene	ND		0.044	0.0060	mg/kg
Pyrene	ND		0.044	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	94	%	22 - 167

Percent moisture is 8.2%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S4 (0.00,0.00)
LAB ID: 059724-0021-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.039	mg/kg
Acenaphthylene	ND		0.22	0.053	mg/kg
Anthracene	ND		0.022	0.0028	mg/kg
Benzo(a)anthracene	ND		0.022	0.0037	mg/kg
Benzo(a)pyrene	ND		0.016	0.0024	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	ND		0.054	0.0033	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0038	mg/kg
Chrysene	ND		0.044	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0037	mg/kg
Fluorene	ND		0.044	0.0070	mg/kg
Fluoranthene	ND		0.044	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.033	0.0033	mg/kg
Naphthalene	0.16	JM	0.22	0.050	mg/kg
Phenanthrene	ND		0.044	0.0060	mg/kg
Pyrene	ND		0.044	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	85	%	22 - 167

Percent moisture is 8.2%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S7 (0.00,0.00)
LAB ID: 059724-0022-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.042	mg/kg
Acenaphthylene	ND		0.24	0.058	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0040	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.059	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	ND		0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	7.6	d	0.24	0.054	mg/kg
Phenanthrene	ND		0.047	0.0065	mg/kg
Pyrene	ND		0.047	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	99	%	22 - 167

Percent moisture is 14.9%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB06-S7 (0.00,0.00)		
LAB ID:	059724-0022-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 23 APR 98
Instrument:	HPLC-Y	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.042	mg/kg
Acenaphthylene	ND		0.24	0.058	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0040	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.059	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	ND		0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	6.5	M	0.24	0.054	mg/kg
Phenanthrene	ND		0.047	0.0065	mg/kg
Pyrene	ND		0.047	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	82	%	22 - 167

Percent moisture is 14.9%. All results and limits are reported on a dry weight basis.

M = Preferred Result
ND = Not Detected

Reported By: Blake Besser

Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BXSB07S4.5 (0.00,0.00)
LAB ID: 059724-0001-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.040	mg/kg
Acenaphthylene	ND		0.22	0.054	mg/kg
Anthracene	ND		0.022	0.0029	mg/kg
Benzo(a)anthracene	ND		0.022	0.0038	mg/kg
Benzo(a)pyrene	ND		0.017	0.0024	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0028	mg/kg
Benzo(g,h,i)perylene	ND		0.055	0.0033	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0039	mg/kg
Chrysene	ND		0.044	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0038	mg/kg
Fluorene	ND		0.044	0.0071	mg/kg
Fluoranthene	ND		0.044	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.033	0.0033	mg/kg
Naphthalene	ND		0.22	0.051	mg/kg
Phenanthrene	ND		0.044	0.0061	mg/kg
Pyrene	ND		0.044	0.0029	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	100	%	22 - 167

Percent moisture is 9.3%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB07-S7 (0.00,0.00)
LAB ID: 059724-0002-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	ND		0.023	0.0030	mg/kg
Benzo(a)anthracene	ND		0.023	0.0039	mg/kg
Benzo(a)pyrene	ND		0.017	0.0025	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.058	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0040	mg/kg
Chrysene	ND		0.046	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0039	mg/kg
Fluorene	ND		0.046	0.0074	mg/kg
Fluoranthene	ND		0.046	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	ND		0.23	0.053	mg/kg
Phenanthrene	ND		0.046	0.0064	mg/kg
Pyrene	ND		0.046	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	98	%	22 - 167

Percent moisture is 13.6%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB08-S5 (0.00,0.00)
LAB ID: 059724-0003-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.21	0.038	mg/kg
Acenaphthylene	ND		0.21	0.052	mg/kg
Anthracene	ND		0.021	0.0028	mg/kg
Benzo(a)anthracene	ND		0.021	0.0036	mg/kg
Benzo(a)pyrene	ND		0.016	0.0023	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	ND		0.053	0.0032	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0037	mg/kg
Chrysene	ND		0.043	0.0021	mg/kg
Dibenz(a,h)anthracene	ND		0.021	0.0036	mg/kg
Fluorene	ND		0.043	0.0068	mg/kg
Fluoranthene	ND		0.043	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.032	0.0032	mg/kg
Naphthalene	ND		0.21	0.049	mg/kg
Phenanthrene	ND		0.043	0.0059	mg/kg
Pyrene	ND		0.043	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	100	%	22 - 167

Percent moisture is 6.0%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB09-S8 (0.00,0.00)
LAB ID: 059724-0004-SA
Matrix: SOIL Sampled: 29 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.043	mg/kg
Acenaphthylene	ND		0.24	0.058	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0040	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0030	mg/kg
Benzo(g,h,i)perylene	ND		0.059	0.0036	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0042	mg/kg
Chrysene	ND		0.048	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0040	mg/kg
Fluorene	ND		0.048	0.0076	mg/kg
Fluoranthene	ND		0.048	0.0029	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.036	0.0036	mg/kg
Naphthalene	ND		0.24	0.055	mg/kg
Phenanthrene	ND		0.048	0.0065	mg/kg
Pyrene	ND		0.048	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	96	%	22 - 167

Percent moisture is 15.8%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB11-S5 (0.00,0.00)
LAB ID: 059724-0005-SA
Matrix: SOIL Sampled: 29 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.039	mg/kg
Acenaphthylene	ND		0.22	0.053	mg/kg
Anthracene	ND		0.022	0.0028	mg/kg
Benzo(a)anthracene	ND		0.022	0.0037	mg/kg
Benzo(a)pyrene	0.0073	JM	0.016	0.0024	mg/kg
Benzo(b)fluoranthene	0.0069	JM	0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	0.0047	JM	0.054	0.0032	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0038	mg/kg
Chrysene	ND		0.043	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0037	mg/kg
Fluorene	ND		0.043	0.0069	mg/kg
Fluoranthene	ND		0.043	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.032	0.0032	mg/kg
Naphthalene	ND		0.22	0.050	mg/kg
Phenanthrene	ND		0.043	0.0059	mg/kg
Pyrene	ND		0.043	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	20	%	22 - 167

Percent moisture is 7.3%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB11-S5 (0.00,0.00)		
LAB ID:	059724-0005-SA		
Matrix:	SOIL	Sampled: 29 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 23 APR 98
Instrument:	HPLC-Y	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.039	mg/kg
Acenaphthylene	ND		0.22	0.053	mg/kg
Anthracene	ND		0.022	0.0028	mg/kg
Benzo(a)anthracene	ND		0.022	0.0037	mg/kg
Benzo(a)pyrene	0.0083	Jd	0.016	0.0024	mg/kg
Benzo(b)fluoranthene	0.0097	Jd	0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	0.0068	Jd	0.054	0.0032	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0038	mg/kg
Chrysene	ND		0.043	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0037	mg/kg
Fluorene	ND		0.043	0.0069	mg/kg
Fluoranthene	ND		0.043	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.032	0.0032	mg/kg
Naphthalene	ND		0.22	0.050	mg/kg
Phenanthrene	ND		0.043	0.0059	mg/kg
Pyrene	ND		0.043	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	19	%	22 - 167

Percent moisture is 7.3%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-SB12-S7 (0.00,0.00)
LAB ID: 059724-0006-SA
Matrix: SOIL Sampled: 30 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.043	mg/kg
Acenaphthylene	ND		0.24	0.058	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0040	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0030	mg/kg
Benzo(g,h,i)perylene	ND		0.059	0.0036	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0040	mg/kg
Fluorene	ND		0.047	0.0076	mg/kg
Fluoranthene	ND		0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.036	0.0036	mg/kg
Naphthalene	ND		0.24	0.055	mg/kg
Phenanthrene	ND		0.047	0.0065	mg/kg
Pyrene	ND		0.047	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	110	%	22 - 167

Percent moisture is 15.6%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB14-S7 (0.00,0.00)		
LAB ID:	059724-0007-SA		
Matrix:	SOIL	Sampled: 30 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 23 APR 98
Instrument:	HPLC-Y	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	ND		0.023	0.0030	mg/kg
Benzo(a)anthracene	ND		0.023	0.0040	mg/kg
Benzo(a)pyrene	ND		0.017	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.058	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	ND		0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	ND		0.23	0.054	mg/kg
Phenanthrene	ND		0.047	0.0064	mg/kg
Pyrene	ND		0.047	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	100	%	22 - 167

Percent moisture is 14.2%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser

Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MP02-S3 (0.00,0.00)
LAB ID: 059724-0011-SA
Matrix: SOIL Sampled: 26 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.039	mg/kg
Acenaphthylene	ND		0.22	0.054	mg/kg
Anthracene	ND		0.022	0.0028	mg/kg
Benzo(a)anthracene	ND		0.022	0.0037	mg/kg
Benzo(a)pyrene	ND		0.016	0.0024	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	ND		0.055	0.0033	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0038	mg/kg
Chrysene	ND		0.044	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0037	mg/kg
Fluorene	ND		0.044	0.0070	mg/kg
Fluoranthene	ND		0.044	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.033	0.0033	mg/kg
Naphthalene	ND		0.22	0.050	mg/kg
Phenanthrene	ND		0.044	0.0060	mg/kg
Pyrene	ND		0.044	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	110	%	22 - 167

Percent moisture is 8.6%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MP02-S5 (0.00,0.00)
LAB ID: 059724-0012-SA
Matrix: SOIL Sampled: 26 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	0.0099	JM	0.023	0.0030	mg/kg
Benzo(a)anthracene	0.15	d	0.023	0.0040	mg/kg
Benzo(a)pyrene	0.083	d	0.018	0.0026	mg/kg
Benzo(b)fluoranthene	0.082	M	0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	0.054	Jd	0.050	0.0035	mg/kg
Benzo(k)fluoranthene	0.019	M	0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	0.43	M	0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	ND		0.23	0.054	mg/kg
Phenanthrene	ND		0.047	0.0064	mg/kg
Pyrene	0.64	d	0.047	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	110	%	22 - 167

Percent moisture is 14.4%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-MP02-S5 (0.00,0.00)
LAB ID: 059724-0012-SA
Matrix: SOIL Sampled: 26 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	0.020	Jd	0.023	0.0030	mg/kg
Benzo(a)anthracene	0.14	M	0.023	0.0040	mg/kg
Benzo(a)pyrene	0.082	M	0.018	0.0026	mg/kg
Benzo(b)fluoranthene	0.10	d	0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	0.049	JM	0.058	0.0035	mg/kg
Benzo(k)fluoranthene	0.041	d	0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	0.47	d	0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	ND		0.23	0.054	mg/kg
Phenanthrene	ND		0.047	0.0064	mg/kg
Pyrene	0.30	M	0.047	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	98	%	22 - 167

Percent moisture is 14.4%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name:	Parsons Engineering Science		
Client ID:	BX-VMP2-S3 (0.00,0.00)		
LAB ID:	059724-0013-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 06 APR 98	Analyzed: 23 APR 98
Instrument:	HPLC-Y	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.040	mg/kg
Acenaphthylene	ND		0.22	0.055	mg/kg
Anthracene	ND		0.022	0.0029	mg/kg
Benzo(a)anthracene	ND		0.022	0.0038	mg/kg
Benzo(a)pyrene	ND		0.017	0.0025	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0028	mg/kg
Benzo(g,h,i)perylene	ND		0.056	0.0034	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0039	mg/kg
Chrysene	ND		0.045	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0038	mg/kg
Fluorene	ND		0.045	0.0072	mg/kg
Fluoranthene	ND		0.045	0.0027	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.034	0.0034	mg/kg
Naphthalene	0.20	JM	0.22	0.051	mg/kg
Phenanthrene	ND		0.045	0.0062	mg/kg
Pyrene	ND		0.045	0.0029	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	100	%	22 - 167

Percent moisture is 10.6%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser

Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S3 (0.00,0.00)
LAB ID: 059724-0013-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.040	mg/kg
Acenaphthylene	ND		0.22	0.055	mg/kg
Anthracene	ND		0.022	0.0029	mg/kg
Benzo(a)anthracene	ND		0.022	0.0038	mg/kg
Benzo(a)pyrene	ND		0.017	0.0025	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0028	mg/kg
Benzo(g,h,i)perylene	ND		0.056	0.0034	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0039	mg/kg
Chrysene	ND		0.045	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0038	mg/kg
Fluorene	ND		0.045	0.0072	mg/kg
Fluoranthene	ND		0.045	0.0027	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.034	0.0034	mg/kg
Naphthalene	0.22	Jd	0.22	0.051	mg/kg
Phenanthrene	ND		0.045	0.0062	mg/kg
Pyrene	ND		0.045	0.0029	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	140	%	22 - 167

Percent moisture is 10.6%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S5 (0.00,0.00)
LAB ID: 059724-0014-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	ND		0.023	0.0030	mg/kg
Benzo(a)anthracene	ND		0.023	0.0040	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.059	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	ND		0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	2.2	M	0.23	0.054	mg/kg
Phenanthrene	ND		0.047	0.0064	mg/kg
Pyrene	ND		0.047	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	95	%	22 - 167

Percent moisture is 14.6%. All results and limits are reported on a dry weight basis.

M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S5 (0.00,0.00)
LAB ID: 059724-0014-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	ND		0.023	0.0030	mg/kg
Benzo(a)anthracene	ND		0.023	0.0040	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.059	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	ND		0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	2.3	d	0.23	0.054	mg/kg
Phenanthrene	ND		0.047	0.0064	mg/kg
Pyrene	ND		0.047	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	120	%	22 - 167

Percent moisture is 14.6%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S7 (0.00,0.00)
LAB ID: 059724-0015-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	ND		0.023	0.0030	mg/kg
Benzo(a)anthracene	ND		0.023	0.0040	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.059	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.047	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0040	mg/kg
Fluorene	ND		0.047	0.0075	mg/kg
Fluoranthene	ND		0.047	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	ND		0.23	0.054	mg/kg
Phenanthrene	ND		0.047	0.0064	mg/kg
Pyrene	ND		0.047	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	100	%	22 - 167

Percent moisture is 14.7%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S3 (0.00,0.00)
LAB ID: 059724-0016-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.039	mg/kg
Acenaphthylene	ND		0.22	0.054	mg/kg
Anthracene	ND		0.022	0.0028	mg/kg
Benzo(a)anthracene	ND		0.022	0.0037	mg/kg
Benzo(a)pyrene	ND		0.016	0.0024	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	ND		0.055	0.0033	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0038	mg/kg
Chrysene	ND		0.044	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0037	mg/kg
Fluorene	ND		0.044	0.0070	mg/kg
Fluoranthene	ND		0.044	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.033	0.0033	mg/kg
Naphthalene	0.30	d	0.22	0.050	mg/kg
Phenanthrene	ND		0.044	0.0060	mg/kg
Pyrene	ND		0.044	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	110	%	22 - 167

Percent moisture is 8.5%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S3 (0.00,0.00)
LAB ID: 059724-0016-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.22	0.039	mg/kg
Acenaphthylene	ND		0.22	0.054	mg/kg
Anthracene	ND		0.022	0.0028	mg/kg
Benzo(a)anthracene	ND		0.022	0.0037	mg/kg
Benzo(a)pyrene	ND		0.016	0.0024	mg/kg
Benzo(b)fluoranthene	ND		0.013	0.0027	mg/kg
Benzo(g,h,i)perylene	ND		0.055	0.0033	mg/kg
Benzo(k)fluoranthene	ND		0.012	0.0038	mg/kg
Chrysene	ND		0.044	0.0022	mg/kg
Dibenz(a,h)anthracene	ND		0.022	0.0037	mg/kg
Fluorene	ND		0.044	0.0070	mg/kg
Fluoranthene	ND		0.044	0.0026	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.033	0.0033	mg/kg
Naphthalene	0.19	JM	0.22	0.050	mg/kg
Phenanthrene	ND		0.044	0.0060	mg/kg
Pyrene	ND		0.044	0.0028	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	89	%	22 - 167

Percent moisture is 8.5%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S5 (0.00,0.00)
LAB ID: 059724-0017-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.043	mg/kg
Acenaphthylene	ND		0.24	0.058	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0041	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0030	mg/kg
Benzo(g,h,i)perylene	ND		0.060	0.0036	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0042	mg/kg
Chrysene	ND		0.048	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0041	mg/kg
Fluorene	ND		0.048	0.0076	mg/kg
Fluoranthene	ND		0.048	0.0029	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.036	0.0036	mg/kg
Naphthalene	0.19	Jd	0.24	0.055	mg/kg
Phenanthrene	ND		0.048	0.0066	mg/kg
Pyrene	ND		0.048	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	98	%	22 - 167

Percent moisture is 16.1%. All results and limits are reported on a dry weight basis.

d = See Preferred Result on Other Column
J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC (Confirmation)
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S5 (0.00,0.00)
LAB ID: 059724-0017-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.24	0.043	mg/kg
Acenaphthylene	ND		0.24	0.058	mg/kg
Anthracene	ND		0.024	0.0031	mg/kg
Benzo(a)anthracene	ND		0.024	0.0041	mg/kg
Benzo(a)pyrene	ND		0.018	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0030	mg/kg
Benzo(g,h,i)perylene	ND		0.060	0.0036	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0042	mg/kg
Chrysene	ND		0.048	0.0024	mg/kg
Dibenz(a,h)anthracene	ND		0.024	0.0041	mg/kg
Fluorene	ND		0.048	0.0076	mg/kg
Fluoranthene	ND		0.048	0.0029	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.036	0.0036	mg/kg
Naphthalene	0.10	JM	0.24	0.055	mg/kg
Phenanthrene	ND		0.048	0.0066	mg/kg
Pyrene	ND		0.048	0.0031	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	94	%	22 - 167

Percent moisture is 16.1%. All results and limits are reported on a dry weight basis.

J = Result is detected below the reporting limit or is an estimated concentration.
M = Preferred Result
ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S7 (0.00,0.00)
LAB ID: 059724-0018-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.041	mg/kg
Acenaphthylene	ND		0.23	0.056	mg/kg
Anthracene	ND		0.023	0.0030	mg/kg
Benzo(a)anthracene	ND		0.023	0.0039	mg/kg
Benzo(a)pyrene	ND		0.017	0.0025	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.057	0.0034	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0040	mg/kg
Chrysene	ND		0.046	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0039	mg/kg
Fluorene	ND		0.046	0.0074	mg/kg
Fluoranthene	ND		0.046	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.034	0.0034	mg/kg
Naphthalene	ND		0.23	0.053	mg/kg
Phenanthrene	ND		0.046	0.0063	mg/kg
Pyrene	ND		0.046	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	99	%	22 - 167

Percent moisture is 13.0%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

AFCEE
Polynuclear Aromatic Hydrocarbons, HPLC
Method 8310

Client Name: Parsons Engineering Science
Client ID: BXVEW2S5.5 (0.00,0.00)
LAB ID: 059724-0019-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 06 APR 98 Analyzed: 23 APR 98
Instrument: HPLC-Y Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
Acenaphthene	ND		0.23	0.042	mg/kg
Acenaphthylene	ND		0.23	0.057	mg/kg
Anthracene	ND		0.023	0.0030	mg/kg
Benzo(a)anthracene	ND		0.023	0.0039	mg/kg
Benzo(a)pyrene	ND		0.017	0.0026	mg/kg
Benzo(b)fluoranthene	ND		0.014	0.0029	mg/kg
Benzo(g,h,i)perylene	ND		0.058	0.0035	mg/kg
Benzo(k)fluoranthene	ND		0.013	0.0041	mg/kg
Chrysene	ND		0.046	0.0023	mg/kg
Dibenz(a,h)anthracene	ND		0.023	0.0039	mg/kg
Fluorene	ND		0.046	0.0074	mg/kg
Fluoranthene	ND		0.046	0.0028	mg/kg
Indeno(1,2,3-cd)pyrene	ND		0.035	0.0035	mg/kg
Naphthalene	ND		0.23	0.053	mg/kg
Phenanthrene	ND		0.046	0.0064	mg/kg
Pyrene	ND		0.046	0.0030	mg/kg

Surrogate	Recovery		Acceptable Range
Terphenyl-d14	97	%	22 - 167

Percent moisture is 13.8%. All results and limits are reported on a dry weight basis.

ND = Not Detected

Reported By: Blake Besser Approved By: Audrey Cornell

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-SB06-S3 (0.00,0.00)
LAB ID: 059724-0020-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 08 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	17		12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	96	%	22 - 166
Nonatriacontane	81	%	10 - 192

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB06-S4 (0.00,0.00)		
LAB ID:	059724-0021-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 08 APR 98	Analyzed: 15 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	34		11	9.9	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	91	%	22 - 166
Nonatriacontane	74	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB06-S7	(0.00,0.00)	
LAB ID:	059724-0022-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 08 APR 98	Analyzed: 15 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	7.5	J	12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	99	%	22 - 166
Nonatriacontane	61	%	10 - 192

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BXSB07S4.5	(0.00,0.00)	
LAB ID:	059724-0001-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 14 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	75		12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	124	%	22 - 166
Nonatriacontane	109	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-SB07-S7 (0.00,0.00)
LAB ID: 059724-0002-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	5.1	J	12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	112	%	22 - 166
Nonatriacontane	44	%	10 - 192

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB08-S5 (0.00,0.00)		
LAB ID:	059724-0003-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 14 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	11		11	9.9	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	133	%	22 - 166
Nonatriacontane	38	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-SB09-S8 (0.00,0.00)
LAB ID: 059724-0004-SA
Matrix: SOIL Sampled: 29 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	29		12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	150	%	22 - 166
Nonatriacontane	55	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-SB11-S5	(0.00,0.00)	
LAB ID:	059724-0005-SA		
Matrix:	SOIL	Sampled: 29 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 07 APR 98	Analyzed: 14 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	25		12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	111	%	22 - 166
Nonatriacontane	109	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-SB12-S7 (0.00,0.00)
LAB ID: 059724-0006-SA
Matrix: SOIL Sampled: 30 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	5.5	J	12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	96	%	22 - 166
Nonatriacontane	60	%	10 - 192

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-SB14-S7 (0.00,0.00)
LAB ID: 059724-0007-SA
Matrix: SOIL Sampled: 30 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 07 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	18		12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	113	%	22 - 166
Nonatriacontane	48	%	10 - 192

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-MP02-S3 (0.00,0.00)
LAB ID: 059724-0011-SA
Matrix: SOIL Sampled: 26 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 08 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	4.8	J	12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	95	%	22 - 166
Nonatriacontane	68	%	10 - 192

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-MP02-S5 (0.00,0.00)
LAB ID: 059724-0012-SA
Matrix: SOIL Sampled: 26 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 08 APR 98 Analyzed: 15 APR 98
Instrument: GCFID-I Dilution: 5.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	1300		57	51	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	NC	%	22 - 166
Nonatriacontane	NC	%	10 - 192

NC = Not Calculated, calculation not applicable.

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-VMP2-S3 (0.00,0.00)		
LAB ID:	059724-0013-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 08 APR 98	Analyzed: 14 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	49		13	12	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	97	%	22 - 166
Nonatriacontane	60	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S5 (0.00,0.00)
LAB ID: 059724-0014-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 08 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	490		12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	96	%	22 - 166
Nonatriacontane	96	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-VMP2-S7 (0.00,0.00)
LAB ID: 059724-0015-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 08 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	5.0	J	12	11	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	97	%	22 - 166
Nonatriacontane	66	%	10 - 192

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-VEW1-S3	(0.00,0.00)	
LAB ID:	059724-0016-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 08 APR 98	Analyzed: 14 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	31		13	12	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	97	%	22 - 166
Nonatriacontane	59	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name:	Parsons Engineering Science		
Client ID:	BX-VEW1-S5	(0.00,0.00)	
LAB ID:	059724-0017-SA		
Matrix:	SOIL	Sampled: 28 MAR 98	Received: 02 APR 98
Authorized:	02 APR 98	Prepared: 08 APR 98	Analyzed: 14 APR 98
Instrument:	GCFID-I	Dilution: 1.0	

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	7.6	J	11	9.9	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	102	%	22 - 166
Nonatriacontane	78	%	10 - 192

J = Result is detected below the reporting limit or is an estimated concentration.

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BX-VEW1-S7 (0.00,0.00)
LAB ID: 059724-0018-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 08 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	28		11	9.9	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	97	%	22 - 166
Nonatriacontane	61	%	10 - 192

Reported By: Quanterra-Tampa Approved By: Cynthia Prentice

Quanterra
Environmental Services

Method FL-PRO - TPH (C8-C40)
Method FL-PRO

Client Name: Parsons Engineering Science
Client ID: BXVEW2S5.5 (0.00,0.00)
LAB ID: 059724-0019-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: 08 APR 98 Analyzed: 14 APR 98
Instrument: GCFID-I Dilution: 1.0

Parameter	Result	Qualifier	RL	MDL	Units
TPH (C8-C40)	11		11	9.9	mg/kg

Surrogate	Recovery		Acceptable Range
o-Terphenyl	95	%	22 - 166
Nonatriacontane	90	%	10 - 192

Reported By: Quanterra-Tampa

Approved By: Cynthia Prentice

Quanterra
Environmental Services

General Inorganics

Client Name: Parsons Engineering Science
Client ID: BX-SB01-S7 (0.00,0.00)
LAB ID: 059724-0023-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98

ND = Not Detected

Reported By: Patty Jungk

Approved By: Jan Ecos

Quanterra
Environmental Services

General Inorganics

Client Name: Parsons Engineering Science
Client ID: BX-SB02-S7 (0.00,0.00)
LAB ID: 059724-0024-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98

ND = Not Detected

Reported By: Patty Jungk Approved By: Jan Ecos

Quanterra
Environmental Services

General Inorganics

Client Name: Parsons Engineering Science
Client ID: BX-SB03-S7 (0.00,0.00)
LAB ID: 059724-0025-SA
Matrix: SOIL Sampled: 28 MAR 98 Received: 02 APR 98
Authorized: 02 APR 98 Prepared: See Below Analyzed: See Below

Parameter	Result	Qual	Dil	MDL	Rep Lim	Units	Method	Prepared Date	Analyzed Date
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98
Total Organic Carbon	ND		1.0	550	2000	mg/kg	9060	09 APR 98	13 APR 98

ND = Not Detected

Reported By: Patty Jungk

Approved By: Jan Ecos

Chain of Custody Record

Quanterra

QUA-4124 0797

Client: Parsons Engineering Science	Project Manager: John Hicks	Date: 3/25/98	Chain of Custody Number: 02311
Address: 1700 Broadway Suite 900	Telephone Number (Area Code)/Fax Number: 303 831 8100	Lab Number	Page 1 of 1
City: Denver; State: CO; Zip Code: 80290	Site Contact: Cindy Nagel	Lab Contact	
Project Name: Eglin AFB	Carrier/Waybill Number: FedEx		
Contract/Purchase Order/Quote No.			

Analysis (Attach list if more space is needed)

Special Instructions/ Conditions of Receipt

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	SW8020A BTEX	SW8310 PAHs (short list)	SW8011 EDB	SW6010 lead	E300.0 Nitrate	EI-PRO TPH	RSKSOP 175 Methane	
BX-GWRW-6	3/25/98	0730	✓									✓	✓	✓					
BX-MW-4	3/25/98	0900	✓									✓	✓						
BX-GWRW-4	3/25/98	0800	✓									[redacted]							
BX-MW-2	3/25/98	1200	✓									[redacted]			✓	✓			
BX-MW-20	3/25/98	1800	✓									[redacted]			✓	✓			
~~BX-MW-1~~	~~3/25/98~~	1330	✓									[redacted]							
~~BX-MW-1/MS~~	~~3/25/98~~	1345	✓									[redacted]							
~~BX-MW-1/MSD~~	~~3/25/98~~	1400	✓									[redacted]							
Trip Blank																			

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☑ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Cindy Nagel	3/25/98	1600	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124 0797

Client	Project Manager	Date	Chain of Custody Number
Parsons	John Hicks	3/25/98	02303
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
1700 Broadway Suite 900	303 831 8100		
City / State / Zip Code	**Site Contact**	**Lab Contact**	
Denver / CO / 80290	Cindy Nagel		
Project Name	**Carrier/Waybill Number**		
Eglin AFB.	FedEx		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Analysis: BTEX	methane	EDB	PAH's	TRPH	nitrate	total lead	dissolved lead	Special Instructions/ Conditions of Receipt
BX [redacted]	3-25-98	1330	X						X	X			[redacted]					X	X	X	
BX [redacted]	3-25-98	1345	X						X	X			[redacted]					X	X	X	
BX [redacted]	3-25-98	1400	X						X	X			[redacted]					X	X	X	
Trip Blank																					
BX-MW-C	3/25/98	1600	✓															✓			

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Relinquished By	Date	Time	Received By	Date	Time
1.	Cindy Nagel	3/25/98	1630			
2.						
3.						

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124 0797

Client	Project Manager	Date	Chain of Custody Number
Parsons	John Hicks	3/26/98	02304
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
1700 Broadway Suite 900	303 831 8100		
City / State / Zip Code	**Site Contact**	**Lab Contact**	
Denver / CO / 80290	Cindy Nagel	Ellen LaPiviere	
Project Name	**Carrier/Waybill Number**		
Eglin AFB	FedEx		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNOS	HCl	NaOH	ZnAc/NaOH	Analysis: BTEX	Fe/Mn	EDB	TRPH	nitrate	methane	dissolved	total lead	Special Instructions/ Conditions of Receipt
~~BX-MW-C~~ (MW) BX-MW-C	3/25/98	1600	✓									✓					✓			
BX-MW-07	3/26/98	0630	✓									✓				✓	✓			
BX-MW-D	3/26/98	0730	✓									[redacted]				✓	[redacted]			
BX-MP-1	3/26/98	1330	✓									[redacted]					[redacted]			
BX-MP-2	3/26/98	1230	✓									[redacted]				✓	[redacted]	✓	✓	
Mil-EA-04	3/26/98	1445	✓									[redacted]				✓	[redacted]	✓	✓	
Mil-EA-40	3/26/98	1500	✓									[redacted]				✓	[redacted]	✓	✓	
Trip Blank																				

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Cindy Nagel	3/26/98	1545	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124 0797

Client	Project Manager	Date	Chain of Custody Number
Parsons	John Hicks	3/27/98	02305
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
1700 Broadway Suite 900	303 831 8100		
City / State / Zip Code	**Site Contact**	**Lab Contact**	
Denver / CO / 80290	Cindy Nagel	Ellen LaRiviere	
Project Name	**Carrier/Waybill Number**		
Eglin AFB			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: SW8020A BTEX	SW8310 PAHs	SW8011 EDB	SW6010 lead	E300.0 Nitrate	EI-PRO TRPH	RSKSOP175 Meth
BX-MW-4	3/27/98	0700	✓			✓								✓				
Mil-EA-10	3/27/98	0830	✓									✓	✓	✓	✓	✓	✓	✓
Mil-EA-5	3/27/98	0930	✓									✓		✓		✓		✓
Mil-EA-8	3/27/98	1130	✓									✓		✓		✓		✓
Trip Blank																		
Temp Blank																		

Special Instructions/ Conditions of Receipt

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other_____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: Cindy Nagel	3/27/98	1400	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124 0797

Client	Project Manager	Date	Chain of Custody Number
Parsons	John Hicks	3/31/98	02310
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
1700 Broadway, Suite 900	303 831 8100		
City / State / Zip Code	**Site Contact**	**Lab Contact**	
Denver / CO / 80290	Cindy Nagel	Ellen LaPiviere	
Project Name	**Carrier/Waybill Number**		
Eglin AFB			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Analysis: BTEX	MTBE	EDB	TRPH	PAHs	Yellow Label	Special Instructions/ Conditions of Receipt
BX-MW-2 ✓	3/31/98											X	X	X	X	X		
BX-MW-20 ✓	3/31/98											X	X	X	X	X		
Trip Blank 1 ✓	3/31/98											X		X				
Trip Blank 2	3/31/98																	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By	3/31/98	1530	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124 0797

Client: Parsons	Project Manager: John Hicks	Date: 3/31/98	Chain of Custody Number: 02309
Address: 1700 Broadway Suite 900	Telephone Number (Area Code)/Fax Number: 303 831 8100	Lab Number:	Page 1 of 1
City: Denver / State: CO / Zip Code: 80290	Site Contact: Cindy Nagel	Lab Contact: Ellen LaRiviere	
Project Name: Eglin AFB	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Analysis: BTEX	MeHg	EDB	TRPH	PAHs	Hold	Special Instructions/ Conditions of Receipt
BX-MW-1	3/31/98				X							X	X	X	X	X		
BX-MW-1/MS	3/31/98				X							X	X	X	X	X		
BX-MW-1/MSD	3/31/98				X							X	X	X	X	X		
BX-MP-1	3/31/98				X							X					X	X
Trip Blank	3/31/98				X							X		X				
Trip Blank	3/31/98				X													

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished By: Cindy Nagel	3/31/98	1700	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments:

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124 0797

Client	Project Manager	Date	Chain of Custody Number
Parsons	John Hicks	3/31/98	02313
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
1700 Broadway Suite 900	303 831 8100		
City / State / Zip Code	**Site Contact**	**Lab Contact**	
Denver / CO / 80290	Cindy Nagel	Ellen LaRiviere	
Project Name	**Carrier/Waybill Number**		
Eglin AFB			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: BTEX	MTBE/Naphthalene	EDB	PAHs	TRPH	Total Lead	Dissolved Lead	Special Instructions/ Conditions of Receipt
~~MP~~ BX-MP-2 ✓	3/31/98	1430	X									X	X	X	X	X			
BX-GWRW-4 ✓	3/31/98		X									X		X	X		X	X	
BX-MW-D ✓	3/31/98		X									X	X				X	X	
BX-SB15/MP-3 ✓	3/31/98		X									X							
Trip Blank 2 ✓	3/31/98		X									X		X					
Trip Blank																			

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

(A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By	3/31/98	1700	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Sheet1

Analyze the following samples--they will not be recollected							
Please hold the remaining samples until the replacement samples are received.							
	BTEX	PAHs	EDB	Methane	TRPH		
3/25/1998 COC#1							
BX-GWRW-6	x	x	x				
BX-MW-4	x	x					
BX-GWRW-4							
BX-MW-2							
BX-MW-20							
Trip Blank	x		x				
3/25/98 COC#2							
BX-MW1							
BX-MW1/MS							
BX-MW1/MSD							
Trip Blank							
BX-MW-C							
3/26/96 COC							
BX-MW-C	x			x			
BX-MW-07	x			x			
BX-MW-D							
BX-MP-1							
BX-MP-2							
Mil-EA-04							
mil-EA-40							
Trip Blank	x						
Note: analyze all total and dissolved lead samples received and all nitrate samples received.							

Cindy - here's what I sent the lab - all samples not "x"ed should be recollected - total of 7 wells - I'm sorry about this but seems to be best plan in the long run. Please also add PAHs to GWRW-4. Lab shipping more bottles for Sat. delivery. Let's talk this weekend.

John

P.S. I suppose trip blanks also should be analyzed for EDB as it is volatile.

73854.0200 2 pages

Post-it® Fax Note 7671	Date 3/27	# of pages ▶ 1
To Cindy Nagel (Guest)	From J-L-Hicks	
Co./Dept. Comfort Inn	Co. Parsons ES	
Phone #	Phone #	
Fax # 850-729-1254	Fax #	

Chain of Custody Record

59724

Quanterra

QUA-4124 0797

Client: Parsons	Project Manager: John Hicks	Date: 3/31/98	Chain of Custody Number: 02306
Address: 1700 Broadway Suite 900	Telephone Number (Area Code)/Fax Number: (303) 831-8100	Lab Number:	Page 1 of 3
City: Denver / State: CO / Zip Code: 80290	Site Contact: Cindy Nagel	Lab Contact: Ellen LaRiviere	
Project Name: Eglin AFB	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

	Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: BTEX+MTBE	PAHs	TRPH	Special Instructions/ Conditions of Receipt
11	BX-MP02-S3	3/26/98	1015			X							X	X	X	
12	BX-MP02-S5	3/26/98	1015			X							X	X	X	
13	BX-VMP2-S3	3/28/98	0725			X							X	X	X	
14	BX-VMP2-S5	3/28/98	0725			X							X	X	X	
15	BX-VMP2-S7	3/28/98	0725			X							X	X	X	
16	BX-VEW1-S3	3/28/98	0815			X							X	X	X	
17	BX-VEW1-S5	3/28/98	0815			X							X	X	X	
18	BX-VEW1-S7	3/28/98	0815			X							X	X	X	
19	BX-VEW2-S5.5	3/28/98	0930			X							X	X	X	
20	BX-SB06-S3	3/28/98	1500			X							X	X	X	
21	BX-SB06-S4	3/28/98	1500			X							X	X	X	
22	BX-SB06-S7	3/28/98	1500			X							X	X	X	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
(A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other_____

QC Requirements (Specify)

1. Relinquished By: Cindy Nagel	Date: 4/1/98	Time: 1530	1. Received By: Kristi Bixby	Date: 4-2-98	Time: 0830
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

59724

Quanterra

QUA-4124 0797

Client: Parsons	Project Manager: John Hicks	Date: 3/31/98	Chain of Custody Number: 02307
Address: 1700 Broadway Ste 900	Telephone Number (Area Code)/Fax Number: (303) 831 - 8100	Lab Number:	Page 2 of 3
City: Denver / State: CO / Zip Code: 80290	Site Contact: Cindy Nagel	Lab Contact: Ellen LaRiviere	
Project Name: Eglin AFB	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Analysis: BTEX + MTBE	PAHs	TRPH	Special Instructions/ Conditions of Receipt
01 BX-SB07-S4.5	3/28/98	1600			X							X	X	X	
02 BX-SB07-S7	3/28/98	1600			X							X	X	X	
03 BX-SB08-S5	3/28/98	1630			X							X	X	X	
04 BX-SB09-S8	3/29/98	0745			X							X	X	X	
05 BX-SB11-S5	3/29/98				X							X	X	X	
06 BX-SB12-S7	3/30/98				X							X	X	X	
07 BX-SB14-S7	3/30/98				X							X	X	X	
08 Mil-B-S25	3/29/98				X							X	X	X	
09 Mil-K-S15	3/30/98				X							X	X	X	
10 Mil-V-S26	3/29/98				X							X	X	X	
10MS Mil-V-S26/MS	3/29/98				X							X	X	X	
10SD Mil-V-S26/MSD	3/29/98				X							X	X	X	

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other_____

QC Requirements (Specify)

1. Relinquished By: Cindy Nagel	Date: 4/1/98	Time: 1530	1. Received By: Kristo Bailey	Date: 4-2-98	Time: 0830
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

59724

Quanterra

QUA-4124 0797

Client: Parsons	Project Manager: John Hicks	Date: 3/31/98	Chain of Custody Number: 02308
Address: 1700 Broadway Suite 900	Telephone Number (Area Code)/Fax Number: (303) 831-8100	Lab Number:	Page 3 of 3
City: Denver / State: CO / Zip Code: 80290	Site Contact: Cindy Nagel	Lab Contact: Ellen LaRiviere	
Project Name: Eglin AFB	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

	Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Matrix: Sed.	Matrix: Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: BTEX + MTBE	Analysis: PAHs	Analysis: TRPH	Analysis: TOC	Special Instructions/ Conditions of Receipt
23	BX-SB01-S7	3/28/98	0750			X										X	
24	BX-SB02-S7	3/28/98	1040			X										X	
25	BX-SB03-S7	3/28/98	1120			X										X	
26	Mil-K-S8	3/30/98				X										X	
27	Mil-V-S8	3/29/98				X										X	
28TB	Trip Blank	3/31/98		X						X			X				
29EB	Rinsate	3/31/98		X									X	X	X		

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

1. Relinquished By: Cindy Nagel	Date: 4/1/98	Time: 1530	1. Received By: Krista Bixby	Date: 4-2-98	Time: 0830
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

AIR TOXICS LTD.

SAMPLE NAME : BX SG1

ID#: 9804028-01A

EPA Method TO-3 GC/PID/FID

File Name:	6041512	Date of Collection:	4/ 1/98
Dil. Factor:	20.2	Date of Analysis:	4/15/98

Compound	Rpt. Limit (ppmv)	Rpt. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.020	0.066	Not Detected	Not Detected
Toluene	0.020	0.077	0.059	0.22
Ethyl Benzene	0.020	0.089	0.048	0.21
Total Xylenes	0.020	0.089	0.19	0.84
TPH (C5+ Hydrocarbons) ref. to Gasoline	0.20	0.84	5.9	24
C2-C4 Hydrocarbons ref. to Gasoline	0.20	0.37	Not Detected	Not Detected

Container Type: 1 Liter Summa Canister

Surrogates	% Recovery	Method Limits
Fluorobenzene (PID)	112	50-150
Fluorobenzene (FID)	125	50-150

AIR TOXICS LTD.

SAMPLE NAME : BX SG2

ID#: 9804028-02A

EPA Method TO-3 GC/PID/FID

File Name:	6041510	Date of Collection:	4/ 1/98
Dil. Factor:	4.92	Date of Analysis:	4/15/98

Compound	Rpt. Limit (ppmv)	Rpt. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.0049	0.016	0.023	0.074
Toluene	0.0049	0.019	0.092	0.35
Ethyl Benzene	0.0049	0.022	0.53	2.3
Total Xylenes	0.0049	0.022	0.41	1.8
TPH (C5+ Hydrocarbons) ref. to Gasoline	0.049	0.20	22	92
C2-C4 Hydrocarbons ref. to Gasoline	0.049	0.090	0.076	0.14

Container Type: 1 Liter Summa Canister

Surrogates	% Recovery	Method Limits
Fluorobenzene (PID)	109	50-150
Fluorobenzene (FID)	126	50-150

AIR TOXICS LTD.

SAMPLE NAME : BX SG3

ID#: 9804028-03A

EPA Method TO-3 GC/PID/FID

File Name:	6041513	Date of Collection:	4/ 1/98
Dil. Factor:	19.9	Date of Analysis:	4/15/98

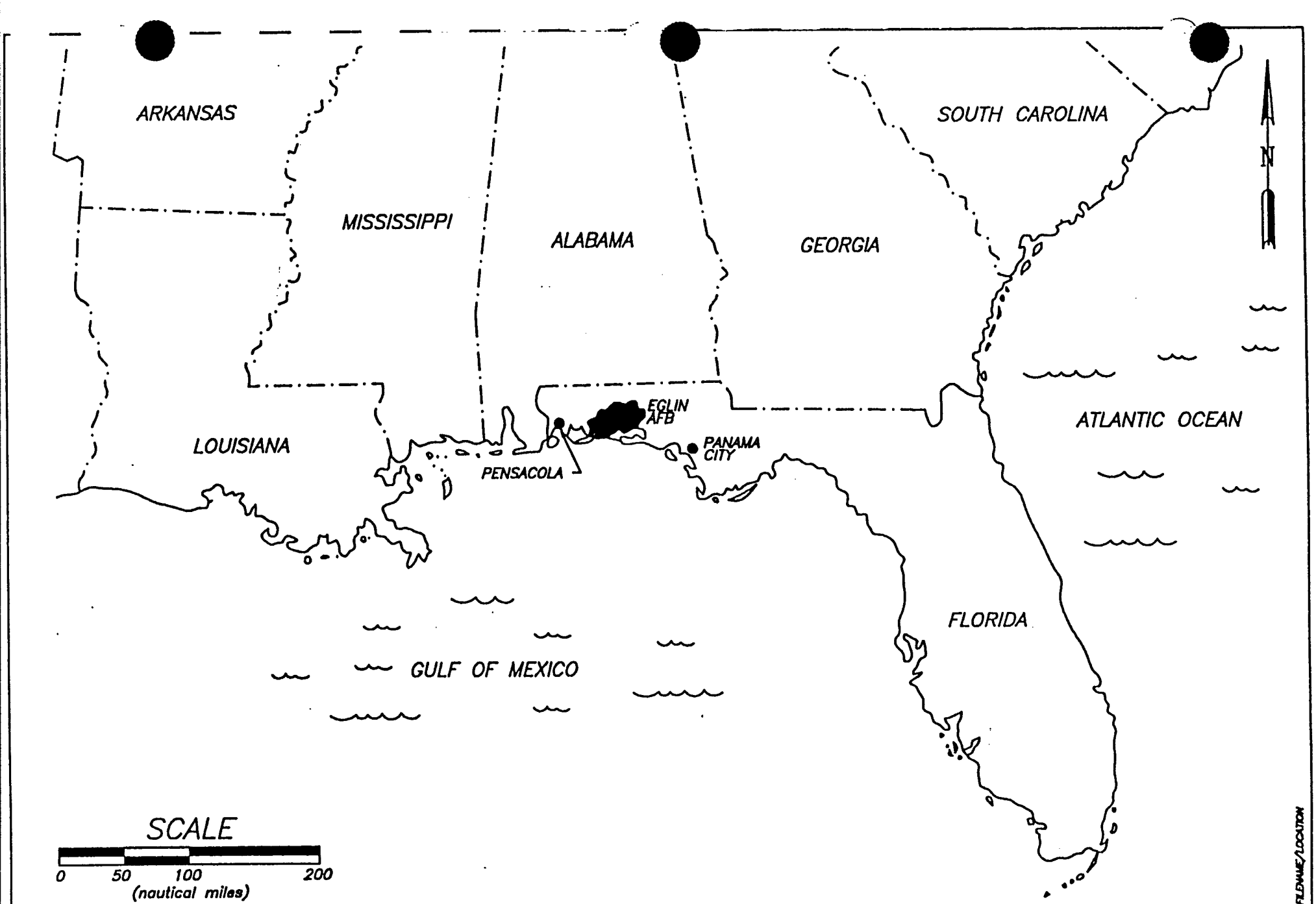
Compound	Rpt. Limit (ppmv)	Rpt. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.020	0.065	Not Detected	Not Detected
Toluene	0.020	0.076	0.047	0.18
Ethyl Benzene	0.020	0.088	0.032	0.14
Total Xylenes	0.020	0.088	0.12	0.51
TPH (C5+ Hydrocarbons) ref. to Gasoline	0.20	0.83	0.79	3.3
C2-C4 Hydrocarbons ref. to Gasoline	0.20	0.36	Not Detected	Not Detected

Container Type: 1 Liter Summa Canister

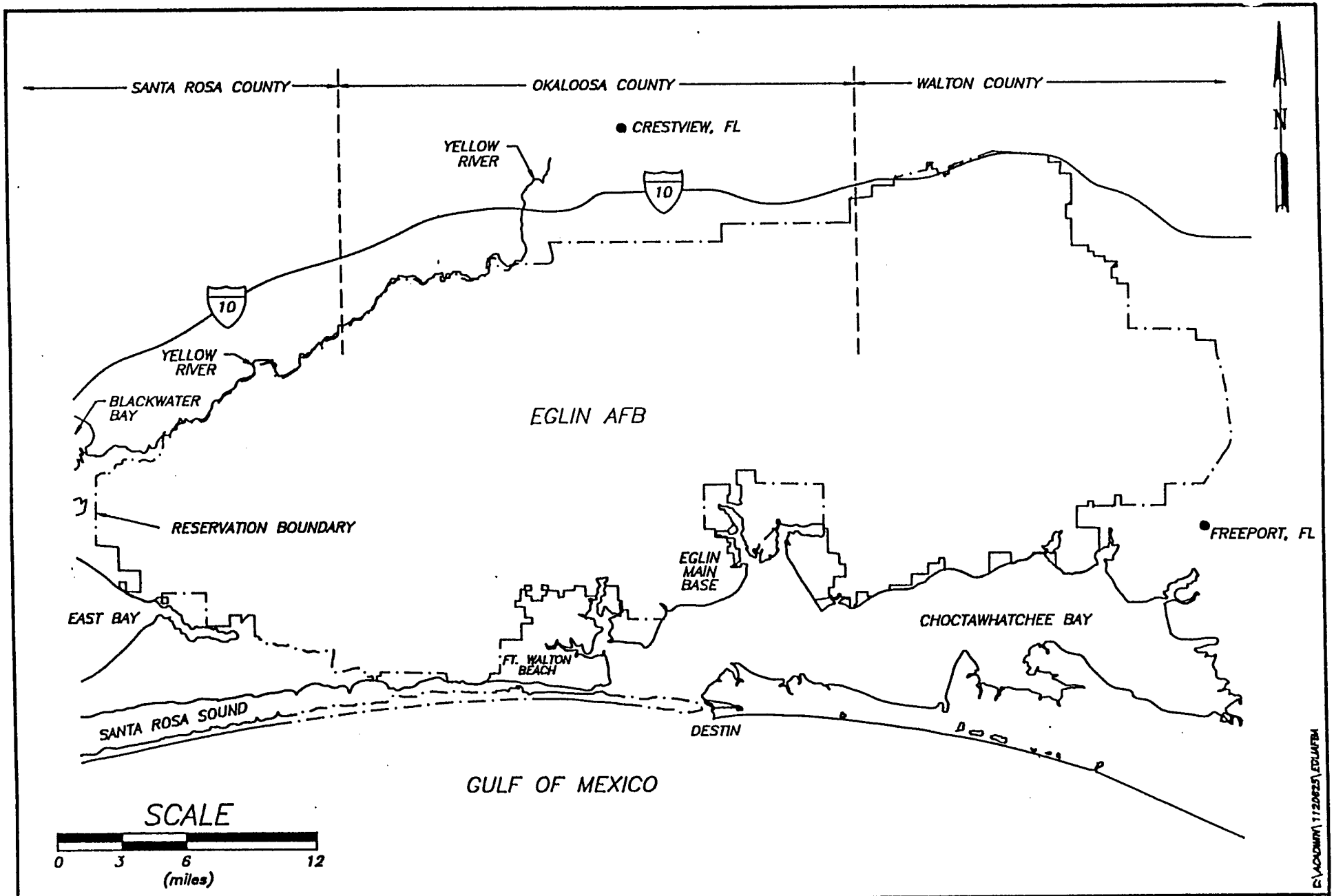
Surrogates	% Recovery	Method Limits
Fluorobenzene (PID)	107	50-150
Fluorobenzene (FID)	107	50-150

APPENDIX B

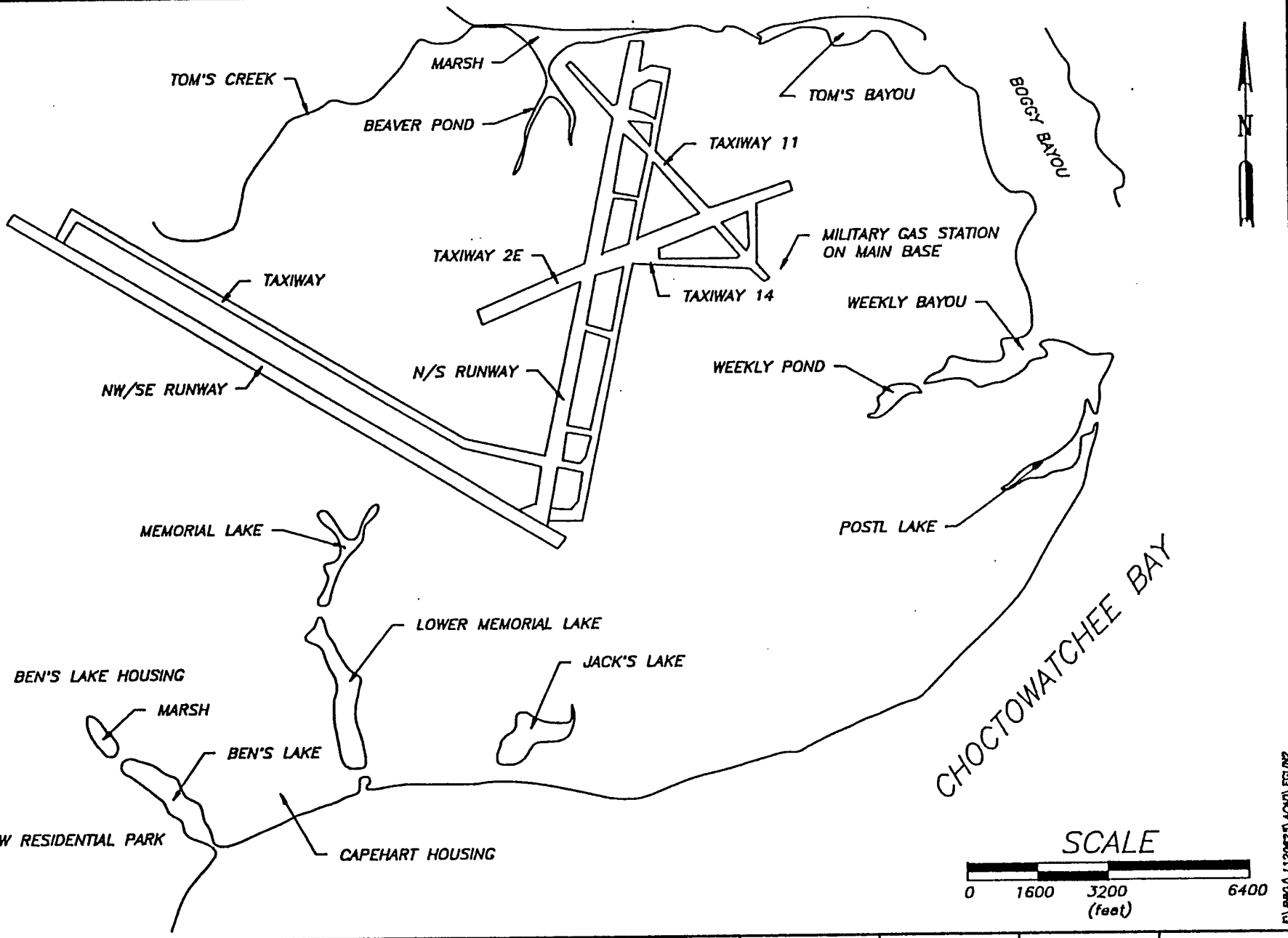
DATA FROM PREVIOUS INVESTIGATIONS



EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC.	EGLIN AFB OKALOOSA COUNTY, FLORIDA	REGIONAL LOCATION MAP	DESIGNED BY J. HUTTON	DRAWN BY J. ANGELO	DATE 6/15/94	PROJECT NO. 11206.25
			CHECKED BY	PROJECT MGR. R. OWENS	SCALE 1" = 100nm	FIGURE 1

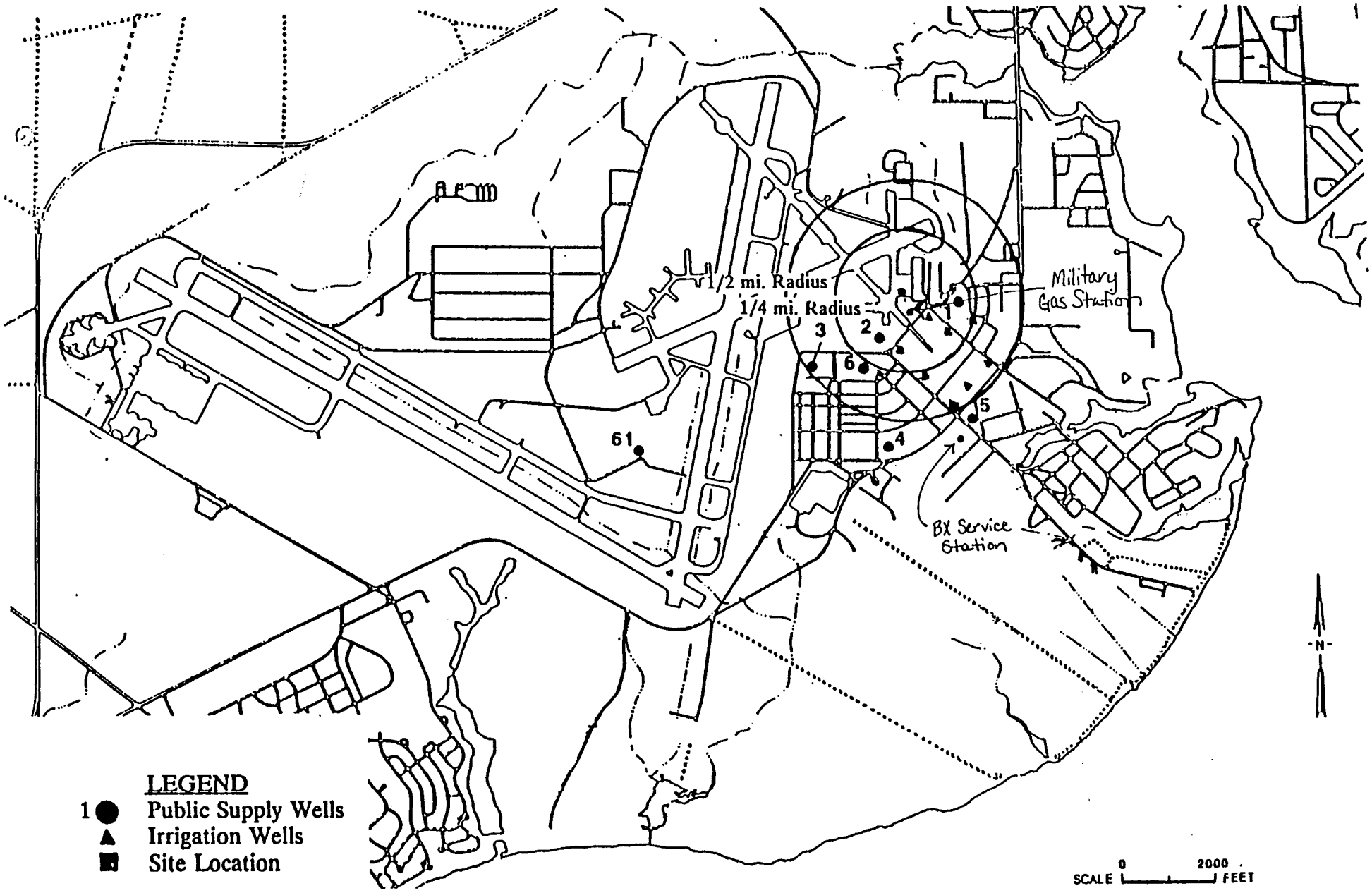


EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC.	EGLIN AFB OKALOOSA COUNTY, FLORIDA	RESERVATION MAP	DESIGNED BY J. ANGELO	DRAWN BY J. ANGELO	DATE 6/30/94	PROJECT NO. 11206.25
			CHECKED BY	PROJECT MGR. R. OWENS	SCALE 1" = 6mi	FIGURE 2



F:\PROJ\11206.25\ACAD\EGLIN2

EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC.	EGLIN AFB, OKALOOSA COUNTY, FLORIDA	MAIN BASE VICINITY MAP	DESIGNED BY J. ANGELO	DRAWN BY J. ANGELO	DATE 10/18/94	PROJECT NO. 11206.25
			CHECKED BY	PROJECT MGR. R. OWENS	SCALE 1" = 3200'	FIGURE 3



EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC.	EGLIN AFB OKALOOSA COUNTY, FLORIDA	Public Water Supply Wells and Irrigation Wells near the Military Gas Station	DESIGNED BY J. HUTTON	DRAWN BY EJR	DATE 10/14/94	PROJECT NO. 11206.25
			CHECKED BY	PROJECT MGR. R. OWENS	SCALE AS SHOWN	FIGURE 6

Table 1
WELL-INSTALLATION, WATER-LEVEL AND
FUEL-THICKNESS INFORMATION
7th Street Station
Eglin AFB

Well Number	Screen Interval (Feet below Land Surface)	Well Elevation, Top of Casing (ft msl)	Water Table Elevation (ft msl)	DTW	Fuel Thickness (in)
1	5-10	20.7	14.0	6.7	1.0
1D	45-50	22.6			
2	5-10	21.3	13.8	7.5	ND
3	5-10	21.2	13.6	7.6	ND
4	5-10	21.1	13.2		ND
5	5-10	20.4	14.1		ND
6	5-10	20.5	12.9		ND
6D	45-50	22.2			
7	5-10	19.4	14.5		ND
8	5-10	19.2	14.3		0.5
9	5-10	19.2	14.4		1.5
10	5-10	18.9	14.3		0.5
A	5-10(?)				NM
B	5-10(?)				NM
C	5-10(?)				NM
D	5-10(?)				NM
E	5-10(?)				ND
P-1	0- 5				ND
P-2	0- 5				ND

Water-level and fuel thickness measured 7/31/85. Well information on wells A-E installed by USAF not verified.

ND = not detected when measured.
NM = not measured - measurement not attempted.

TABLE 2.1
WELL SURVEY DATA (25 JULY 1991)
7TH STREET BX SERVICE STATION
EGLIN AFB

Well	Horizontal North	Horizontal East	Marked Top of Casing[1]	Ground Elevation	Water Level Elevation (ft. MSL) Baseline	DTW	8/16/91	8/23/91	8/30/91
MW1	543747.7438	1370712.7400	20.74	20.60	14.60	6	15.16	13.74	13.56
MW1-DP	543749.3897	1370716.0000	22.67	20.54	14.33	6.21	13.97	13.67	13.49
MW2	543774.4214	1370818.0201	21.25	21.00	(15.8)	-- (7.2)	--	--	--
MW3	543741.6962	1370897.8900	21.25	20.97	14.22	6.75	13.50	13.21	12.64
MW4	543652.2800	1370986.1097	21.30	20.89	(13.2)	-- (7.69)	--	--	--
MW5	543481.4580	1370217.1793	21.02	19.27	14.57	4.7	16.11	15.82	15.79
MW6	543590.9498	1371047.6795	20.40	20.25	13.55	6.7	12.78	12.32	11.96
MW6-DP	543590.9498	1371047.6795	22.05	20.21	13.20	7.01	12.70	12.24	12.06
MW7	543858.2691	1370581.9703	19.40	19.74	14.94	4.8	14.55	14.20	14.03
MW8	543798.3970	1370613.3501	19.78	19.99	(14.3)	-- 5.69	--	--	--
MW9	543831.1550	1370630.7802	19.25	19.70	(14.4)	-- 5.3	--	--	--
MW10	543849.8109	1370673.8303	18.91	19.15	14.81	4.34	14.46	14.12	14.03
MWE	543811.1770	1370966.2202	21.39	20.34	14.58	5.76	13.58	13.24	12.90

(1) Top of 2 inch PVC casing (well riser)

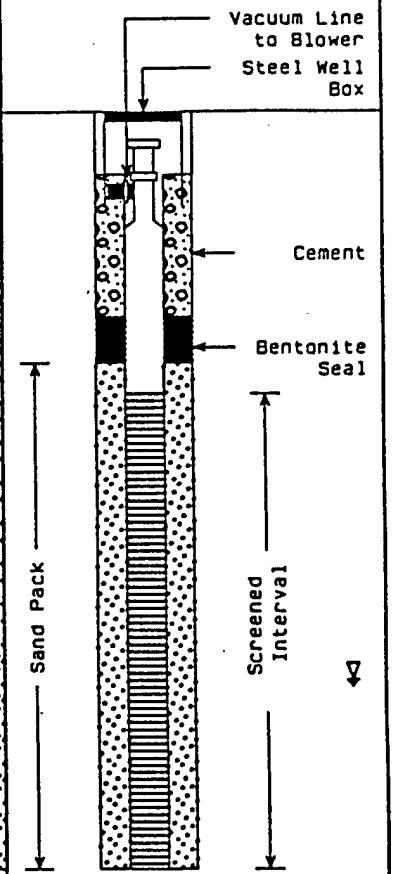
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Client Eglin AFB
Site 7th Street
Boring I.D. VEW-1
Geologist/Engineer Staes
Drilling Method HSA
Sampling Method Split Spoon
Date Started 5/12/92
Date Completed 5/12/92
Driller Griner Drilling Co.
Borehole Diameter (in) 6 5/8
Depth Drilled (ft) 8
Ground Elevation (ft)
Depth to Water (ft) 6
Date Measured 5/12/92

Project I.D. AT510
Well I.D. VEW-1
Date Installed 5/12/92
Date Grouted 5/12/92
Casing Material PVC Sch. 40
Screen Material same, 0.020 slot
Casing Interval (ft) 0-3
Screened Interval (ft) 3-8
Sump Installed? No
Well Depth (ft) 8
TOC Elevation (ft)
Water Level (ft)
Date Measured

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	HNu/OVA (ppm)	LITHOLOGIC DESCRIPTION	SOIL CLASS	GRAPHIC LOG
0		11,11, 5,13		90	ASPHALT. SAND, black, petroliferous, moderate odor, medium-grained, uniform.	SW	
2		5,7, 11,12		50	As above, black to light tan, alternating layers, dark brown at 4'.		
4		4,6, 6,13		40	As above, light tan, moderate to strong petroleum odor, moist at 5.8'.		
6		5,8, 10,11		70	As above, light tan, strong petroleum odor, saturated at 6'.		
8					Total Depth = 8'		
10							

WELL DIAGRAM



eglin2

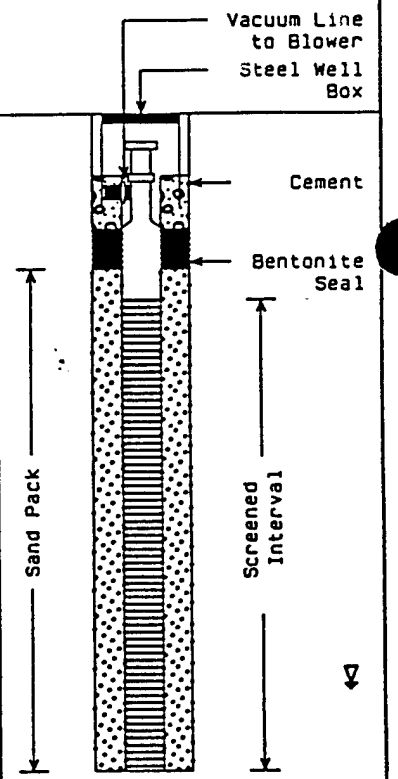
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Client Eglin AFB
Site 7th Street
Boring I.D. VEW-2
Geologist/Engineer Staes
Drilling Method HSA
Sampling Method Split Spoon
Date Started 5/12/92
Date Completed 5/12/92
Driller Griner Drilling Co.
Borehole Diameter (in) 6 5/8
Depth Drilled (ft) 8.58
Ground Elevation (ft)
Depth to Water (ft) 6.08
Date Measured 5/12/92

Project I.D. AT510
Well I.D. VEW-2
Date Installed 5/12/92
Date Grouted 5/12/92
Casing Material PVC Sch. 40
Screen Material same, 0.020 slot
Casing Interval (ft) 0-2
Screened Interval (ft) 2-7
Sump Installed? No
Well Depth (ft) 7
TOC Elevation (ft)
Water Level (ft)
Date Measured

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	HNu/OVA (ppm)	LITHOLOGIC DESCRIPTION	SOIL CLASS	GRAPHIC LOG
0					ASPHALT.	SW	
		7,6, 6,7		35	SAND, black to light tan, medium-grained, uniform, moderate petroleum odor.		
2		3,3, 3,3		55			
4		1,1, 2,6		30	As above, strong petroleum odor, moist, light tan.		
6		1,5, 9,11		45	As above, some black layers, strong petroleum odor, saturated at 6.17'.		
8					Total Depth = 8.58'		
10							

WELL DIAGRAM



eglin2

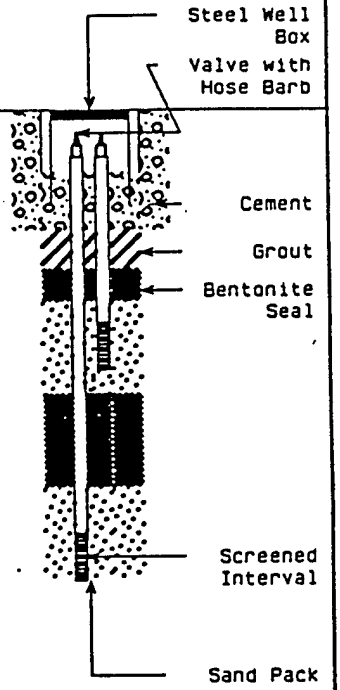
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Client Eglin AFB
Site 7th Street
Boring I.D. VMP-2
Geologist/Engineer Staes
Drilling Method HSA
Sampling Method Split Spoon
Date Started 5/13/92
Date Completed 5/13/92
Driller Griner Drilling Co.
Borehole Diameter (in) 6 5/8
Depth Drilled (ft) 5
Ground Elevation (ft)
Depth to Water (ft) NA
Date Measured NA

Project I.D. AT510
Well I.D. VMP-2
Date Installed 5/13/92
Date Grouted 5/13/92
Casing Material .25" Polyethylene
Screen Material 1" PVC, 0.010 slot
Casing Interval (ft) 0-2.25/0-4.5
Screened Interval (ft) 6"
Sump Installed? No
Well Depth (ft) 5
TOC Elevation (ft)
Water Level (ft)
Date Measured

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	HNu/OVA (ppm)	LITHOLOGIC DESCRIPTION	SOIL CLASS	GRAPHIC LOG
0					ASPHALT.	SW	
		5,8, 10,12		85	SAND, light tan to black, medium-grained, fairly uniform, some shells, tree stump at 2.5'.		
2							
		1,1, -,-		90	Black petroliferous SAND, spoon dropped two feet.		
4							
		1,1, 3,3		90	Black SAND with WOOD timber, all wood in spoon.		
					Total Depth = 5'		
6							
8							
10							

WELL DIAGRAM



eglin2

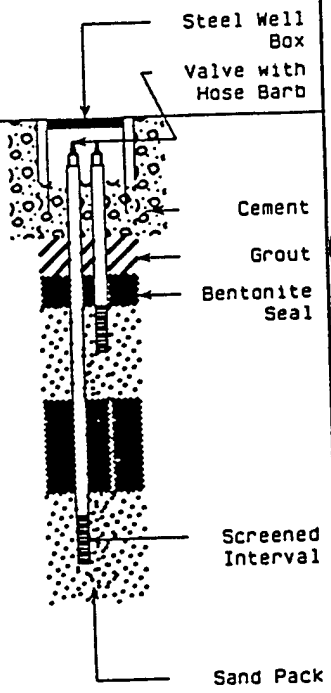
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Client Eglin AFB
Site 7th Street
Boring I.D. VMP-1
Geologist/Engineer Staes
Drilling Method HSA
Sampling Method Split Spoon
Date Started 5/13/92
Date Completed 5/13/92
Driller Griner Drilling Co.
Borehole Diameter (in) 6 5/8
Depth Drilled (ft) 6
Ground Elevation (ft)
Depth to Water (ft) NA
Date Measured NA

Project I.D. AT510
Well I.D. VMP-1
Date Installed 5/13/92
Date Grouted 5/13/92
Casing Material .25" Polyethylene
Screen Material 1" PVC, 0.010 slot
Casing Interval (ft) 0-2/0-3.25
Screened Interval (ft) 6"
Sump Installed? No
Well Depth (ft) 5.17
TOC Elevation (ft)
Water Level (ft)
Date Measured

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	HNu/OVA (ppm)	LITHOLOGIC DESCRIPTION	SOIL CLASS	GRAPHIC LOG
0					ASPHALT.	SW	
		12,11, 11,13		25	SAND, light tan to black, medium-grained, slightly moist, uniform.		
2		3,4, 6,5		80	As above, light tan to black to red-brown, moderate petroleum odor.		
4		5,5, 5,9		10	As above, light tan to light brown, minor petroleum odor.		
6					Total Depth = 6'		
8							
10							

WELL DIAGRAM



eglin2

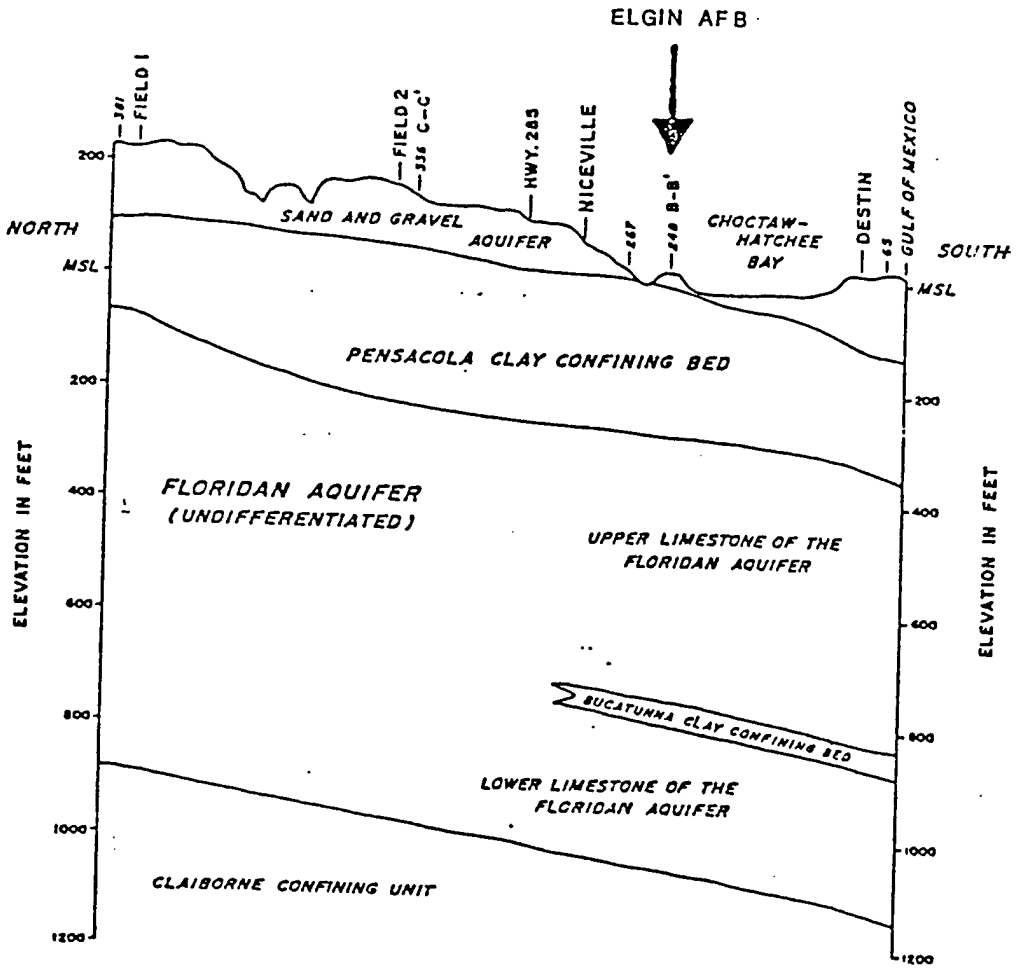


Figure B-1. Regional N-S Cross Section through Eglin AFB

TABLE 3
SUMMARY OF SOIL SAMPLING RESULTS OVER ONE YEAR OF BIOVENTING
7TH STREET BX SERVICE STATION
EGLIN AFB

		VEW1				VEW2				EAST TRENCH B1		EAST TRENCH B2		VAPOR MONITORING POINTS			
		May -92		May-93		May-92		May-93		May-92		May-93		May-92		May-93	
Parameter	Units	SS1	SS2	SS1 4-5'	SS2 5-6'	SS1	SS2	SS1 4-5'	SS2 5-6'	SB1	SB2	SB1 SW?	SB2 NE?	VMP1	VMP2	VMP1	VMP2
Benzene	ug/Kg	NA	ND	ND	ND	NA	1190 J	5500 U	5400 U	NA	NA	ND	ND	1.0 U	26,500	1.5	5400 U
Toluene	ug/Kg	NA	4,760	8,900	1,100	NA	7,620	1,200	22,000	NA	NA	ND	ND	1.0 U	152,000	5.4 U	73,000
Ethylbenzene	ug/Kg	NA	23,000	17,000	5,500	NA	6,430	5500 U	8,900	NA	NA	ND	ND	1.0 U	55,300	4.6	38,000
Xylenes	ug/Kg	NA	56,700	92,000	18,000	NA	32,100	130,000	150,000	NA	NA	ND	ND	1.0 U	274,000	7.6	340,000
TPH/TRPH	mg/Kg	830	150	53	31	1,000	130	180	55	640	ND	12B	13B	ND	1,200	15.0	190.0

NOTE: May - 92 Data is for pre-bioventing conditions at the site. May - 93 Data is for site subsurface conditions after one year of bioventing.

NA Not Analyzed
ND - Not Detected
J - Estimated value
TRPH analysis was performed in May 1993.
TPH analysis was performed in May 1992.
U - Not Detected at the detection limit shown.

TABLE 2.2
RESULTS OF BASELINE SAMPLING of Groundwater
JULY 19, 1991
7TH STREET BX SERVICE STATION
EGLIN AFB, FLORIDA

Parameter	Units	MCL Federal(2)	MCL Florida(3)	MW-1S	MW-1DP	MW-3	MW-5	MW-6S	MW-6DP	MW-8	MW-10	MW-E
Benzene	ug/L	5	1	7,140 **	ND	62.5 JN**	ND	ND	ND	1,190 **	4,650 **	ND
Toluene	ug/L	1,000	-	30,200 **	ND	45.6 JN	ND	ND	ND	10,500 **	4,590 **	ND
Ethylbenzene	ug/L	700	-	3,040 **	ND	7.5 JN	ND	ND	ND	6,730 **	563	ND
Xylenes	ug/L	10,000	-	18,910 **	ND	47.8 JN	ND	ND	ND	12,720 **	2,350	ND
Tric,Fl-Methane	ug/L	-	-	ND	ND	ND	20.5	ND	ND	ND	ND	ND
1,1-Dichloroethene	ug/L	7	7	ND	0.5 JN	ND	0.6 JN	0.5 JN	ND	ND	ND	0.5 JN
Chloromethane	ug/L	5	-	ND	3.2 U	3.2 U	2.4 U	2.3 U	ND	177 JN**	55 JN	2.8 U
Chloroform	ug/L	100 (1)	-	ND	ND	ND	ND	ND	1.1 U	ND	ND	ND
Trichloroethene	ug/L	5	3	ND	5.9 **	ND	ND	ND	3.7 **	ND	ND	ND
T-1,3-Dichloropropene	ug/L	-	-	ND	ND	2.2 JN	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ug/L	600 (1)	-	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ug/L	15 *	50	9.3	ND	8.8	ND	6.5	ND	9.6	35.1 **	4.1
pH	-	NA	NA	6.01	6.71	6.58	5.35	5.75	5.56	6.44	6.78	6.97
Conductivity	umhos/cm	NA	NA	371	76	290	186	256	67	234	290	218

MCL - Maximum Contaminant Level
NA - Not Applicable
ND - Not Detected
J - Estimated value
(1) - Compound listed for regulation
(2) - USEPA "Drinking Water Regulations and Health Advisories," November 1991.
(3) - FDER "Drinking Water Standards, Monitoring and Reporting," April 1990.

* - Action level
** - Concentration exceeding MCL
N - Tentative identification. Presumptive evidence of presence of material
U - Undetected at and above this level

AT510/922J153/T-2-2.XLS

TABLE 3 SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED AT THE 7TH STREET BX SERVICE STATION, IRP SITE OT-35, EGLIN AFB, OKALOOSA COUNTY, FLORIDA.

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date						
					MW-1						
					12/14/94	4/5/95	7/6/95	11/15/95	2/12/96	6/12/96	1/15/97
Volatile Organic Aromatics (VOA)											
Benzene	602	1-100	1	µg/L	1300	110	210	40	39	52	20
Toluene	602	1-100	NA	µg/L	5000	5300	2800	2000	1700	1500	1700
Ethylbenzene	602	1-100	NA	µg/L	2100	1300	920	600	510	720	620
Xylenes, Total	602	1-100	NA	µg/L	14,800	18,400	6800	9400	5900	6100	8300
Total VOA	602	1-100	50	µg/L	23,200	25,110	10,730	12,040	8149	8372	10,640
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	1400	---	18	<1	6.7	<5	<10
Chlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<5	<5	<10
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<5	<5	<10
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<5	<5	<10
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<5	<5	<10
Volatile Organic Halocarbons[c]											
Trichloroethene	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
Polynuclear Aromatic Hydrocarbons											
Naphthalene	610	1-20	NA	µg/L	---	1100	630	750	480	380	410
1-Methylnaphthalene	610	1-20	NA	µg/L	---	400	270	320	220	180	180
2-Methylnaphthalene	610	1-20	NA	µg/L	---	300	170	140	140	94	110
Total Naphthalenes	610	1-20	100	µg/L	---	1800	1070	1210	840	654	700
Acenaphthylene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	1.9	2.2
Acenaphthene	610	1-20	MDL	µg/L	---	21	<10	<10	5.8	1.7	<1
Fluorene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	---	<20	<10	<10	5.8	2.7	3
Anthracene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	2.1	2.8
Pyrene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	2.5	2.3
Benz(a)anthracene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Chrysene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	4.5	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---	<20	<10	<10	<5	<1	<1
Semivolatile Organics	625	1-10	NA	µg/L	---	---	---	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	9.7	9.4	2.7	6.2	4.3	4.8	2.5
Lead, Dissolved	239.2	1	50	µg/L	---	2.8	---	---	---	---	---

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date: MW-1D 12/14/94
Volatile Organic Aromatics (VOA)					
Benzene	602	1-100	1	µg/L	<1
Toluene	602	1-100	NA	µg/L	<1
Ethylbenzene	602	1-100	NA	µg/L	<1
Xylenes, Total	602	1-100	NA	µg/L	1.1
Total VOA	602	1-100	50	µg/L	1.1
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1
Chlorobenzene	602	1-100	NA	µg/L	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1
Volatile Organic Halocarbons[c]					
Trichloroethene	601	1-5	NA	µg/L	2.2
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1
Trichlorofluoromethane	601	1-5	NA	µg/L	<1
Polynuclear Aromatic Hydrocarbons					
Naphthalene	610	1-20	NA	µg/L	---
1-Methylnaphthalene	610	1-20	NA	µg/L	---
2-Methylnaphthalene	610	1-20	NA	µg/L	---
Total Naphthalenes	610	1-20	100	µg/L	---
Acenaphthylene	610	1-20	MDL	µg/L	---
Acenaphthene	610	1-20	MDL	µg/L	---
Fluorene	610	1-20	MDL	µg/L	---
Phenanthrene	610	1-20	MDL	µg/L	---
Anthracene	610	1-20	MDL	µg/L	---
Fluoranthene	610	1-20	MDL	µg/L	---
Pyrene	610	1-20	MDL	µg/L	---
Benz(a)anthracene	610	1-20	MDL	µg/L	---
Chrysene	610	1-20	MDL	µg/L	---
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---
Benzo(a)pyrene	610	1-20	MDL	µg/L	---
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---
Semivolatile Organics	625	1-10	NA	µg/L	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	<1
Lead, Dissolved	239.2	1	50	µg/L	---

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[c]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date						
					MW-2						
					12/15/94	4/5/95	7/6/95	11/15/95	2/12/96	6/12/96	1/15/97
Volatile Organic Aromatics (VOA)											
Benzene	602	1-100	1	µg/L	2400	2200	5100	2500	1800	2300	1100
Toluene	602	1-100	NA	µg/L	10,000	9500	32,000	25,000	20,000	23,000	18,000
Ethylbenzene	602	1-100	NA	µg/L	1100	1100	2800	2100	1900	2100	1800
Xylenes, Total	602	1-100	NA	µg/L	8200	9900	21,200	18,300	15,400	16,200	13,700
Total VOA	602	1-100	50	µg/L	21,700	22,700	61,100	47,900	39,100	43,600	34,600
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<5	---	<1	<1	<100	<50	<50
Chlorobenzene	602	1-100	NA	µg/L	<5	<1	<1	<1	<100	<50	<50
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<5	<1	<1	<1	<100	<50	<50
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<5	<1	<1	<1	<100	<50	<50
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<5	<1	<1	<1	<100	<50	<50
Volatile Organic Halocarbons[d]											
Trichloroethene	601	1-5	NA	µg/L	<5	---	---	---	---	---	---
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<5	---	---	---	---	---	---
Trichlorofluoromethane	601	1-5	NA	µg/L	<5	---	---	---	---	---	---
Polynuclear Aromatic Hydrocarbons											
Naphthalene	610	1-20	NA	µg/L	---	670	700	540	770	700	500
1-Methylnaphthalene	610	1-20	NA	µg/L	---	230	210	200	340	240	190
2-Methylnaphthalene	610	1-20	NA	µg/L	---	120	130	88	200	140	94
Total Naphthalenes	610	1-20	100	µg/L	---	1020	1040	828	1310	1080	784
Acenaphthylene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	4.5	2.8
Acenaphthene	610	1-20	MDL	µg/L	---	21	<10	<10	<10	1.5	<1
Fluorene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	---	13	<10	<10	<10	<1	<1
Anthracene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Pyrene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	6.8	<1
Chrysene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	5.7	1.5
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	1.1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---	<10	<10	<10	<10	<1	<1
Semivolatile Organics	625	1-10	NA	µg/L	---	---	---	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	16.9	6.3	7.8	6.8	13.8	11.8	3.9
Lead, Dissolved	239.2	1	50	µg/L	---	3.3	---	---	---	---	---

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date						
					MW-3						
					12/15/94	4/12/95	7/6/95	11/15/95	2/12/96	6/12/96	1/16/97
Volatile Organic Aromatics (VOA)											
Benzene	602	1-100	1	µg/l.	980	390	240	<1	<1	<1	<1
Toluene	602	1-100	NA	µg/l.	2100	5.6	5.6	<1	<1	<1	<1
Ethylbenzene	602	1-100	NA	µg/l.	210	190	130	<1	<1	260	<1
Xylenes, Total	602	1-100	NA	µg/L	1850	211	276	<1	3.3	65	<1
Total VOA	602	1-100	50	µg/l.	5140	796.6	651.6	<1	3.3	325	<1
Methyl Tert-Butyl Ether	602	1-100	50	µg/l.	<1	<5	1.6	<1	<1	<1	<1
Chlorobenzene	602	1-100	NA	µg/l.	<1	<5	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/l.	<1	<5	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<5	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/l.	<1	<5	<1	<1	<1	<1	<1
Volatile Organic Halocarbons[c]											
Trichloroethene	601	1-5	NA	µg/l.	<1	---	---	---	---	---	---
1,1,1-Trichloroethane	601	1-5	NA	µg/l.	<1	---	---	---	---	---	---
Trichlorofluoromethane	601	1-5	NA	µg/l.	<1	---	---	---	---	---	---
Polynuclear Aromatic Hydrocarbons											
Naphthalene	610	1-20	NA	µg/L	---	210	1	<1	3.8	32	<1
1-Methylnaphthalene	610	1-20	NA	µg/l.	---	69	<1	<1	2.8	1.1	<1
2-Methylnaphthalene	610	1-20	NA	µg/l.	---	55	1.1	<1	1.7	1.6	<1
Total Naphthalenes	610	1-20	100	µg/l.	---	334	2.1	<1	8.3	34.7	<1
Acenaphthylene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Acenaphthene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Fluorene	610	1-20	MDL	µg/l.	---	<10	<1	<1	1.4	<1	<1
Phenanthrene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Anthracene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Fluoranthene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Pyrene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	---	<10	<1	<1	<1	<1	<1
Chrysene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/l.	---	<10	<1	<1	<1	<1	<1
Semivolatile Organics	625	1-10	NA	µg/L	---	---	---	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/l.	4.9	1.3	<1	<1	<1	<1	<1
Lead, Dissolved	239.2	1	50	µg/l.	---	<1	---	---	---	---	---

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b,1]	Units	Well Number and Sample Date					
					MW-4					
					12/15/94	4/12/95	7/6/95	11/15/95	2/13/96	1/16/97
Volatile Organic Aromatics (VOA)										
Benzene	602	1-100	1	µg/L	200	43	<1	<1	<1	<1
Toluene	602	1-100	NA	µg/L	850	250	3.3	2.7	<1	<1
Ethylbenzene	602	1-100	NA	µg/L	110	61	1.3	<1	<1	<1
Xylenes, Total	602	1-100	NA	µg/L	620	540	7.7	13.0	<1	<1
Total VOA	602	1-100	50	µg/L	1780	894	12.3	15.7	<1	<1
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	35	<1	1.4	<1	<1	<1
Chlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	1.8	<1	<1
Volatile Organic Halocarbons[d]										
Trichloroethene	601	1-5	NA	µg/L	<1	---	---	---	---	---
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	---	---	---	---	---
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	---	---	---	---	---
Polynuclear Aromatic Hydrocarbons										
Naphthalene	610	1-20	NA	µg/L	---	5.7	<1	<1	<1	<1
1-Methylnaphthalene	610	1-20	NA	µg/L	---	1	<1	<1	<1	<1
2-Methylnaphthalene	610	1-20	NA	µg/L	---	5.4	<1	<1	<1	<1
Total Naphthalenes	610	1-20	100	µg/L	---	12.1	<1	<1	<1	<1
Acenaphthylene	610	1-20	MDL	µg/L	---	<1	1.2	<1	<1	<1
Acenaphthene	610	1-20	MDL	µg/L	---	<1	2.1	<1	<1	<1
Fluorene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Anthracene	610	1-20	MDL	µg/L	---	<1	1.8	<1	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Pyrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Chrysene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1
Semivolatile Organics	625	1-10	NA	µg/L	---	---	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	1.5	<1	<1	<1	<1	<1
Lead, Dissolved	239.2	1	50	µg/L	---	<1	---	---	---	---

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date	
					MW-5	
					12/14/94	4/5/95
Volatile Organic Aromatics (VOA)						
Benzene	602	1-100	1	µg/L	<1	<1
Toluene	602	1-100	NA	µg/L	<1	2.4
Ethylbenzene	602	1-100	NA	µg/L	13	<1
Xylenes, Total	602	1-100	NA	µg/L	33	2.8
Total VOA	602	1-100	50	µg/L	46	5.2
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1	--
Chlorobenzene	602	1-100	NA	µg/L	<1	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1
Volatile Organic Halocarbons[c]						
Trichloroethene	601	1-5	NA	µg/L	<1	--
1,1,1-Trichloromethane	601	1-5	NA	µg/L	<1	--
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	--
Polynuclear Aromatic Hydrocarbons						
Naphthalene	610	1-20	NA	µg/L	--	<1
1-Methylnaphthalene	610	1-20	NA	µg/L	--	<1
2-Methylnaphthalene	610	1-20	NA	µg/L	--	<1
Total Naphthalenes	610	1-20	100	µg/L	--	<1
Acenaphthylene	610	1-20	MDL	µg/L	--	<1
Acenaphthene	610	1-20	MDL	µg/L	--	<1
Fluorene	610	1-20	MDL	µg/L	--	<1
Phenanthrene	610	1-20	MDL	µg/L	--	<1
Anthracene	610	1-20	MDL	µg/L	--	<1
Fluoranthene	610	1-20	MDL	µg/L	--	<1
Pyrene	610	1-20	MDL	µg/L	--	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	--	<1
Chrysene	610	1-20	MDL	µg/L	--	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	--	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	--	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	--	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	--	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	--	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	--	<1
Semivolatile Organics[c]						
2,4-Dimethylphenol	625	1-10	NA	µg/L	--	--
Naphthalene	625	1-10	NA	µg/L	--	--
Bis(2-ethylhexyl)phthalate	625	1-10	NA	µg/L	--	--
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	1.8	<1
Lead, Dissolved	239.2	1	50	µg/L	--	<1

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date						
					MW-6						
					12/16/94	4/5/95	7/6/95	11/15/95	2/13/96	6/13/96	1/16/97
Volatile Organic Aromatics (VOA)											
Benzene	602	1-100	1	µg/L	<1	50	<1	<1	<1	<1	<1
Toluene	602	1-100	NA	µg/L	<1	2.2	2.1	<1	<1	<1	<1
Ethylbenzene	602	1-100	NA	µg/L	<1	69	<1	<1	<1	<1	<1
Xylenes, Total	602	1-100	NA	µg/L	<1	10.5	2.9	<1	<1	<1	<1
Total VOA	602	1-100	50	µg/L	<1	131.7	5	<1	<1	<1	<1
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1	---	<1	<1	<1	<1	<1
Chlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
Volatile Organic Halocarbons[a,c]											
Trichloroethene	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
Polynuclear Aromatic Hydrocarbons											
Naphthalene	610	1-20	NA	µg/L	---	<1	<1	<1	<1	<1	<1
1-Methylnaphthalene	610	1-20	NA	µg/L	---	<1	<1	<1	<1	<1	<1
2-Methylnaphthalene	610	1-20	NA	µg/L	---	<1	<1	<1	<1	<1	<1
Total Naphthalenes	610	1-20	100	µg/L	---	<1	<1	<1	<1	<1	<1
Acenaphthylene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Acenaphthene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Fluorene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Anthracene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Pyrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Chrysene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---	<1	<1	<1	<1	<1	<1
Semivolatile Organics[a,c]											
2,4-Dimethylphenol	625	1-10	NA	µg/L	---	---	---	---	---	---	---
Naphthalene	625	1-10	NA	µg/L	---	---	---	---	---	---	---
Bis(2-ethylhexyl)phthalate	625	1-10	NA	µg/L	---	---	---	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	<1	<1	<1	<1	<1	<1	<1
Lead, Dissolved	239.2	1	50	µg/L	---	---	---	---	---	---	---

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date				
					MW-6D	MW-8			
					12/16/94	12/14/94	11/15/95	2/12/96	6/12/96
Volatile Organic Aromatics (VOA)									
Benzene	602	1-100	1	µg/L	<1	12	<1	<10	<5
Toluene	602	1-100	NA	µg/L	1.1	79	17	<10	5.4
Ethylbenzene	602	1-100	NA	µg/L	<1	4500	1800	1600	1700
Xylenes, Total	602	1-100	NA	µg/L	1	11,300	4900	3300	4400
Total VOA	602	1-100	50	µg/L	2.1	15,891	6717	5900	6105.4
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1	<1	<1	<10	<5
Chlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<10	<5
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<10	<5
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<10	<5
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<10	<5
Volatile Organic Halocarbons[c]									
Trichloromethene	601	1-5	NA	µg/L	4.9	<1	--	--	--
1,1,1-Trichloromethane	601	1-5	NA	µg/L	11	<1	--	--	--
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	<1	--	--	--
Polynuclear Aromatic Hydrocarbons									
Naphthalene	610	1-20	NA	µg/L	<1.8	--	79	45	23
1-Methylnaphthalene	610	1-20	NA	µg/L	<1.8	--	36	18	20
2-Methylnaphthalene	610	1-20	NA	µg/L	<1.8	--	25	12	16
Total Naphthalenes	610	1-20	100	µg/L	<1.8	--	140	75	59
Acenaphthylene	610	1-20	MDL	µg/L	<2.3	--	1.1	<1	<1
Acenaphthene	610	1-20	MDL	µg/L	<1.8	--	1.7	<1	<1
Fluorene	610	1-20	MDL	µg/L	<0.21	--	<1	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	<0.64	--	<1	<1	<1
Anthracene	610	1-20	MDL	µg/L	<0.66	--	<1	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	<0.21	--	<1	<1	<1
Pyrene	610	1-20	MDL	µg/L	<0.27	--	<1	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	<0.014	--	<1	<1	<1
Chrysene	610	1-20	MDL	µg/L	<0.15	--	<1	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	<0.018	--	<1	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	<0.019	--	<1	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	<0.024	--	<1	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	<0.030	--	<1	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	<0.076	--	<1	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	<0.043	--	<1	<1	<1
Semivolatile Organics[d]									
2,4-Dimethylphenol	625	1-10	NA	µg/L	<10	--	--	--	--
Naphthalene	625	1-10	NA	µg/L	<10	--	--	--	--
Bis(2-ethylhexyl)phthalate	625	1-10	NA	µg/L	15	--	--	--	--
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	<1	2.2	2.2	<1	1.6
Lead, Dissolved	239.2	1	50	µg/L	--	--	--	--	--

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date			
					MW-9			
					12/14/94	11/15/95	2/12/96	6/12/96
Volatile Organic Aromatics (VOA)								
Benzene	602	1-100	1	µg/L	15	<10	<1	<2
Toluene	602	1-100	NA	µg/L	790	110	14	11
Ethylbenzene	602	1-100	NA	µg/L	1900	1500	540	510
Xylenes, Total	602	1-100	NA	µg/L	8200	6900	2010	2250
Total VOA	602	1-100	50	µg/L	10,905	8510	2564	2771
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1	<1	<1	<2
Chlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<2
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	74	<2
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	12	<2
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<2
Volatile Organic Halocarbons[c]								
Trichloroethene	601	1-5	NA	µg/L	<1	--	--	--
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	--	--	--
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	--	--	--
Polynuclear Aromatic Hydrocarbons								
Naphthalene	610	1-20	NA	µg/L	140	92	81	49
1-Methylnaphthalene	610	1-20	NA	µg/L	41	59	55	31
2-Methylnaphthalene	610	1-20	NA	µg/L	82	32	16	17
Total Naphthalenes	610	1-20	100	µg/L	263	183	152	97
Acenaphthylene	610	1-20	MDL	µg/L	21	<1	1.1	<1
Acenaphthene	610	1-20	MDL	µg/L	<1.8	<1	<1	<1
Fluorene	610	1-20	MDL	µg/L	0.63	<1	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	0.79	<1	<1	<1
Anthracene	610	1-20	MDL	µg/L	<0.66	<1	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	0.30	<1	<1	<1
Pyrene	610	1-20	MDL	µg/L	<0.27	<1	1.7	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	0.028	<1	<1	<1
Chrysene	610	1-20	MDL	µg/L	<0.15	<1	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	0.019	<1	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	<0.019	<1	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	0.065	<1	1.4	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	<0.030	<1	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	<0.076	<1	1.1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	<0.043	<1	<1	<1
Semivolatile Organics[c]								
2,4-Dimethylphenol	625	1-10	NA	µg/L	130	--	--	--
Naphthalene	625	1-10	NA	µg/L	130	--	--	--
Bis(2-ethylhexyl)phthalate	625	1-10	NA	µg/L	<10	--	--	--
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	4.6	2.1	3.6	1.4
Lead, Dissolved	239.2	1	50	µg/L	--	--	--	--

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date						
					MW-10						
					12/15/94	4/12/95	7/6/95	11/15/95	2/12/96	6/12/96	1/16/97
Volatile Organic Aromatics (VOA)											
Benzene	602	1-100	1	µg/L	980	390	240	80	52	70	49
Toluene	602	1-100	NA	µg/L	2100	5.6	5.6	2000	2500	2500	970
Ethylbenzene	602	1-100	NA	µg/L	210	190	130	700	1000	1300	940
Xylenes, Total	602	1-100	NA	µg/L	1850	211	276	2040	2330	2900	2700
Total VOA	602	1-300	50	µg/L	5140	796.6	651 6	4820	5882	6770	4659
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1	<5	1.6	<1	<10	<5	<5
Chlorobenzene	602	1-100	NA	µg/L	<1	<5	<1	<1	<10	<5	<5
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<5	<1	<1	<10	<5	<5
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<5	<1	<1	<10	<5	<5
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<5	<1	<1	<10	<5	<5
Volatile Organic Halocarbons[c]											
Trichloroethene	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	---	---	---	---	---	---
Polynuclear Aromatic Hydrocarbons											
Naphthalene	610	1-20	NA	µg/L	---	210	1	100	190	140	180
1-Methylnaphthalene	610	1-20	NA	µg/L	---	69	<1	40	61	36	50
2-Methylnaphthalene	610	1-20	NA	µg/L	---	55	1.1	15	35	19	27
Total Naphthalenes	610	1-20	100	µg/L	---	334	2 1	155	286	195	257
Acenaphthylene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Acenaphthene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Fluorene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Anthracene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Pyrene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Chrysene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---	<10	<1	<1	<5	<1	<1
Semivolatile Organics	625	1-10	NA	µg/L	---	---	---	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	4 9	1.3	<1	1 6	1.5	2.2	1.9
Lead, Dissolved	239.2	1	50	µg/L	---	<1	---	---	---	---	---

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date						
					MW-C						
					12/14/94	4/5/95	7/6/95	11/15/95	2/13/96	6/12/96	1/15/97
Volatile Organic Aromatics (VOA)											
Benzene	602	1-100	1	µg/L	4.5	4.8	<1	<1	<1	<1	<1
Toluene	602	1-100	NA	µg/L	12	15	1.4	<1	<1	<1	<1
Ethylbenzene	602	1-100	NA	µg/L	9.9	9.1	<1	<1	<1	<1	3.3
Xylenes, Total	602	1-100	NA	µg/L	170	97	14.1	2.8	1.7	1.2	3.6
Total VOA	602	1-100	50	µg/L	196.4	125.9	15.5	2.8	1.7	1.2	6.9
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1	--	<1	<1	<1	<1	<1
Chlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<1	<1	<1	<1
Volatile Organic Halocarbons[c]											
Trichloroethene	601	1-5	NA	µg/L	<1	--	--	--	--	--	--
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	--	--	--	--	--	--
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	--	--	--	--	--	--
Polynuclear Aromatic Hydrocarbons											
Naphthalene	610	1-20	NA	µg/L	--	12	1.9	<1	1	<1	<1
1-Methylnaphthalene	610	1-20	NA	µg/L	--	13	<1	<1	<1	<1	<1
2-Methylnaphthalene	610	1-20	NA	µg/L	--	14	<1	1.4	<1	<1	<1
Total Naphthalenes	610	1-20	100	µg/L	--	39	1.9	1.4	1	<1	<1
Acenaphthylene	610	1-20	MDL	µg/L	--	1.2	<1	<1	<1	<1	<1
Acenaphthene	610	1-20	MDL	µg/L	--	3.5	2.1	<1	<1	<1	<1
Fluorene	610	1-20	MDL	µg/L	--	2.5	<1	<1	<1	<1	<1
Phenanthrene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Anthracene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Pyrene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Chrysene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	--	<1	<1	<1	<1	<1	<1
Semivolatile Organics	625	1-10	NA	µg/L	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	2.7	2.2	<1	<1	<1[e]	<1	<1
Lead, Dissolved	239.2	1	50	µg/L	--	1.6	--	--	--	--	--

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date: MW-D 12/15/94
Volatile Organic Aromatics (VOA)					
Benzene	602	1-100	1	µg/L	<1
Toluene	602	1-100	NA	µg/L	<1
Ethylbenzene	602	1-100	NA	µg/L	<1
Xylenes, Total	602	1-100	NA	µg/L	<1
Total VOA	602	1-100	50	µg/L	<1
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1
Chlorobenzene	602	1-100	NA	µg/L	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1
Volatile Organic Halocarbons[b]					
Trichloroethene	601	1-5	NA	µg/L	<1
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1
Trichlorofluoromethane	601	1-5	NA	µg/L	<1
Polynuclear Aromatic Hydrocarbons					
Naphthalene	610	1-20	NA	µg/L	--
1-Methylnaphthalene	610	1-20	NA	µg/L	--
2-Methylnaphthalene	610	1-20	NA	µg/L	--
Total Naphthalenes	610	1-20	100	µg/L	--
Acenaphthylene	610	1-20	MDL	µg/L	--
Acenaphthene	610	1-20	MDL	µg/L	--
Fluorene	610	1-20	MDL	µg/L	--
Phenanthrene	610	1-20	MDL	µg/L	--
Anthracene	610	1-20	MDL	µg/L	--
Fluoranthene	610	1-20	MDL	µg/L	--
Pyrene	610	1-20	MDL	µg/L	--
Benz(a)anthracene	610	1-20	MDL	µg/L	--
Chrysene	610	1-20	MDL	µg/L	--
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	--
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	--
Benzo(a)pyrene	610	1-20	MDL	µg/L	--
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	--
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	--
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	--
Semivolatile Organics	625	1-10	NA	µg/L	--
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	<1
Lead, Dissolved	239.2	1	50	µg/L	--

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date				
					MW-E	GWRW-1		GWRW-2	
					12/15/94	12/15/94	4/12/95	12/15/94	4/12/95
Volatile Organic Aromatics (VOA)									
Benzene	602	1-100	1	µg/L	<1	87	57	1400	360
Toluene	602	1-100	NA	µg/L	<1	830	230	5800	3500
Ethylbenzene	602	1-100	NA	µg/L	<1	150	33	830	310
Xylenes, Total	602	1-100	NA	µg/L	<1	1370	300	6700	2140
Total VOA	602	1-100	50	µg/L	<1	2437	620	14,730	6310
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<1	<1	<1	52	<10
Chlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<2	<10
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<2	<10
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<2	<10
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	<1	<1	<2	<10
Volatile Organic Halocarbons[c]									
Trichloroethene	601	1-5	NA	µg/L	<1	<1	--	<2	--
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	<1	--	<2	--
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	<1	--	<2	--
Polynuclear Aromatic Hydrocarbons									
Naphthalene	610	1-20	NA	µg/L	--	--	--	--	--
1-Methylnaphthalene	610	1-20	NA	µg/L	--	--	--	--	--
2-Methylnaphthalene	610	1-20	NA	µg/L	--	--	--	--	--
Total Naphthalenes	610	1-20	100	µg/L	--	--	--	--	--
Acenaphthylene	610	1-20	MDL	µg/L	--	--	--	--	--
Acenaphthene	610	1-20	MDL	µg/L	--	--	--	--	--
Fluorene	610	1-20	MDL	µg/L	--	--	--	--	--
Phenanthrene	610	1-20	MDL	µg/L	--	--	--	--	--
Anthracene	610	1-20	MDL	µg/L	--	--	--	--	--
Fluoranthene	610	1-20	MDL	µg/L	--	--	--	--	--
Pyrene	610	1-20	MDL	µg/L	--	--	--	--	--
Benz(a)anthracene	610	1-20	MDL	µg/L	--	--	--	--	--
Chrysene	610	1-20	MDL	µg/L	--	--	--	--	--
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	--	--	--	--	--
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	--	--	--	--	--
Benzo(a)pyrene	610	1-20	MDL	µg/L	--	--	--	--	--
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	--	--	--	--	--
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	--	--	--	--	--
Semivolatile Organics	625	1-10	NA	µg/L	--	--	--	--	--
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	<1	2.2	<1	15.2	1.6
Lead, Dissolved	239.2	1	50	µg/L	--	--	--	--	--

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date					
					GWRW-3		GWRW-4		GWRW-5	
					12/15/94	4/12/95	12/16/94	4/12/95	12/16/94	4/12/95
Volatile Organic Aromatics (VOA)										
Benzene	602	1-100	1	µg/L	310	2200	1800	1300	660	110
Toluene	602	1-100	NA	µg/L	5600	650	5900	90	1100	7.7
Ethylbenzene	602	1-100	NA	µg/L	680	1400	570	790	270	66
Xylenes, Total	602	1-100	NA	µg/L	5900	5900	4100	2000	1350	172
Total VOA	602	1-100	50	µg/L	12,490	10,150	12,370	4180	3380	355.7
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	<2	<20	15	<5	25	<1
Chlorobenzene	602	1-100	NA	µg/L	<2	<20	<2	<5	<1	<1
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<2	<20	<2	<5	<1	<1
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<2	<20	<2	<5	<1	<1
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<2	<20	<2	<5	<1	<1
Volatile Organic Halocarbons[c]										
Trichloroethene	601	1-5	NA	µg/L	<2	---	<2	---	<1	---
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<2	---	<2	---	<1	---
Trichlorofluoromethane	601	1-5	NA	µg/L	<2	---	<2	---	<1	---
Polynuclear Aromatic Hydrocarbons										
Naphthalene	610	1-20	NA	µg/L	---	---	---	---	---	---
1-Methylnaphthalene	610	1-20	NA	µg/L	---	---	---	---	---	---
2-Methylnaphthalene	610	1-20	NA	µg/L	---	---	---	---	---	---
Total Naphthalenes	610	1-20	100	µg/L	---	---	---	---	---	---
Acenaphthylene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Acenaphthene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Fluorene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Phenanthrene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Anthracene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Fluoranthene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Pyrene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Benz(a)anthracene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Chrysene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Benzo(a)pyrene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---	---	---	---	---	---
Semivolatile Organics	625	1-10	NA	µg/L	---	---	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	10.1	2.5	2.3	<1	1.8	<1
Lead, Dissolved	239.2	1	50	µg/L	---	---	---	---	---	---

TABLE 3 (Continued)

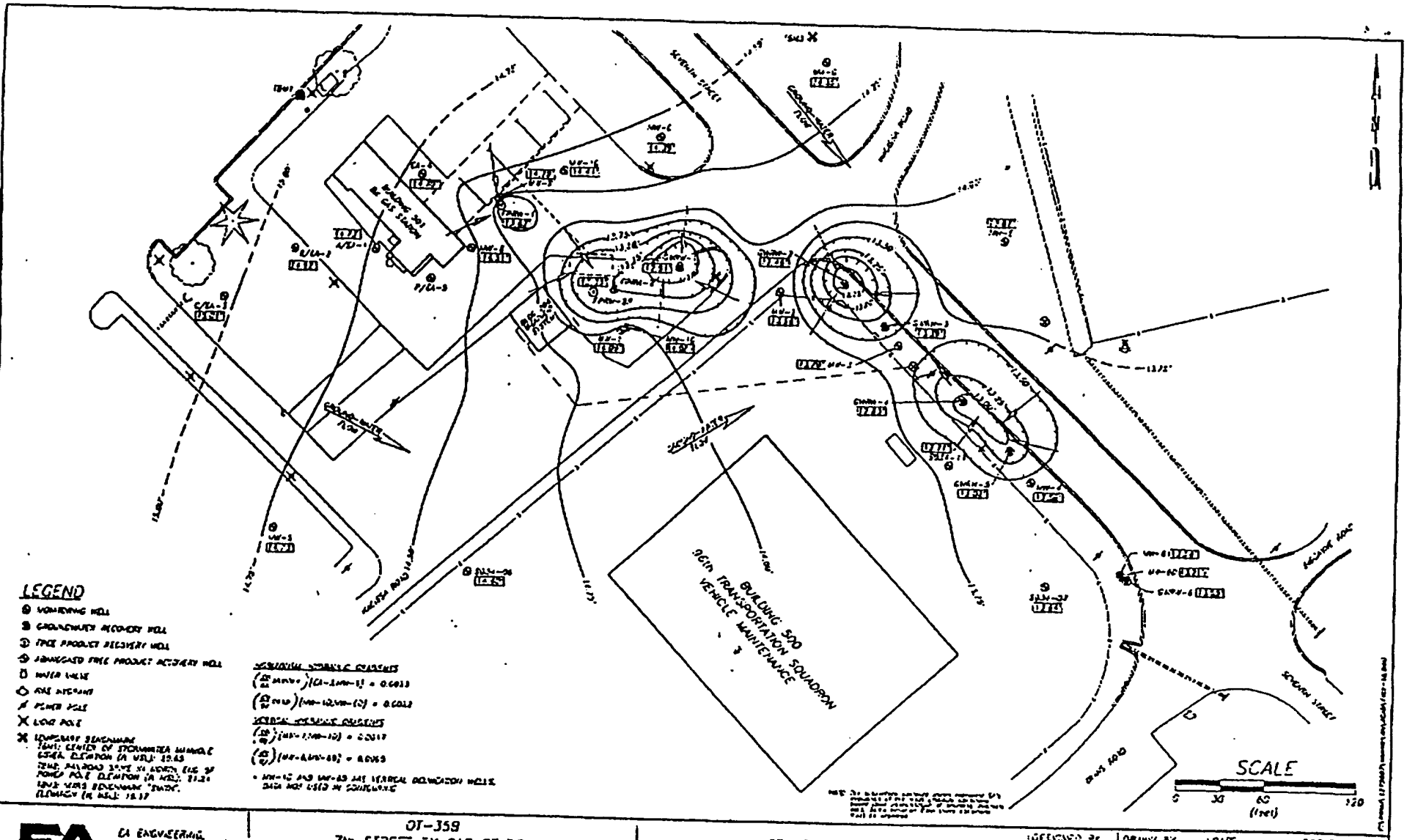
Analyte	EPA Method Number	MDL[a]	Florida Target Cleanup Concentration[b]	Units	Well Number and Sample Date			
					GWRW-6	FPRW-1		FPRW-2R
					12/16/94	12/14/94	4/12/95	4/12/95
Volatile Organic Aromatics (VOA)								
Benzene	602	1-100	1	µg/L	<1	---	5	370
Toluene	602	1-100	NA	µg/L	<1	---	45	2800
Ethylbenzene	602	1-100	NA	µg/L	<1	---	88	1200
Xylenes, Total	602	1-100	NA	µg/L	<1	---	289	2220
Total VOA	602	1-100	50	µg/L	<1	---	427	6590
Methyl Tert-Butyl Ether	602	1-100	50	µg/L	3.2	---	3.3	140
Chlorobenzene	602	1-100	NA	µg/L	<1	---	<1	<10
1,2-Dichlorobenzene	602	1-100	NA	µg/L	<1	---	<1	<10
1,3-Dichlorobenzene	602	1-100	NA	µg/L	<1	---	<1	<10
1,4-Dichlorobenzene	602	1-100	NA	µg/L	<1	---	<1	<10
Volatile Organic Halocarbons[c]								
Trichloroethene	601	1-5	NA	µg/L	<1	---	<1	<5
1,1,1-Trichloroethane	601	1-5	NA	µg/L	<1	---	<1	<5
Trichlorofluoromethane	601	1-5	NA	µg/L	<1	---	<1	<5
Polynuclear Aromatic Hydrocarbons								
Naphthalene	610	1-20	NA	µg/L	---	---	16	80
1-Methylnaphthalene	610	1-20	NA	µg/L	---	---	6.1	21
2-Methylnaphthalene	610	1-20	NA	µg/L	---	---	3.6	11
Total Naphthalenes	610	1-20	100	µg/L	---	---	25.7	112
Acenaphthylene	610	1-20	MDL	µg/L	---	---	<1	4.4
Acenaphthene	610	1-20	MDL	µg/L	---	---	<1	2.8
Fluorene	610	1-20	MDL	µg/L	---	---	1.1	1.3
Phenanthrene	610	1-20	MDL	µg/L	---	---	1.4	2.5
Anthracene	610	1-20	MDL	µg/L	---	---	<1	<1
Fluoranthene	610	1-20	MDL	µg/L	---	---	<1	<1
Pyrene	610	1-20	MDL	µg/L	---	---	<1	<1
Benz(a)anthracene	610	1-20	MDL	µg/L	---	---	<1	<1
Chrysene	610	1-20	MDL	µg/L	---	---	<1	<1
Benzo(b)fluoranthene	610	1-20	MDL	µg/L	---	---	<1	<1
Benzo(k)fluoranthene	610	1-20	MDL	µg/L	---	---	<1	<1
Benzo(a)pyrene	610	1-20	MDL	µg/L	---	---	<1	<1
Dibenz(a,h)anthracene	610	1-20	MDL	µg/L	---	---	<1	<1
Benzo(g,h,i)perylene	610	1-20	MDL	µg/L	---	---	<1	<1
Indeno(1,2,3-cd)pyrene	610	1-20	MDL	µg/L	---	---	<1	<1
Semivolatile Organics	625	1-10	NA	µg/L	---	---	---	---
Total Petroleum Hydrocarbons	418.1	1	5	mg/L	<1	<1	<1	1.1
Lead, Dissolved	239.2	1	50	µg/L	---	---	<1	<1

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	FDEP Target Cleanup Concentration[b]	Units	Well Identification and Sample Date			
					OT35B/EA1		OT35B/EA2	
					10/24/95	1/15/97	10/24/95	1/15/97
Volatile Organic Aromatics (VOA)[c]								
Benzene	602	1.0	1	µg/L	<1	<1	<1	<1
Toluene	602	1.0	NA	µg/L	<1	<1	<1	<1
Ethylbenzene	602	1.0	NA	µg/L	<1	<1	<1	<1
Total Xylenes	602	1.0	NA	µg/L	<1	<1	<1	1.4
Total VOA	602	1.0	50	µg/L	<1	<1	<1	1.4
Chlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1
1,3-Dichlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1
1,4-Dichlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1
1,2-Dichlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1
Methyl Tert-Butyl Ether	602	1.0	50	µg/L	<1	<1	<1	<1
Volatile Organic Halocarbons (VOH)[c]								
Tetrachloroethane	601	1.0	NA	µg/L	1.1	--	<1	--
Chloroform	601	1.0	NA	µg/L	<1	--	<1	--
Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	8100	1.0	NA	µg/L	<1	<1	<1	<1
1-Methylnaphthalene	8100	1.0	NA	µg/L	<1	<1	<1	<1
2-Methylnaphthalene	8100	1.0	NA	µg/L	<1	<1	<1	<1
Total Naphthalenes	8100	1.0	100	µg/L	<1	<1	<1	<1
Acenaphthene	8100	1.0	MDL	µg/L	<1	<1	<1	<1
Total Petroleum Hydrocarbons (TPH)	418.1	0.60-1.0	5	mg/L	<1	<1	<1	<1
Metals								
Lead, Total	239.2	1.0	50	µg/L	3.9	--	6.0	--

TABLE 3 (Continued)

Analyte	EPA Method Number	MDL[a]	FDEP Target Cleanup Concentration[b]	Units	Well Number and Sample Date					
					OT35IW/EA3			OT35IW/EA9		
					10/24/95	6/26/96	1/15/97	1/17/96	6/26/96	1/15/97
Volatile Organic Aromatics (VOA)[c]										
Benzene	602	1.0	1	µg/L	1.9	<1	<1	<1	<1	<1
Toluene	602	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
Ethylbenzene	602	1.0	NA	µg/L	16	<1	<1	<1	<1	<1
Total Xylenes	602	1.0	NA	µg/L	8.5	<1	<1	<1	<1	<1
Total VOA	602	1.0	50	µg/L	26.4	<1	<1	<1	<1	<1
Chlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	602	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
Methyl Tert-Butyl Ether	602	1.0	50	µg/L	11	<1	3.8	49	45	17
Volatile Organic Halocarbons (VOH)[c]										
Tetrachloroethane	601	1.0	NA	µg/L	<1	<1	---	<1	<1	---
Chloroform	601	1.0	NA	µg/L	<1	<1	---	<1	<1	---
Polynuclear Aromatic Hydrocarbons (PAH)										
Naphthalene	8100	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
1-Methylnaphthalene	8100	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
2-Methylnaphthalene	8100	1.0	NA	µg/L	<1	<1	<1	<1	<1	<1
Total Naphthalenes	8100	1.0	100	µg/L	<1	<1	<1	<1	<1	<1
Acenaphthene	8100	1.0	MDL	µg/L	1.6	<1	<1	<1	<1	<1
Total Petroleum Hydrocarbons (TPH)	418.1	0.60-1.0	5	mg/L	<1	<1	<1	<1	<1	<1
Metals										
Lead, Total	239.2	1.0	50	µg/L	3.5	4.5	---	14.4	4.4	---

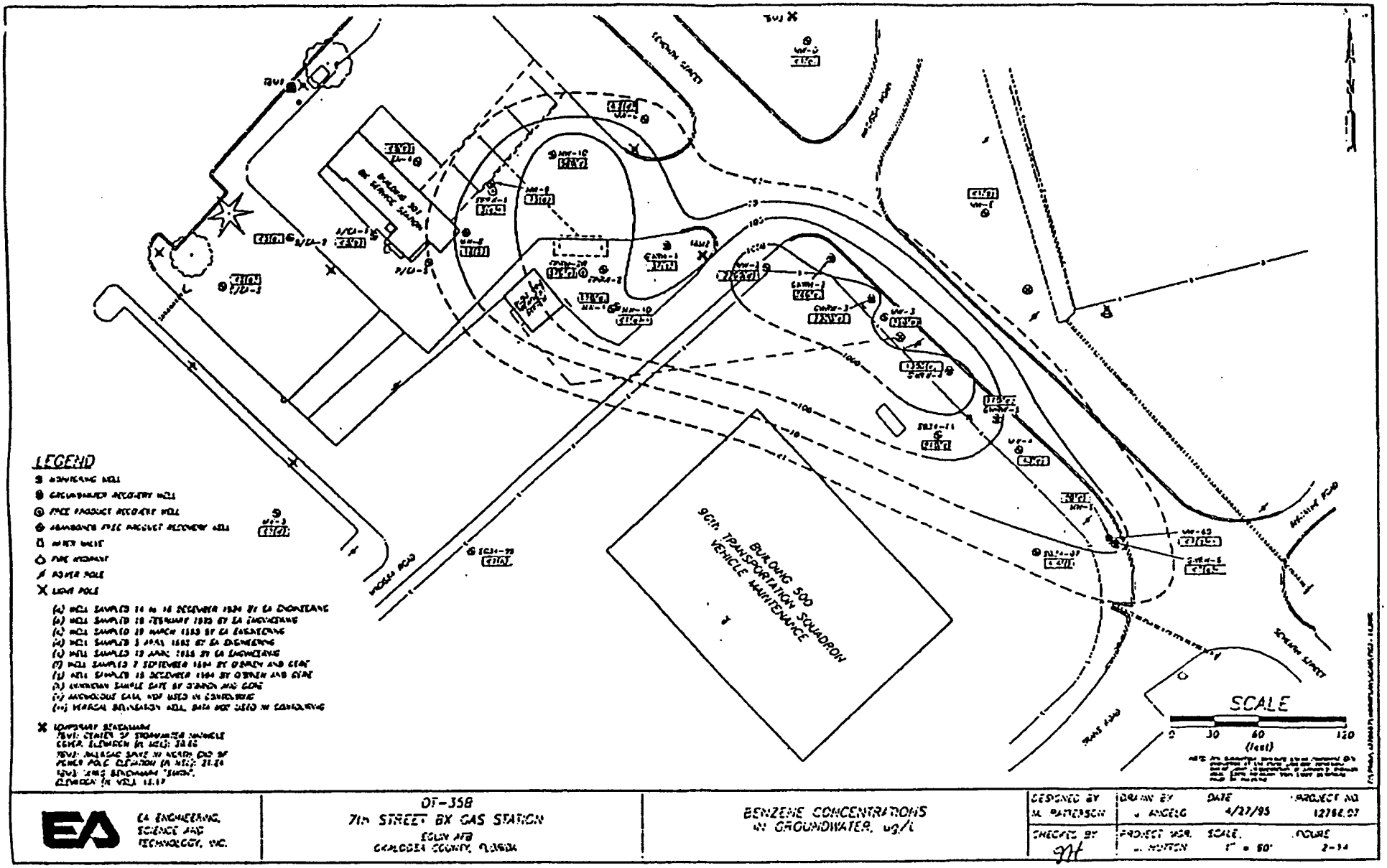


EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC.

OT-359
7th STREET BX GAS STATION
EGLIN AFB
OKALOOSA COUNTY, FLORIDA

WATER TABLE ELEVATION
27 APRIL 1995

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.
J. PATTERSON	J. ANGELO	4/11/95	12735.07
CHECKED BY	PROJECT MGR.	SCALE	FIGURE
GH	A. HUTSON	1" = 60'	2-16

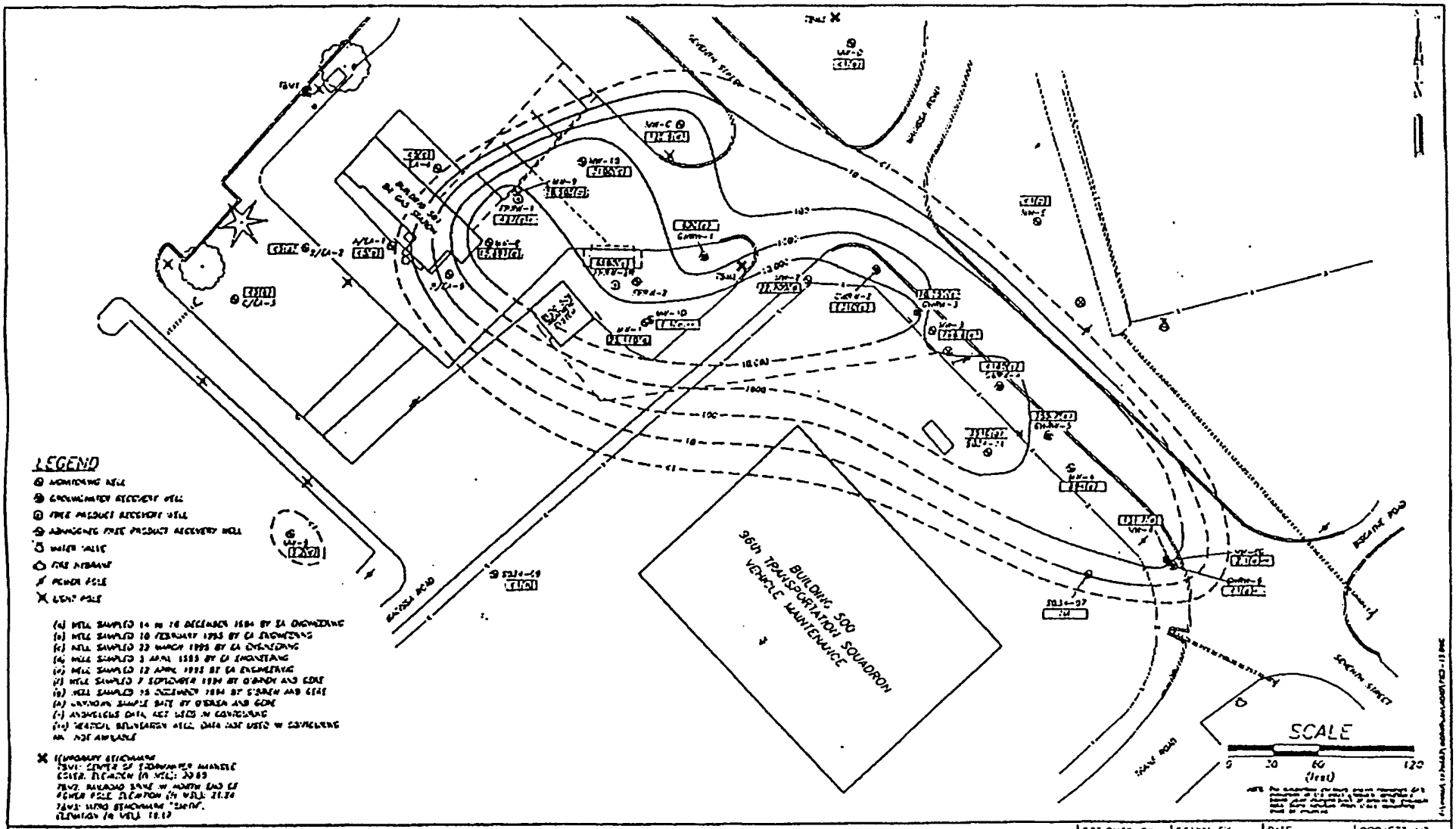


EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC.

OT-35B
71ST STREET BX GAS STATION
EGLIN AFB
OKALOOSA COUNTY, FLORIDA

BENZENE CONCENTRATIONS IN GROUNDWATER, ug/L

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.
M. PATTERSON	J. ANGELO	4/27/95	12766.07
CHECKED BY	PROJECT MGR.	SCALE	FIGURE
	J. HUNTON	1" = 60'	2-14



EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC	OT-35B 7th STREET BX GAS STATION EGLIN AFB OKALOOSA COUNTY, FLORIDA	TOTAL VOA CONCENTRATIONS IN GROUNDWATER, ug/L	DESIGNED BY M. PATTERSON	DRAWN BY J. ANGELO	DATE 4/27/93
			CHECKED BY	PROJECT MGR. J. HUTTON	SCALE 1" = 60'
					PROJECT NO. FIGURE 2-15

TABLE 5
CHRONOLOGY OF EVENTS
7TH STREET AND A-20 SITES
EGLIN AFB

Date	Event
20 October 1983	FDER receives information regarding estimated 3,600-gallon leak of unleaded gasoline at 7th Street BX station. Issues warning notice on 8 November 1983; recommends remedial actions.
May 1984	Eglin identifies diesel fuel spill at A-20 site, as indicated by product leaking into sewage lift station located near NW corner of radar building.
26 June 1984	Monitoring program for JP-4 fuel spills initialized in cooperation with FDER.
9 July 1984 -	Eglin issues work order for installation of 5 monitoring wells at 7th Street. To include 5 feet of screen across water table.
September 1984	Five (5) monitoring wells--designated A, B, C, D, E--installed at 7th Street.
22 February 1985	Eglin requests IRP Phase IV funds for 7th Street remediation. Describes leaks having occurred "since at least 1970" with estimated 4,500-gallon total fuel leaked.
19 March 1985	Analytical results submitted for 7th Street; indicate BTEX contamination in two wells.
Spring 1985	Eglin contracts Geraghty and Miller, Inc. (G&M) to provide remedial investigation and design for 7th Street, A-20, HERD sites. Contract through Corps of Engineers (COE Contract No. DACA41-85-C-0068) requires completion of Environmental Assessment (EA), Remedial Action Plan (RAP), and drawings and specifications for remedial design.
22 April 1985	FDER issues Notice of Violation (NOV) to Eglin for 7th Street site.
26 June 1985	Eglin meets with FDER, G&M to discuss NOV, remediation of 7th Street, A-20, and HERD sites. Agreed that G&M will install 10 monitoring wells at 7th Street.
August 1985	G&M submit draft EA and RAP for A-20, 7th Street sites. Include results of environmental investigations at both sites. Seven permanent wells installed at A-20 sites; 12 permanent wells installed at 7th Street site. Groundwater recovery and treatment recommended for both sites.

TABLE 5--Continued
CHRONOLOGY OF EVENTS
7TH STREET AND A-20 SITES
EGLIN AFB

Date	Event
4 September 1985	FDER submits comments to draft EA and RAP for both sites. Notes inconsistency between compounds found at A-20 site and typical composition of diesel fuel. Speculates there may be unidentified source of BTEX, chlorinated compounds.
10 September 1985	Eglin submits design documents for recovery systems at both sites to FDER. Design prepared for G&M by Jones, Edmunds, and Assoc. Inc.
September 1985	G&M submits final EA, RAP for both sites.
Spring 1986	Eglin negotiates to move directly to Consent Order for A-20 site, avoiding issuance of NOV.
16 May 1986	FDER submits draft Consent Order for A-20 site. Cover letter states that "Eglin has already satisfied many of the requirements stated in the Orders for Corrective Action."
17 July 1986	FDER submits revised draft Consent Order for A-20 site. Cover letter states plans and reports which have been submitted for the site satisfy the Order's requirements for a contamination assessment plan and report and clean-up proposal (RAP). We do need the QA/QC Plan ... We will forward you our comments on the engineering details for the recovery system in the near future."
31 July 1986	Eglin signs Consent Order for A-20 site; signed and ordered by FDER 15 August 1986.
21 August 1986	FDER submits letter to Eglin stating: "The information you supplied in your August 5 letter adequately addresses our concerns on the RAP for the A-20 site. You may proceed to implement the RAP for this site as well as the 7th Street site." Note: ES could not locate a copy of the 5 August letter referenced here.
Summer 1986	COE prepares bid package and modifications for "Site A-20 and 7th Street Improvements". Drawings and specifications, prepared by Jones, Edmunds, and Assoc., Inc., under contract to G&M submitted July 1986. Bid opening on 17 September 1986.
April 1987	Groundwater recovery and treatment systems installation begins. Contract awarded to Phoenix Construction, Panama City. Subcontracts to Layne-Western for well drilling and T&A Utilities for mechanical installations.

TABLE 5--Continued
CHRONOLOGY OF EVENTS
7TH STREET AND A-20 SITES
EGLIN AFB

Date	Event
28 May 1987	Consumptive Use Permits (CUPs) issued for both systems by Northwest Florida Water Management District (NWFWMD).
July 1987	Both facilities operated for 30-day period. Influent and effluent samples collected and analyzed; indicate treatment facilities operating correctly; all compounds analyzed by EPA 624 below detection limit in effluent samples.
5 October 1987	Eglin informs FDER of operating states at both sites, submits analytical data for start-up samples.
7 December 1987	Eglin accepts both facilities with exceptions for design omissions; these include lack of adequate pressure gauges, flow gauges, sampling ports. Indicates that Base Bioenvironmental office begins quarterly sampling.
16 December 1987	ORNL and CH2M Hill personnel meet at Eglin to discuss scope of services for CH2M Hill to operate and evaluate both systems for period of 1 year. Proposed CH2M Hill to prepare technical specifications for, and ORNL to negotiate contract with a subcontractor to operate and maintain system. Contractor to install flow meters, pressure gauges and sampling ports as required. No contractor selected as of meeting. A-20 facility in operation; 7th Street facility not in operation due to broken air fan belt. A-20 system subsequently shut down by CH2M Hill personnel.
February 1988	CH2M Hill and HAZWRAP submit bid package for *Specifications for Eglin AFB Air Stripper Operation*, as described above.
11 April 1988	Eglin submits periodic report to FDER for both systems, explains ongoing resolution of design deficiencies; quarterly sampling by Base Bioenvironmental Office continuing. Sample analyses attached. Neither system operational.
5 May 1988	Eglin meets with HAZWRAP and CH2M Hill. Discusses: preparation of O&M manuals; instituting spare parts program; installation of sampling ports, flow and pressure gauges; limited ongoing operation; manpower requirements. Neither system operational.

TABLE 5--Continued
CHRONOLOGY OF EVENTS
7TH STREET AND A-20 SITES
EGLIN AFB

Date	Event
June 1988	CH2M Hill personnel inspected both facilities, made recommendations for prestart-up activities in 12 August 1988 letter report.
6 July 1988	Eglin submits periodic report to FDER. Problems at both sites unresolved. Neither system operational. Quarterly sampling ongoing. Analytical results attached.
August 1988	ORNL personnel refitted both systems to provide for bypass of oil/water separators; also installed flow meters at treatment facilities (not at individual recovery wells).
September 1988	CH2M Hill and ORNL personnel inspected both facilities. ORNL personnel start up 7th Street facility and perform operational tests of system.
5 October 1988	CH2M Hill submits technical memorandum describing current status of and modifications to 7th Street facility.
6 October 1988	CH2M Hill submits technical memorandum describing current status of and modifications to A-20 facility.
17 October 1988	CH2M Hill submits technical memorandum describing current operations of 7th Street facility.
10 November 1988	ORNL submits analytical data for 7th Street system operation(stripper influent/effluent samples).
2 December 1988	Eglin submits periodic report to FDER, includes analytical data for both sites.
January 1989	Eglin requests ORNL prepare operations and maintenance manuals for both facilities. ORNL begins negotiations to include in CH2M Hill contract. Contract ammended 6 April 1989.
11 January 1989	ORNL submits analytical data for 7th Street System operation (stripper influent/effluent samples).
20 April 1989	CH2M Hill submits technical memorandum discussing maintenance and repairs for A-20 facility.
26 June 1989	ORNL submits analytical data for 7th Street System operating (stripper influent/effluent samples).

TABLE 5--Continued
CHRONOLOGY OF EVENTS
7TH STREET AND A-20 SITES
EGLIN AFB

Date	Event
30 November 1989	FDER requests that Eglin provide firm game plan for resolutions of problems at A-20 facility.
18 December 1989	ORNL submits analytical data for 7th Street stripper operation (stripper influent/effluent samples). Recommendations for system operations by CH2M Hill attached.
28 March 1990	Eglin responds to FDER request of 18 December 1989. States: (1) risk assessment being prepared as first step toward resolution of problems at A-20 site and; (2) Eglin has initiated additional funding for site.
Spring 1990 -	Idaho National Environmental Laboratory (INEL) performs field study in support of risk assessment for A-20 site, collects groundwater from existing monitoring wells and from 12 additional monitoring well points, submit draft *risk assessment* on 29 June 1990.
14 May 1990	ORNL submits draft report of systems operations tests conducted since September 1988; included recommendations for stripper maintenance.

Layne-Western Company, Inc.

Subject 7th St. 24hr. Continuous Discharge TEST Date 6-11-87 / 6-12-87

TEST FLOW RATE - 10 GPM AS CONFIRMED BY AL JENKS

Drawdown Values given in inches.

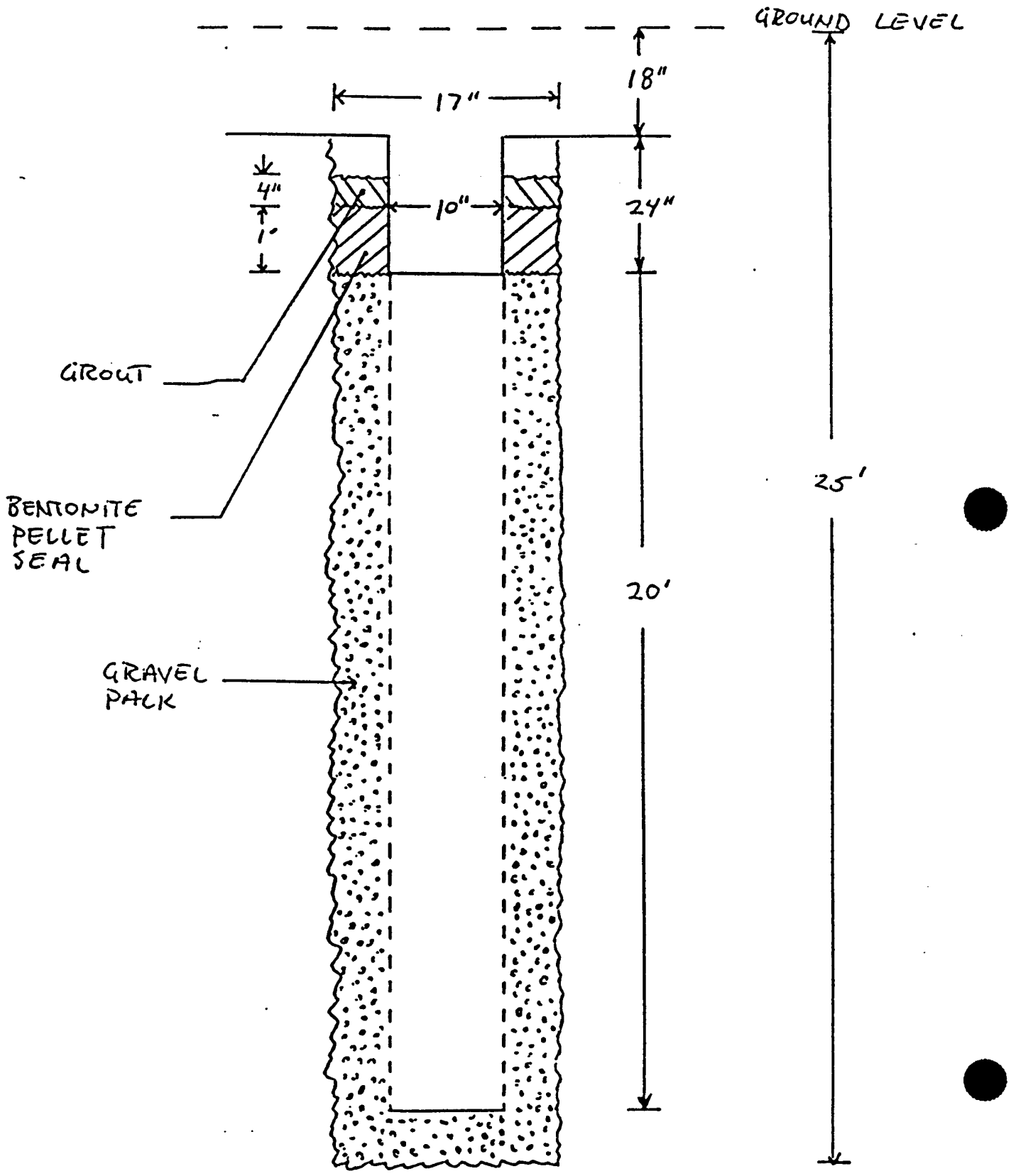
APSED ME IN INUTES	PUMPED WELL	OBSERVATION WELLS					
	FPRW#2	GWRW#1	GWRW#2	GWRW#3	GWRW#4	GWRW#5	GWRW
1	7	0	0	0	0	0	0
2	7	0	0	0	0	0	0
3	7	0	0	0	0	0	0
4	7.5	0	0	0	0	0	0
5	8	0	0	0	0	0	0
6	8	0	0	0	0	0	0
7	8.5	0	0	0	0	0	0
8	8.5	0	0	0	0	0	0
4	9.5	0	0	0	0	0	0
10	9.5	0	0	0	0	0	0
15	10	0	0	0	0	0	0
20	10.5	0	0	0	0	0	0
25	11.5	0	0	0	0	0	0
10	13	.25	0	0	0	0	0
35	14	.25	0	0	0	0	0
40	15	.25	.25	0	0	0	0
45	16	.25	.25	0	0	0	0
50	17	.25	.25	0	0	0	0
60	17	.25	.25	0	0	0	0
70	17	.25	.25	0	0	0	0
80	17	.25	.25	0	0	0	0
90	17.5	.25	.25	0	0	0	0
100	17.5	.25	.25	0	0	0	0
150	17.5	1.25	.5	.5	.5	.5	0
200	18.5	1.25	.5	.5	.5	.5	0
250	20.5	1.5	.75	.5	.5	.5	0
300	22	1.75	1.25	.5	.5	.5	0
150	22	1.75	1.25	.5	.5	.5	0
400	22	1.75	1.75	.5	1.0	.5	0
450	22.25	1.75		.5	.5	.5	0
500	22.25	1.75		.5	.5	.5	0
550	22.5	1.75		.5	.5	.5	0
600	22.5	1.75		.5	.5	.5	0
650	23	1.75		.5	.5	.5	0
	23	1.75		.5	.5	.5	0
700	23.25	2.25		.5	.5	.5	0

Layne-Western Company, Inc.

Subject FPRW-#1 7th St. BX GAS STATION Date 4-20-87

Drilled and Completed on 4-11-87

well depth measured from top of box, which has an elevation of 20.18 ft.

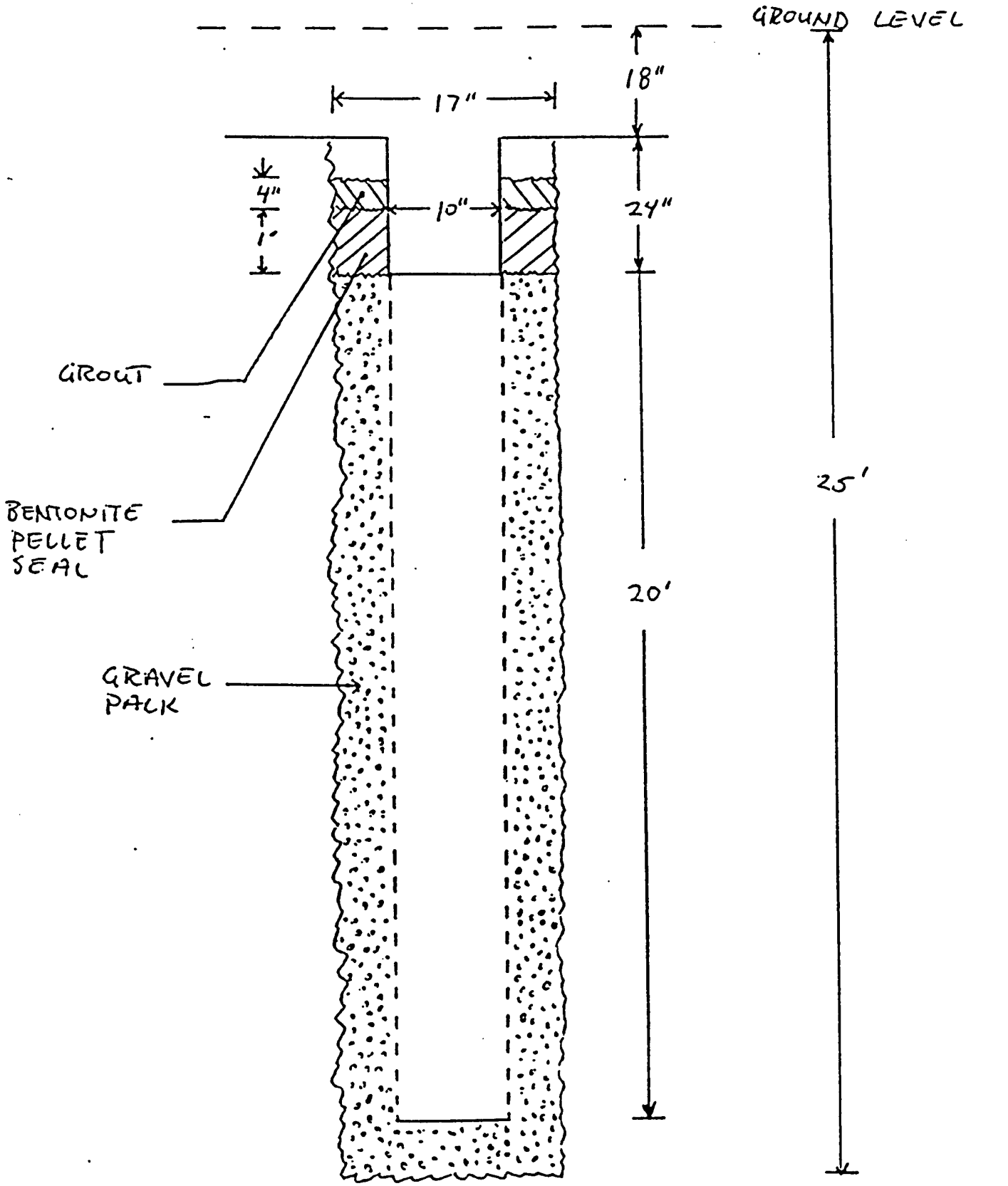


Layne-Western Company, Inc.

Subject FPRW #7 7th ST BX GAS STATION Date 4-20-87

Drilled and Completed on 4-10-87

Well depth measured from top of box, which has an elevation of 20.01 ft.

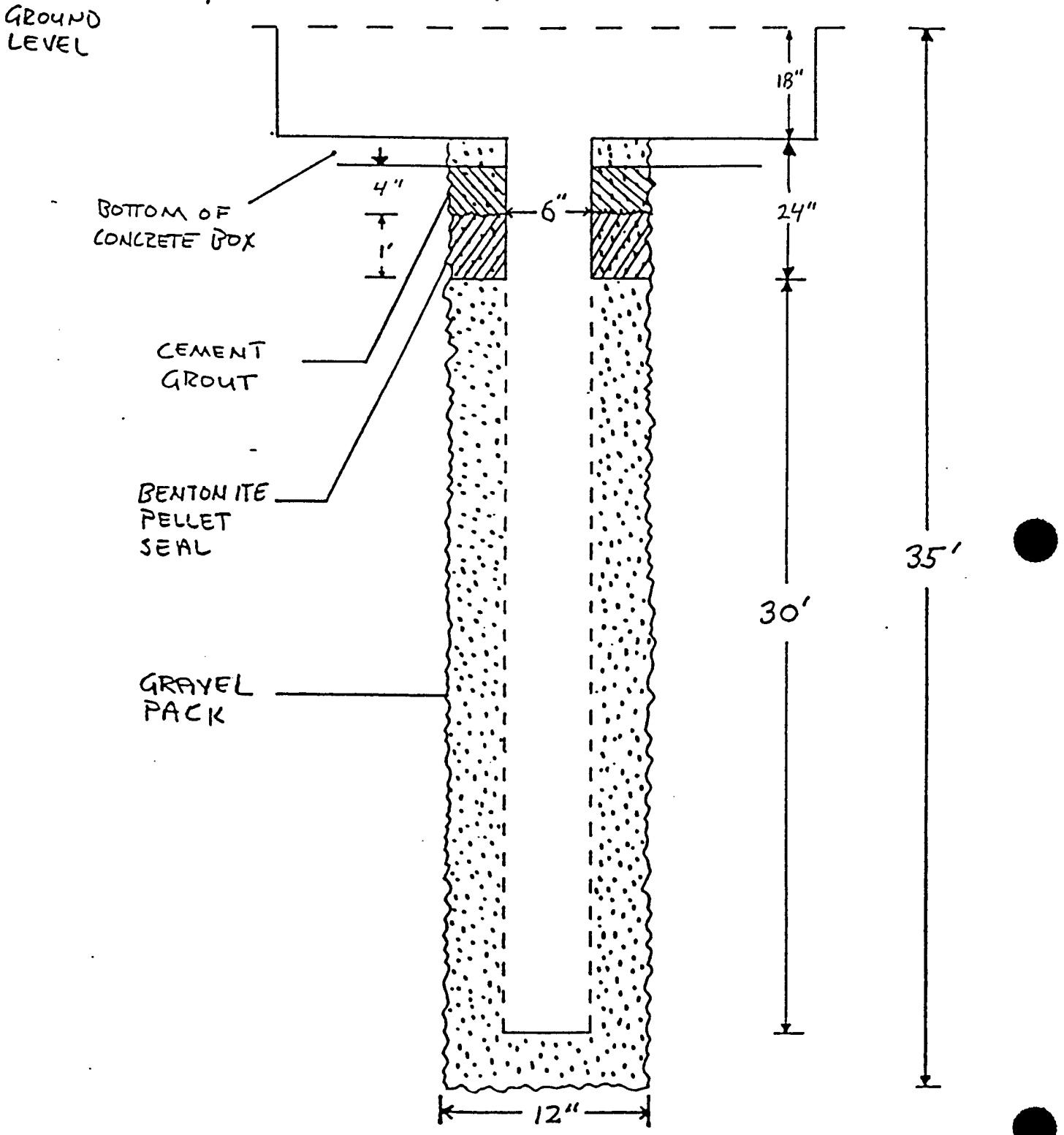


Layne-Western Company, Inc.

Subject GWRW #1 7th St. BX Gas Station Date _____

Drilled & completed on 4-4-87

Well depth measured from top of box, which has an elevation of 19.93 Ft.

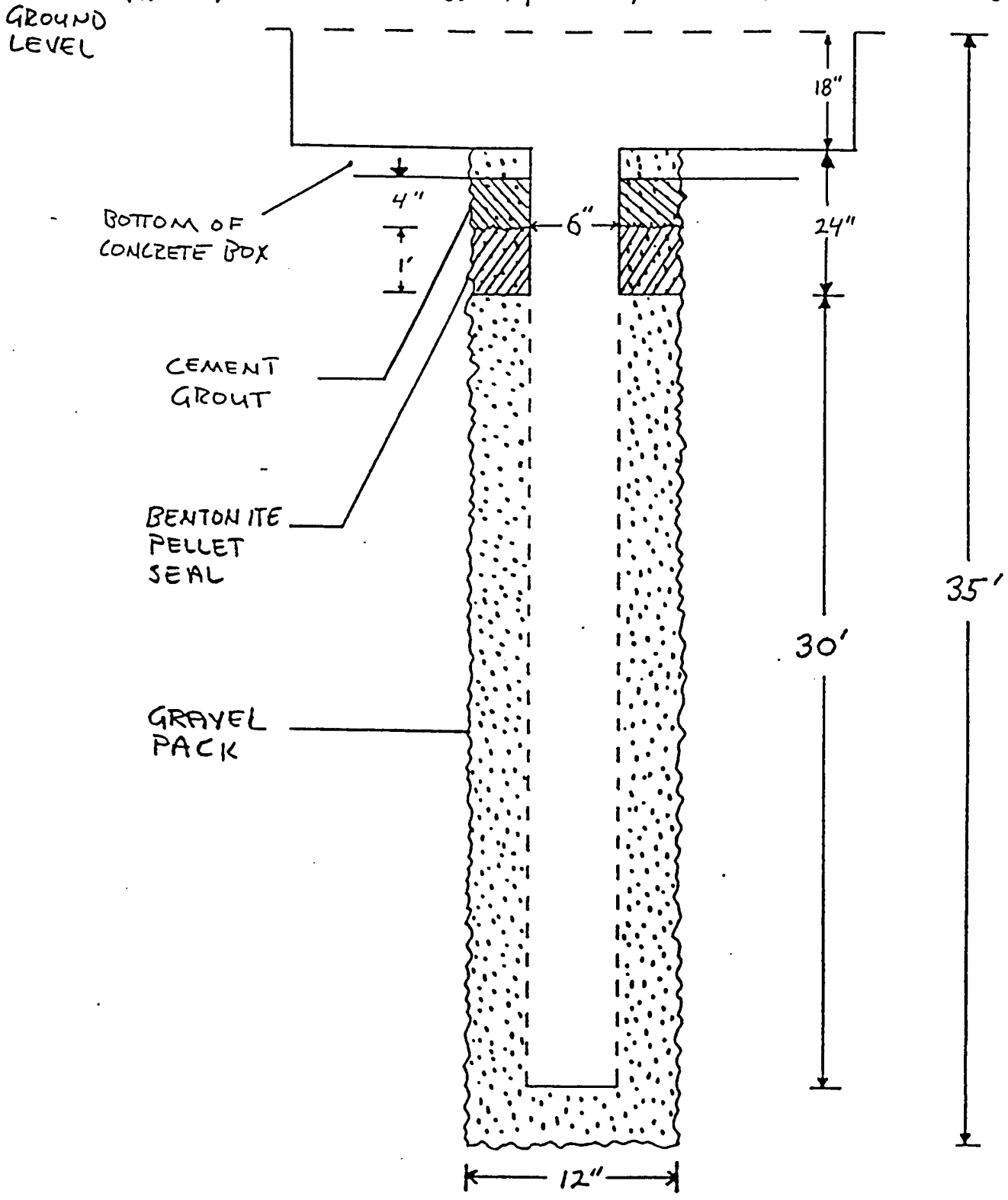


Layne-Western Company, Inc.

Subject GWRW #2 7th St. BX GAS STATION Date _____

Drilled & completed on 4-3-87

Well depth measured from top of box, which has an elevation of 20.93 ft.

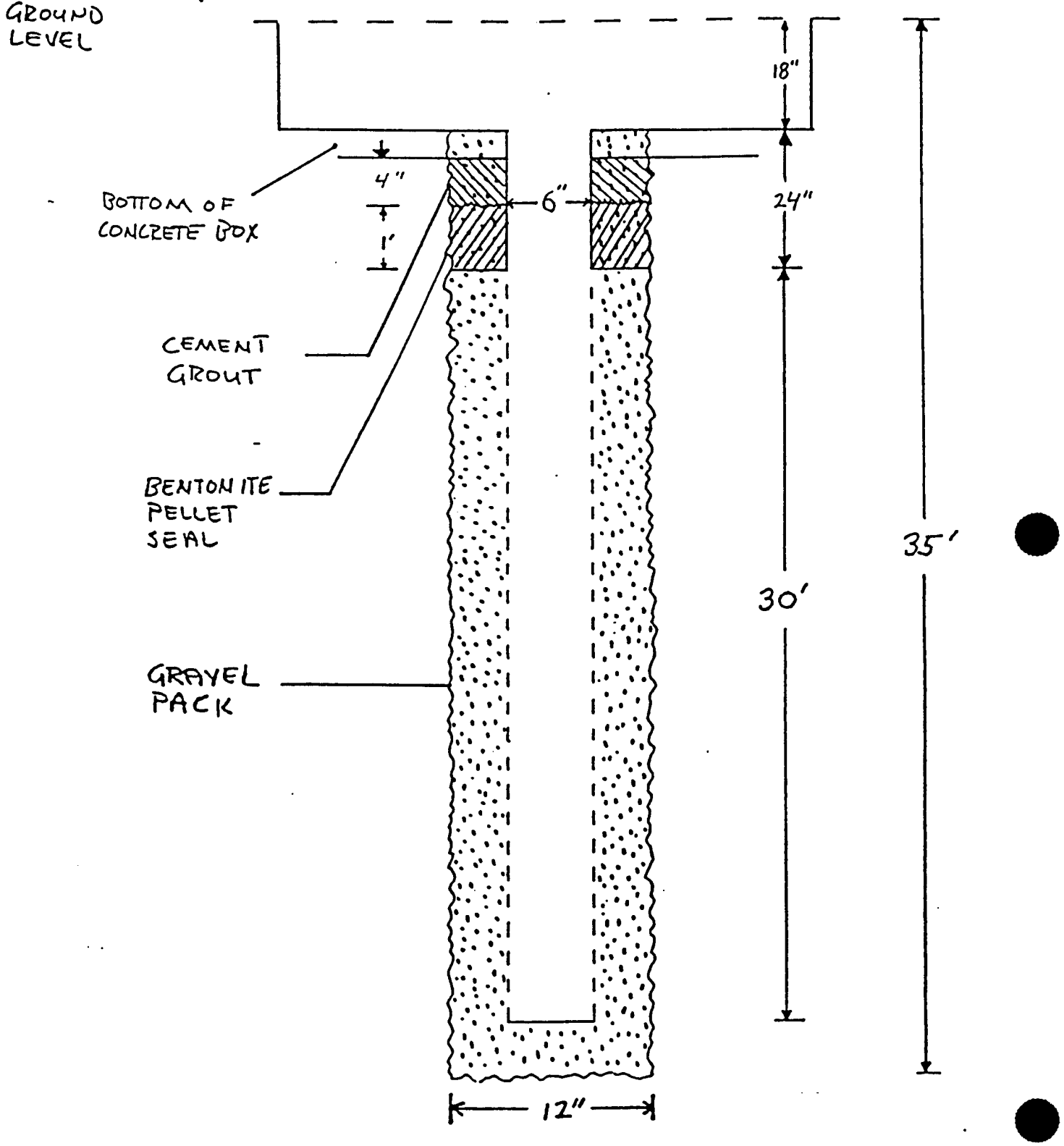


Layne-Western Company, Inc.

Subject GWRW #3 7th ST. BX GAS STATION Date _____

Drilled and Completed on 4-3-87

Well depth measured from top of box, which has an elevation of 20.93 ft.

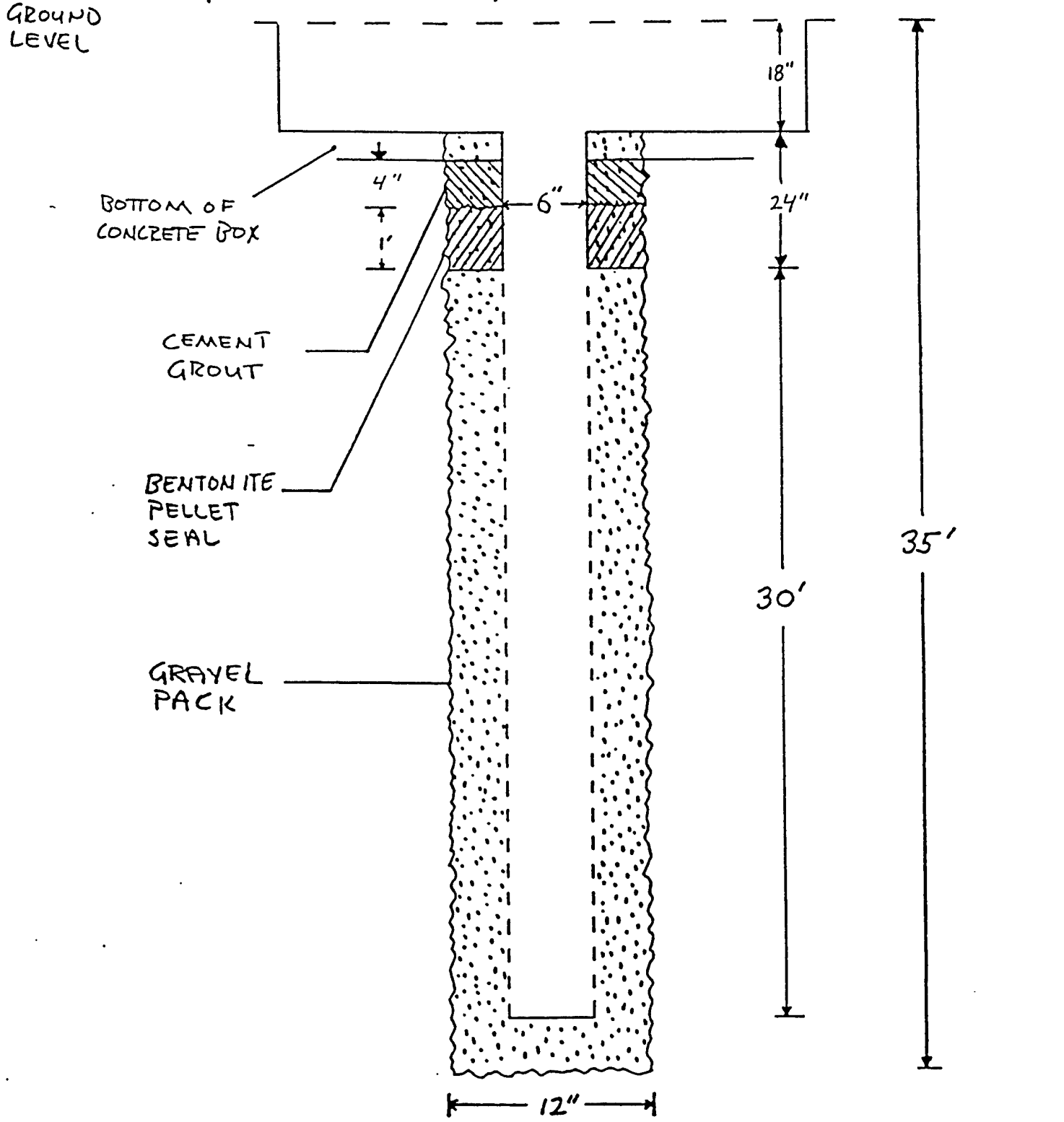


Layne-Western Company, Inc.

Subject GWRW # 4 7th St. BX GAS STATION Date

Drilled and completed on 4-2-87

well depth measured from top of box, which has an elevation of 21.43 ft

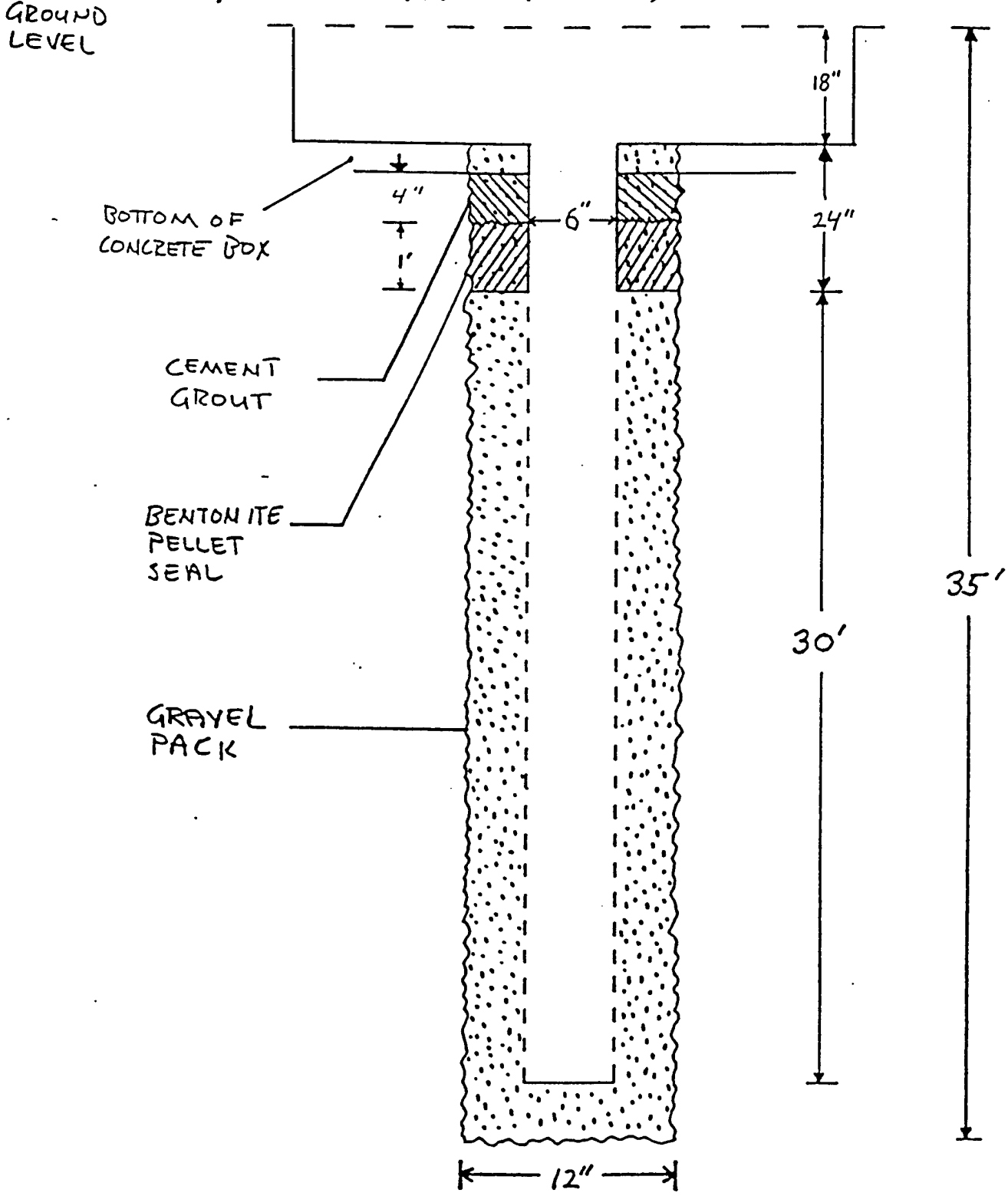


Layne-Western Company, Inc.

Subject GWRW #5 7th ST BY GAS STATION Date

Drilled and Completed on 4-2-87

Well depth measured From top of box, which has an elevation of 21.01 f



Layne-Western Company, Inc.

Subject T & S for 7th St. Date 6-18-92

GWRW #1

$$T = \frac{264(Q)}{\Delta S} - \frac{264(10)}{.708} = 12,692 \text{ gpd per ft}$$

$$S = \frac{0.3\,T t_0}{r^2} = \frac{0.3(12,692)(.056)}{(30)^2} = 0.085$$

GWRW #2

$$T = \frac{264(10)}{.096} = 27,500 \text{ gpd per ft.}$$

$$S = \frac{.3(27,500)(.01167)}{(110)^2} = 0.018$$

GWRW #3, GWRW #4 & GWRW #5

$$T = \frac{264(10)}{.375} = 70,400 \text{ gpd per ft}$$

$$S = \frac{0.3(70,400)(.0208)}{(160^2)} = .017$$

GWRW #6

Since no drawdown occurred in GWRW #6, Time-drawd and Distance drawn graphs cannot be constructed due to a lack of information.

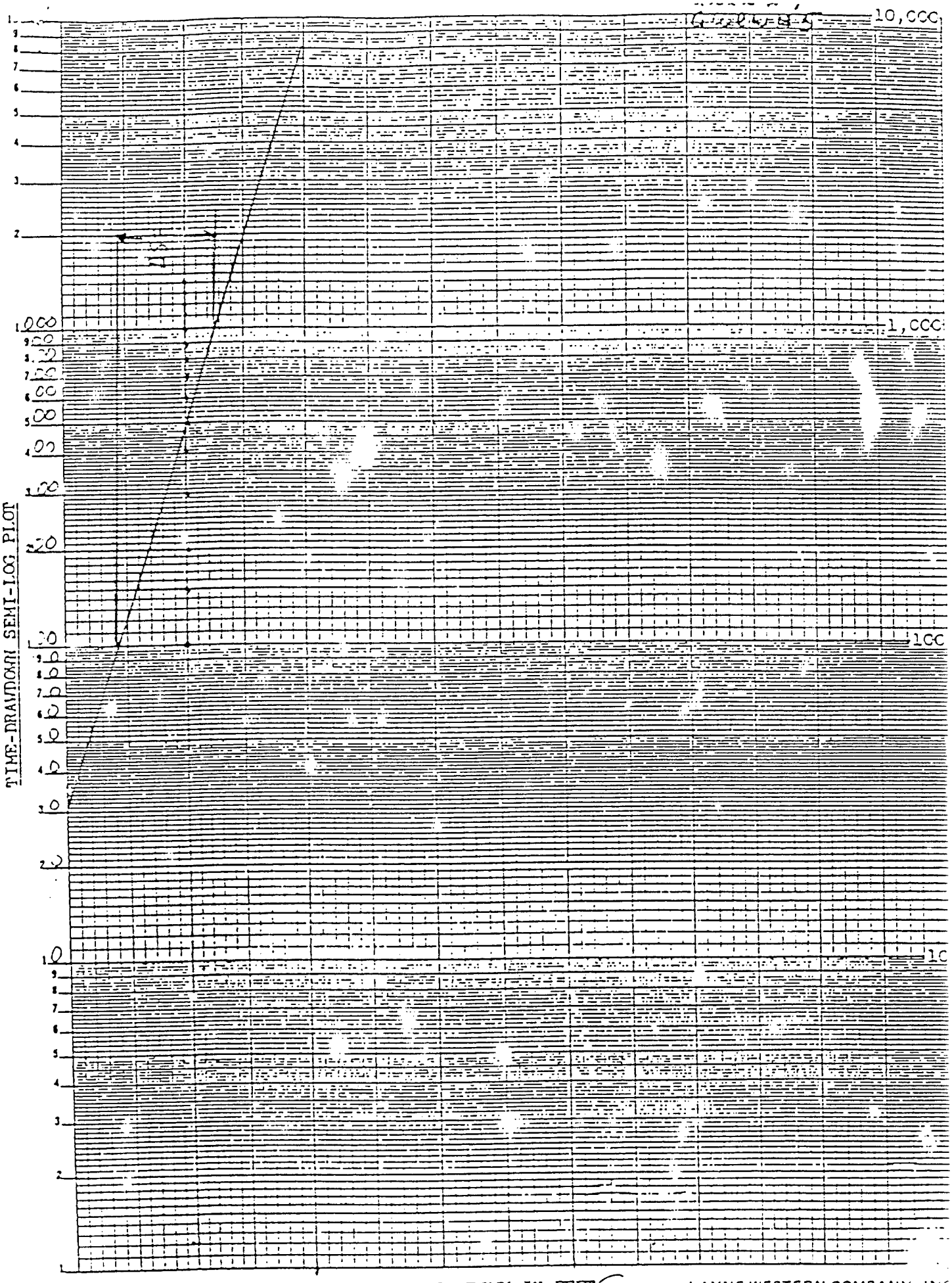
No step-drawdown tests were performed due to All Jones' request

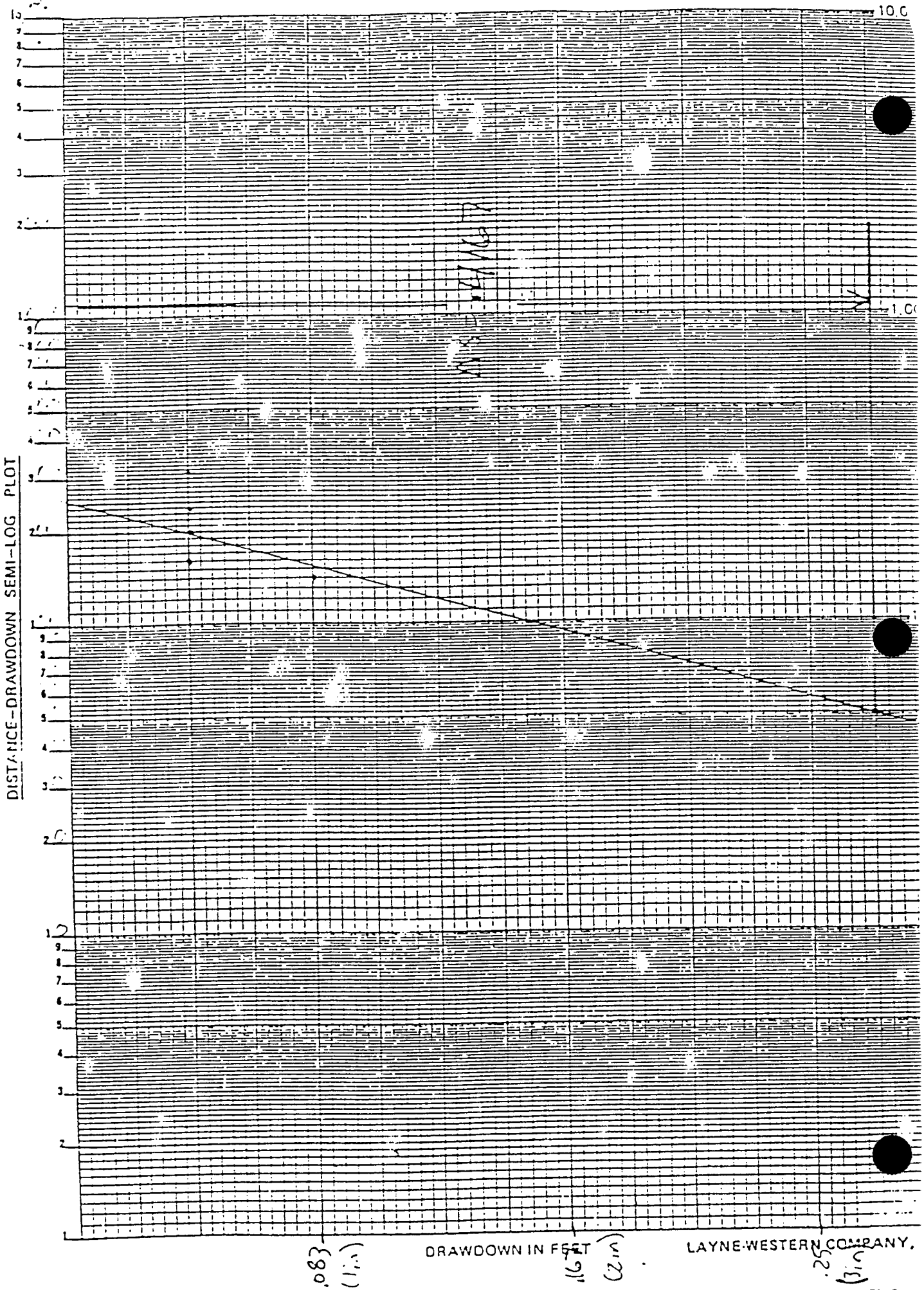
Subject _____ Date _____

Coefficient of Transmissibility & Storage Coefficient from the Distance - Drawdown Graph

$$T = \frac{528\,(10)}{.4167} = 17,671 \text{ gpd per ft.}$$

$$S = \frac{0.3\,(17,671)\,(1)}{(250)^2} = 0.0608$$


TIME-DRAWDOWN SEMI-LOG PLOT
DRAWDOWN IN FEET
LAYNE-WESTERN COMPANY, INC.


DISTANCE-DRAWDOWN SEMI-LOG PLOT
10.0
1.0
DRAWDOWN IN FEET
LAYNE-WESTERN COMPANY.

APPENDIX C

FIELD DATA FORMS

Eglin AFB

GEOLOGIC BORING LOG

BORING NO.: SB-1 CONTRACTOR: Parsons DATE SPUD: 3/28/98 0730
CLIENT: AFCEE/EglinAFB RIG TYPE: Geoprobe DATE CMPL.: 3/28/98 0750
JOB NO.: 726876.43121 DRLG METHOD: Geoprobe ELEVATION:
LOCATION: BX Service Station BORING DIA.: 2" TEMP: 70-75° F
GEOLOGIST: Cindy Nagel DRLG FLUID: none WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Profile	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			asphalt cover					7			
				dk brown silty f-med SAND - organics - minor staining 2-4' streaks - could be asphalt? no smell					2			
									2			
									1			
	5								2			
								▼	10			
									322			
			GS	lt. brown to buff clean Qtz SAND m-coarse wet					300			
	10			bottom of boring 8'								
	15			no sign of soil contamination								
	20											
	25											
	30											
	35											

background PID 1.8

NOTES
bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-2 | CONTRACTOR: Parsons | DATE SPUD: 3/28/98 1000
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/28/98 1040
JOB NO.: 726876 43121 | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 70-75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: Sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown silty f-med SAND					6			
									1			
				2.5 reddish brown silty f-med SAND-moist					6			
				3.5 buff silty SAND-wet-med-coarse					4			
				4.5 reddish-brown silty f-med SAND-moist				▼	9			
	5			5.5 buff SAND-wet-med-coarse					137			
									265			
									190			
				8 bottom of boring 8'								
	10											
				no sign of soil contamination								
	15											
	20											
	25											
	30											
	35											

background PID 1.4

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-3 | CONTRACTOR: Parsons | DATE SPUD: 3/28/98 1100
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/28/98 1120
JOB NO.: 726876.43121 | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Profile	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown-red silty f-med SAND - moist					1			
									1			
									1			
	3			brown med-coarse SAND moist					1			
									2			
	5								1			
	6			buff med-coarse SAND-wet					570			
				bottom of hole 8'.					230			
				no sign of soil contamination								
	10											
	15											
	20											
	25											
	30											
	35											

background PID 1.4

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-4 | CONTRACTOR: Parsons | DATE SPUD: 3/28/98 1130
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/28/98 1150
JOB NO.: 726876.43121 | DRLG METHOD: Geoprobe | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown silty f-med SAND					425			
			1.5	lt. brown silty f-med SAND					4			
									3			
	5								5			
			5.5						8			
				buff clean Qtz SAND med-coarse					530			
			8						398			
				bottom of boring 8'					222			
	10											
	15											
	20											
	25											
	30											
	35											

background PID 1.4

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-5 | CONTRACTOR: Parsons | DATE SPUD: 3/28/98 1400
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/28/98 1430
JOB NO.: 726876.4312 | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown silty f-med SAND organic						0.0		
										0.0		
										0.0		
										0.0		
	4			lt brown silty f-med SAND						0.0		
	5							▼		0.0		
										0.0		
	6			buff med-coarse Qtz SAND wet						0.0		
				bottom of hole 8'								
	10			no odor								
				no sign of contamination								
	15											
	20											
	25											
	30											
	35											

background PID 0.0

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-6 | CONTRACTOR: Parsons | DATE SPUD: 3/28/98 1445
CLIENT: AFCEE/EglinAFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/28/98 1500
JOB NO.: 726876.43121 | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Profile	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
				grass cover								
	1			orange-brown silty f-med sand					0			
				1.5 brown silty f-med SAND					1			
									1			
									900			
									▼ 1017			
	5								770			
				6 buff med-coarse SAND clean Qtz - wet					689			
				bottom of boring 8'					275			
	10			no obvious staining fuel odor					..			
	15											
	20											
	25											
	30											
	35											

background PID 0.0

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-7 | CONTRACTOR: Parsons | DATE SPUD: 3/28/98 1515
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/28/98 1610
JOB NO.: 726876.43121 | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 70°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Profile	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown to black silty f-med SAND w/ shell fragments					15			
									8			
									4			
									4			
				3.5 brown silty f-med SAND - moist					47			
	5								4			
									4			
				7.5 buff med-coarse SAND - wet					4			
				bottom of boring 8'								
	10								..			
				no staining								
				slight fuel odor at 5' could be due to GW								
	15											
	20											
	25											
	30											
	35											

background PID 4.2

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-8 | CONTRACTOR: Parsons | DATE SPUD: 3/28/98 1615
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/28/98 1630
JOB NO.: 726876.43121 | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 70°F
GEOLOGIST: Tindy Nagel | DRLG FLUID: none | WEATHER: breezy, sunny
COMMENTS:

Elev (ft)	Depth (ft)	Profile	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk silty SAND - organic					2			
			1.	lt brown to brown silty f-med SAND					2			
									2			
									2			
	5								2			
			5.5	buff med-coarse SAND					750			
									650			
				bottom of boring 8'								
	10								..			
	15											
				no sign of soil contamination								
	20											
	25											
	30	...										
	35											

background PID 1.8

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-9
CLIENT: AFCEE/Eglin AFB
JOB NO.: 726876 43121
LOCATION: BX Service Sta.
GEOLOGIST: Cindy Nagel
CONTRACTOR: Parsons
RIG TYPE: Geoprobe
DRLG METHOD: Geoprobe
BORING DIA.: 2"
DRLG FLUID: none
DATE SPUD: 3/29/98 0645
DATE CMPL.: 3/29/98 0745
ELEVATION:
TEMP: 60°F
WEATHER: foggy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
				asphalt cover								
	1			dk brown silty SAND f-med organic					134			
			1	lt brown f-med SAND					17			
									2			
									4			
									1			
	5		5.5	dk brown f-med SAND				▼	6			
			6	buff clean Qtz SAND med-coarse				=	2600			
				smear stain at 7.5-8'?					370			
				smearing continues 8-10'.					980			← product?
				Product in the clear					146			
	10			Qtz - no strong odor - but					50			
				[redacted] fuel - leaves a					280			
				sheen in decon water								
				bottom of boring 12'								
	15											
	20											
	25											
	30											
	35											

background PID 000.0

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

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Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB10 | CONTRACTOR: Parsons | DATE SPUD: 3/29/98 0945
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/29/98 1015
JOB NO.: 720876.43121 | DRLG METHOD: Geoprobe | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 70°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Profile	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1		1	dk brown silty f-med SAND w/shell fragments					0			
				lt. brown f-med SAND					0			
									0			
	5								0			
			6	buff med-coarse SAND					0			
			8	bottom of boring 8'					2100			
	10											
	15											
	20											
	25											
	30											
	35											

- no sign of soil contamination or product
- fuel odor below water table

GASTECH Meter background 0

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

BORING NO.: SB-11 | CONTRACTOR: Parsons | DATE SPUD: 3/29/98 1030
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/29/98 1130
JOB NO.: | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			orange-brown silty f-med SAND - organic smell					0			
			1.5	grey med SAND					0			
									20			
			3.5	black med SAND					20			
	5		4.5	grey med SAND					0			
			5.5	brown med-coarse SAND					40			
			6.5	lt. tan to buff med to coarse SAND					40			
			8	bottom of boring 8'					60			
	10											
				no sign of soil contamination								
	15											
	20											
	25											
	30											
	35											

GASTECH

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-12 | CONTRACTOR: Parsons | DATE SPUD: 3/30/98
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/30/98
JOB NO.: | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 70°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: Windy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown to gray f-med SAND					0			
			2.5						0			
				lt brown f-med SAND					30 (on)			
	5								10			
			6.5	buff med-coarse SAND					20			
			8						40			
				bottom of boring 8'								
	10											
				no sign of soil contamination or product								
	15											
	20											
	25											
	30											
	35											

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

BORING NO.: SB-13 | CONTRACTOR: Parsons | DATE SPUD: 3/30/98
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/30/98
JOB NO.: | DRLG METHOD: | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 70°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: partly cloudy
COMMENTS:

Elev (ft)	Depth (ft)	Profile	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown-gray f-med SAND					@ 20			
				lt brown f-med SAND					@ 40			
	5								60			
				buff med-coarse SAND clean Qtz					880			
				bottom of boring 8'								
	10											
				no sign of soil contamination or product								
	15											
	20											
	25											
	30											
	35											

GASTECH

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: SB-14 | CONTRACTOR: Parsons | DATE SPUD: 3/30/98
CLIENT: AFCEE/Eglin AFB | RIG TYPE: Geoprobe | DATE CMPL.: 3/30/98
JOB NO.: | DRLG METHOD: Geoprobe | ELEVATION:
LOCATION: BX Service Sta. | BORING DIA.: 2" | TEMP: 75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: none | WEATHER: sunny, windy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			gray med SAND					200 ch			
			25						20			
				H. brown f-med SAND					NM			
	5								40			
			6						NM			
				buff med-coarse SAND-moist wet at 11 feet					60			
				product 7-11 feet				7	NM			
				no strong fuel odor					100			
	10								NM			
			12					11	100			
				bottom of boring 12'								
	15											
	20											
	25											
	30											
	35											

GASTECH background-0

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: MP-1 CONTRACTOR: Parsons DATE SPUD: 3/26/98 1030
CLIENT: AFCEE RIG TYPE: Geoprobe DATE CMPL.: 3/26/98 1100
JOB NO.: 731854.02000 DRLG METHOD: ELEVATION:
LOCATION: Eglin BX Service Sta. BORING DIA.: 2" diam. TEMP: 70-75°F
GEOLOGIST: Cindy Nagel DRLG FLUID: none WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Profile	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			tan to lt. brown med. gr. Sand - well sorted (clean) no obvious fuel contamination					0.0			
									0.0			
	5								0.0			
									0.0			
	10			Total Depth 9'								
				no sign of soil contamination								
	15											
	20											
	25											
	30											
	35											

background PID 0.0

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

K:\AFCEE\731854_7DN0760, 09/08/97 at 09:41

GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: MP-2 | CONTRACTOR: Parsons | DATE SPUD: 3/26/98 0915
CLIENT: AFCEE | RIG TYPE: Geoprobe | DATE CMPL.: 3/26/98 1015
JOB NO.: 731854.02000 | DRLG METHOD: ~~2 in.~~ | ELEVATION:
LOCATION: Eglin, BX Service Sta. | BORING DIA.: 2 in. | TEMP: 70°F - 75°F
GEOLOGIST: Cindy Nagel | DRLG FLUID: N/A | WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Recovery Pen-et Res.	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			light brown - organics 1-2' Qtz sand - med gr. rounded, clean 2-4' (no fines) fuel staining 3-4' dk color	1	1'-4'		34"	— 0.0 0.0 135 ←			
	5			same lithology buff to tan color fuel staining 4-6' streaks only fuel smell in wet sand	2	4-8'		36"	5.2 500 ← — 400			
	10			9' bottom of boring ½" diam. PVC monitoring point set screened approx. 4'-9' bgs water at approx. 6' bgs								
	15											
	20											
	25											
	30											
	35											

background PID 0.0

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: VMP-2 CONTRACTOR: Parsons DATE SPUD: 3/28/98 0645
CLIENT: AFCEE/Eglin AFB RIG TYPE: Geoprobe DATE CMPL.: 3/28/98 0725
JOB NO.: 726876.43121 DRLG METHOD: Geoprobe ELEVATION:
LOCATION: BX Service Sta BORING DIA.: 2" TEMP: 70-75°F
GEOLOGIST: Cindy Nagel DRLG FLUID: none WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
				asphalt cover								
	1			dk brown silty f.-med. SAND organics					41			
				↓ gradation - no sharp contact					2			
				lt. brown f.-med. SAND - moist minor staining					5			
				" same - wet					840	- dirty soil		
	5							▼ ≡	58			
									940			
				buff med.-coarse SAND - wet					200	- clean sand		
									220			
				bottom of boring 8'								
	10											
	15											
	20											
	25											
	30											
	35											

background PID 1.4

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

K:\AFCEE\731x98\97DN0760, 09/08/97 at 09:41

GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: VEW-1 CONTRACTOR: Parsons DATE SPUD: 3/28/98 0800
CLIENT: AFCEE/Eglin AFB RIG TYPE: Geoprobe DATE CMPL.: 3/28/98 0815
JOB NO.: 720876 43121 DRLG METHOD: Geoprobe ELEVATION:
LOCATION: BX Service Station BORING DIA.: 2" TEMP: 70F
GEOLOGIST: Cindy Nagel DRLG FLUID: none WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			dk brown f-med silty SAND					2			
				no obvious staining 0-2'					3			
				reddish tint to dk brown soil 2-3'					750			
									9600 ←			
	5								350			
								▼	1027 ←			
				buff med-coarse SAND - wet					1022			
				clean Qtz					360			
				bottom of boring 8'								
	10								..			
	15											
	20											
	25											
	30											
	35											

background PID 1.4

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

K:\AFCEE\731_28\97DN0760, 09/08/97 at 09:41

GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.: VEW-2 CONTRACTOR: Parsons DATE SPUD: 3/28/98 0830
CLIENT: AFCEE/Eglin AFB RIG TYPE: Geoprobe DATE CMPL.: 3/28/98 0930
JOB NO.: 726876 43121 DRLG METHOD: Geoprobe ELEVATION:
LOCATION: BX Service Station BORING DIA.: 2" TEMP: 70-75°F
GEOLOGIST: Cindy Nagel DRLG FLUID: none WEATHER: sunny, breezy
COMMENTS:

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
				asphalt cover								
	1			lt. brown silty f-med SAND					2			
				lt. brown clean Qtz. med.-coarse SAND moist at 3-4'					2			
									2			
									2			
									NR			
	5							▼	2			
									10			
				buff clean Qtz med.-coarse SAND - wet - sheen at 8'					420			
									750			
									85			
	10			bottom of hole 10'					..			
				no sign of soil contamination								
	15											
	20											
	25											
	30											
	35											

NR = no recovery
background PID 1.8

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above
U – Undetected

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Risk-Based Approach to Remediation

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

K:\AFCEE\731x98\97DN0760, 09/08/97 at 09:41

Eglin MONITORING WELL INSTALLATION RECORD

JOB NAME ~~[redacted]~~ AIR FORCE BASE — WELL NUMBER MP-1

JOB NUMBER ~~[redacted]~~ — INSTALLATION DATE 3/26/98 — LOCATION BX Service Station

DATUM ELEVATION _____ — GROUND SURFACE ELEVATION _____

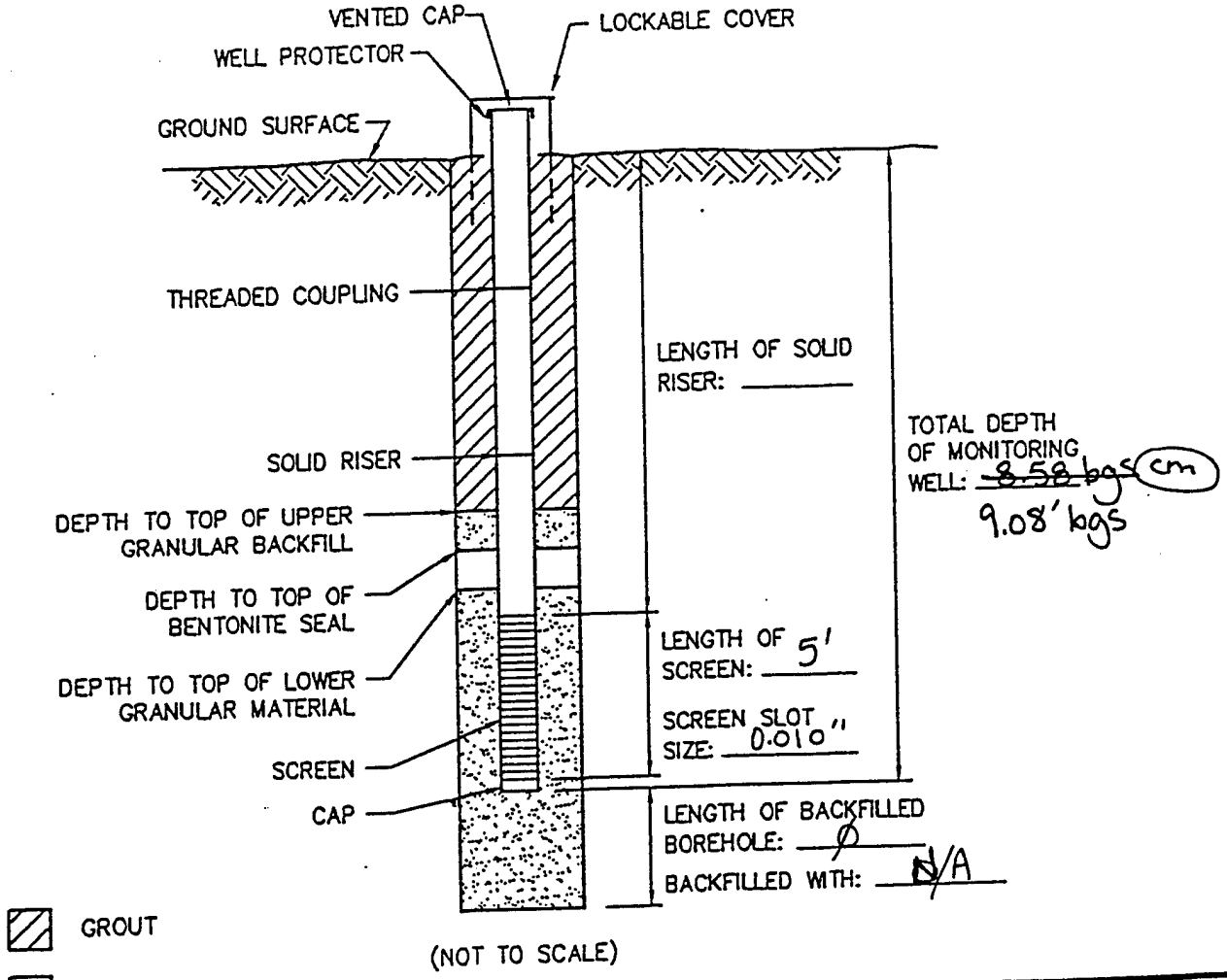
DATUM FOR WATER LEVEL MEASUREMENT _____

SCREEN DIAMETER & MATERIAL 2" SCH 40 PVC — SLOT SIZE 0.01"

RISER DIAMETER & MATERIAL 2" SCH 40 PVC — BOREHOLE DIAMETER 2 INCHES

GRANULAR BACKFILL MATERIAL silica sand — ES REPRESENTATIVE Cindy Nagel

DRILLING METHOD ~~HOLLOW STEM AUGER~~ Geoprobe — DRILLING CONTRACTOR Parsons



STABILIZED WATER LEVEL 6.87 FEET bgs
BELOW DATUM.
MEASURED ON 3/26/98 11:25a

FIGURE 3.4

MONITORING WELL INSTALLATION RECORD

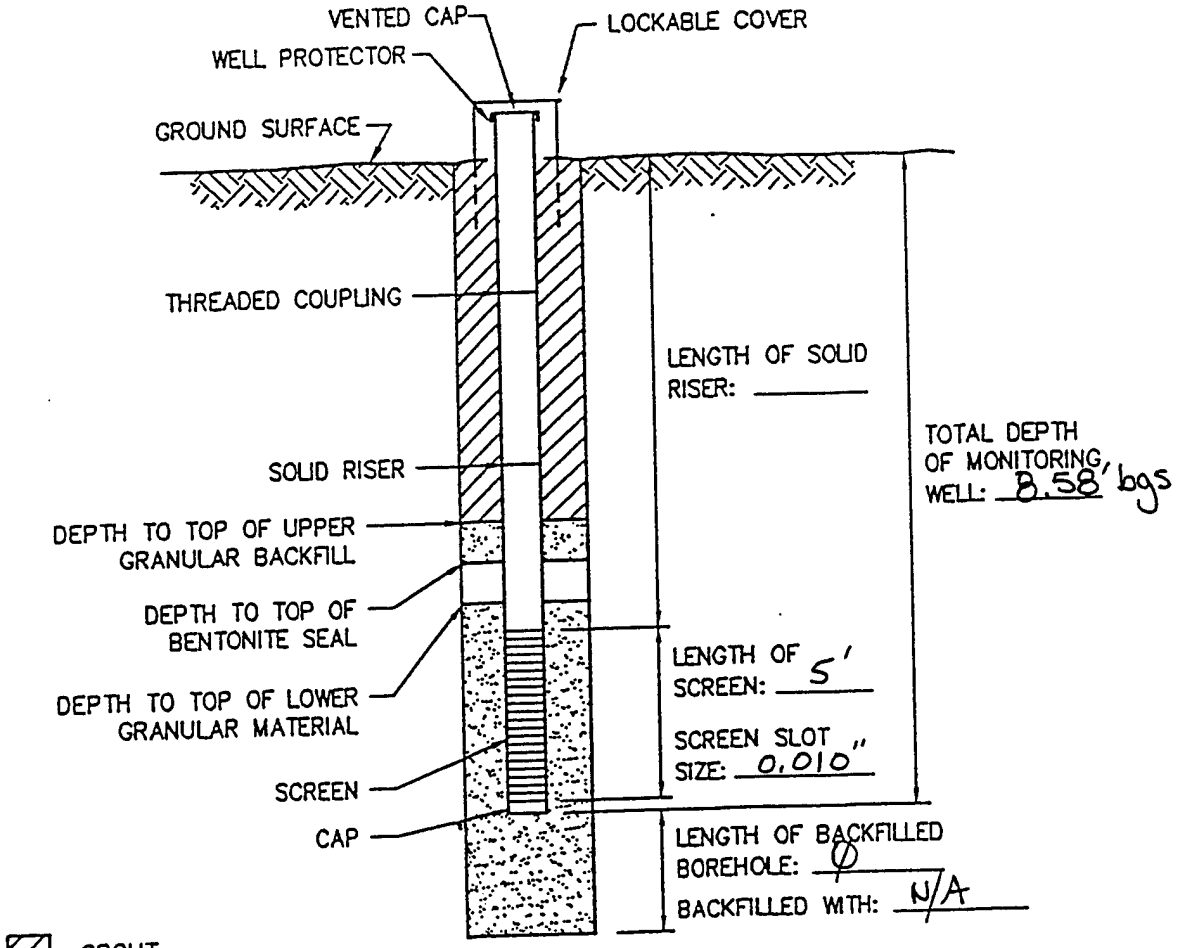
Building 301
Intrinsic Remediation TS
Offutt Air Force Base, Nebraska

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

L:\45024\BLDG301\WORKPLAN\MONWLRCD, 05/28/96 at 10:14

MONITORING WELL INSTALLATION RECORD

JOB NAME Eglin ~~OFFUTT~~ AIR FORCE BASE — WELL NUMBER MP-2
JOB NUMBER ~~7L2450~~ — INSTALLATION DATE 3/26/98 — LOCATION BX Service Sta.
DATUM ELEVATION ____ — GROUND SURFACE ELEVATION ____
DATUM FOR WATER LEVEL MEASUREMENT ____
SCREEN DIAMETER & MATERIAL 2" SCH 40 PVC 1/2" Ø — SLOT SIZE 0.01"
RISER DIAMETER & MATERIAL 2" SCH 40 PVC 1/2" Ø — BOREHOLE DIAMETER 2 ¼ INCHES
GRANULAR BACKFILL MATERIAL silica sand — ES REPRESENTATIVE Cindy Nagel
DRILLING METHOD ~~HOLLOW STEM AUGER~~ Geoprobe — DRILLING CONTRACTOR Parsons



(NOT TO SCALE)

STABILIZED WATER LEVEL 5.76 FEET bgs
BELOW DATUM.
MEASURED ON 3/26/98 11:18a

FIGURE 3.4

MONITORING WELL INSTALLATION RECORD

Building 301
Intrinsic Remediation TS
Offutt Air Force Base, Nebraska

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

GROUNDWATER SAMPLING RECORD

Sampling Location ~~Homestead AFB~~ Eglin AFB Fl.
Sampling Dates 3-25-98

GROUND WATER SAMPLING RECORD - MONITORING WELL(S) MW-01
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-25-98 at 1330 a.m./p.m.
SAMPLE COLLECTED BY: KDB of Parsons ES
WEATHER: Warm ~ 70°F, Breeze 5-10 mph S
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of casing (TOC)

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: N/A
INNER PVC CASING CONDITION IS: OK
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH Alconox, DI, TSO, DI
Items Cleaned (List): all instantaneous probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: 121 interface meter

WATER DEPTH 6.64' FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Yellow
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~3.5 l
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. BX MW-01 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[ ] Pump, type: peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	19.3	19.0	19.2	19.2			
pH	6.07	6.08	6.07	6.08			
Cond (µS/cm)	.045	.045	.046	.046			
DO (mg/L)	0.94	0.39	0.34	0.33			
Redox (mV)	-63.2	-109.1	-108.4	-108.1			
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): 9-40ml glass vials, 5-1 lite glass ambers
2-500ml poly
MS/SAA
MSD/SAA

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method Dissolved lead Containers: 500ml poly HNO3
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method TRPH Containers: 1-liter amber HCl
Method BTEX + Methane Containers: 40ml vials HCl
Method Total lead Containers: 500 ml poly HNO3
Method Dissolved lead Containers: 500 ml poly HNO3

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: MS and MSD sampled from this well (MW-01)

GROUNDWATER SAMPLING RECORD Eglin

Sampling Location ~~Homestead~~ ARB
Sampling Dates 3-31-97

GROUND WATER SAMPLING RECORD - MONITORING WELL BY MW-01
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-31-95 at 1200 a.m./p.m.
SAMPLE COLLECTED BY: KWJ of Parsons ES
WEATHER: Warm ~70° F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): TOC Top of casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: N/A
INNER PVC CASING CONDITION IS: OK
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH Alconox, DI, isopropanol
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH None FT. BELOW DATUM
Measured with: Model 121 interface meter

WATER DEPTH _____ FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Yellow
Odor: None
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~3 gal
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: None
Other comments:

Groundwater Sampling Record

Monitoring Well No. BX MW-01 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____

[X] Pump, type: peristaltic

[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	21.1	20.8	20.8	20.7			YSI 55
pH	6.08	6.09	6.08	6.08			Orion 250A
Cond (µS/cm)	0.45	0.46	0.45	0.45			Hach
DO (mg/L)	0.37	0.34	0.33	0.33			YSI 55
Redox (mV)	-69.9	-110.1	-108.1	-107.9			Orion 250A
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): 9-40ml glass vials, 4-1Liter glass, ~~2-500 ml poly~~

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:

Method _____ Containers: _____

Method _____ Containers: _____

Method _____ Containers: _____

[ ] Preservatives added:

Method BTex + methane Containers: 40 ml vial, HCl

Method TPH Containers: 1-Liter amber HCl

Method _____ Containers: _____

Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled

[ ] Container Lids Taped

[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: MS/MSD sample from this well (MW-01)

GROUNDWATER SAMPLING RECORD

Eglin AFB Fl.

Sampling Location ~~Homestead ARB~~

Sampling Dates 7-25-98

GROUND WATER SAMPLING RECORD - MONITORING WELL ~~MW~~ BX MW-2 Dup = MW-2

(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 7-25-98 at 1200 ~~a.m.~~ p.m.
SAMPLE COLLECTED BY: LDS of Parsons ES
WEATHER: warm ~70°F Sunny
DATUM FOR WATER DEPTH MEASUREMENT (Describe): (TOC) Top of casing

MONITORING WELL CONDITION:

[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - ~~IS NOT~~) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox DI, TSO DI
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: model 121 interface meter

WATER DEPTH 7.56' FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: Clear
Volume Removed: ~~none~~ ~6 gal
Observations: Water (slightly - very) ~~cloudy~~ clear
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No BX mw-02 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____

[X] Pump, type: Peristaltic

[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	20.9	20.3	20.4	20.4			YSI 55
pH	6.31	6.65	6.60	6.61			orion 250A
Cond (µS/cm)	.222	.222	.225	.227			Hach
DO (mg/L)	1.16	1.27	1.31	1.12			YSI 55
Redox (mV)	10.1	11.06	10.95	10.76			orion 250A
gallons purged		1	3	6			

7 [ ] SAMPLE CONTAINERS (material, number, size): 9-40ml glass vials, 4-liter glass ambers, 1-liter poly, and 2-500 ml poly

Dup mw20 Same as above

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method Dissolved lead Containers: 500ml poly HNO3

Method _____ Containers: _____

Method _____ Containers: _____

[ ] Preservatives added:

Method Total lead Containers: 500ml poly HNO3

Method TRPH Containers: liter amber

Method BTEX + Methane Containers: 40 ml vials

Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled

[ ] Container Lids Taped

[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: mw-2 = mw20

GROUNDWATER SAMPLING RECORD Eglin AFB

Sampling Location ~~Homestead ARB~~
Sampling Dates 3-31-98

GROUND WATER SAMPLING RECORD - MONITORING WELL BK MW-2 ~~MW-28~~ DUP = MW-?
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 7-31-98 at 1030 a.m./p.m. DUP = 1730
SAMPLE COLLECTED BY: EBS of Parsons ES
WEATHER: warm ~70° F cloudy
DATUM FOR WATER DEPTH MEASUREMENT (Describe): TOC top of casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS / IS NOT) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS / IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox, di, iso, di
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: Mid-Tech interfacemeter

WATER DEPTH 4.55' FT. BELOW DATUM
Measured with: Slope Tech Conductivity

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: Grundfos pump
Volume Removed: ~3 gal
Observations: Water (slightly - very) ~~cloudy~~ clear
Water level (rose - fell - ~~no change~~)
Water odors: none
Other comments:

Groundwater Sampling Record

3-31-98

Monitoring Well No. MW-2 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[X] Pump, type: peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	22.1	22.3	22.2	22.3			YSI 55
pH	6.52	6.51	6.51	6.51			orion 250A
Cond (µS/cm)	.222	.223	.223	.223			Hach
DO (mg/L)	1.24	1.28	1.28	1.27			YSI 55
Redox (mV)	10.91	11.00	11.3	11.5			orion FA
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): _____

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX + Methane Containers: 40 ml vials HCl
Method TPH Containers: liter ambers HCl
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: MW10 is dup of MW2

GROUNDWATER SAMPLING RECORD

Sampling Location ~~Homestead AFB~~ Eglin AFB FL.
Sampling Dates 3-25-98

GROUND WATER SAMPLING RECORD - MONITORING WELL MW-4
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-25-98 at 0900 a.m./p.m.
SAMPLE COLLECTED BY: RDS of Parsons ES
WEATHER: Sunny ~70°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): TOC Top of casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: N/A
INNER PVC CASING CONDITION IS: OK
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH Alconox, DI, TSP, DI
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with:

WATER DEPTH 7.98 FT. BELOW DATUM
Measured with:

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~3 gal
Observations: Water (slightly - very) ~~cloudy~~ clear
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. MW-4 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[ ] Pump, type: peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	19.0	19.8	19.9	19.9			
pH	6.85	6.55	6.86	6.84			
Cond (µS/cm)	.169	.172	.176	.178			
DO (mg/L)	6.39	6.53	5.78	5.57			
Redox (mV)	1.86	3.75	3.72	3.73			
gallons purged		1	2	3			

7 [X] SAMPLE CONTAINERS (material, number, size): 6-40ml glass vials, 1-liter glass

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX Containers: 40ml vials (HCL)
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD

Sampling Location ~~Homestead ARB~~ Eglin AFB Fl.
Sampling Dates 3-26-98

GROUND WATER SAMPLING RECORD - MONITORING WELL BR MW-07
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-26-98 at 0630 a.m./p.m.
SAMPLE COLLECTED BY: RB of Parsons ES
WEATHER: clear, sunny ~ 55°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): (TOC) Top of casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - ~~IS NOT~~) APPARENT
STEEL CASING CONDITION IS: ok
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH Alconox
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: model 121 interface meter

WATER DEPTH 5.00' FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: ~~Bladder~~ Pump
Volume Removed: ~3 gal
Observations: Water (slightly - very) ~~cloudy~~ clear
Water level (rose - fell - ~~no change~~)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. Bx MW-07 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[✓] Pump, type: peristaltic
[ ] Other, describe:_____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	14.8	20.3	20.2	20.2			YSI 55
pH	6.26	6.41	6.56	~~6.54~~ 6.54			Orion 250A
Cond (µS/cm)	.224	.198	.198	.196			Hach
DO (mg/L)	4.25	3.77	3.40	3.44			YSI 55
Redox (mV)	77.7	70.6	67.0	65.1			Orion 250A
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): 6 - 40ml glass vials, 1 - 1 Liter poly

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method BTEX Containers: 40ml vials (HCL)
Method methane Containers: 40ml vials (HCL)
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

GROUNDWATER SAMPLING RECORD

EGLIN AFB FL.

Sampling Location Homestead ARB
Sampling Dates 3-25-91

GROUND WATER SAMPLING RECORD - MONITORING WELL MW-C
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-25-91 at 1606 a.m (p.m.)
SAMPLE COLLECTED BY: RAB of Parsons ES
WEATHER: Warm Sunny ~70° F.
DATUM FOR WATER DEPTH MEASUREMENT (Describe): (TOC) Top of casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: OK
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox, DI, ISO, DI
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: 12.1 interface meter

WATER DEPTH 5.55' FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~3 gal
Observations: Water (slightly - very) ~~cloudy~~ clear
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. BK MW-C (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____

[X] Pump, type: peristaltic

[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	16.9	16.9	16.8	16.8			
pH	6.86	6.86	6.78	6.78			
Cond (µS/cm)	.082	.081	.086	.086			
DO (mg/L)	5.48	5.17	5.69	5.71			
Redox (mV)	-53.7	-50.3	-74.6	-76.6			
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): 6-40ml glass vials, 1-liter poly

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX + Methane Containers: 40ml vials HCL
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD

Elgin AFB Fl.

Sampling Location ~~Homestead ARB~~
Sampling Dates 3-26-98

GROUND WATER SAMPLING RECORD - MONITORING WELL BX MW-D
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [X] Special Sampling;
DATE AND TIME OF SAMPLING: 3-26-98 at _____ a.m./p.m.
SAMPLE COLLECTED BY: RDS of Parsons ES
WEATHER: Sunny, Clear ~ 55°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): (Toc) Top of Casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: missing
INNER PVC CASING CONDITION IS: OK
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[X] MONITORING WELL REQUIRED REPAIR (describe): needs protective casing

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alkonox, DI, ISO, DI
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: model 121 interface meter

WATER DEPTH 5.97' FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: cloudy
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~3gal
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: none
Other comments:

TD = 14.55

Groundwater Sampling Record

Monitoring Well No. BK MW-D (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[X] Pump, type: Peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time	~~TBT~~						Measured with
Temp (°C)	19.7	20.0	20.1	20.2			YSI 55
pH	6.87	6.85	6.84	6.79			orion 250A
Cond (µS/cm)	.140	.139	.132	.130			Hach
DO (mg/L)	3.88	3.33	3.23	3.30			YSI 55
Redox (mV)	66.9	65.9	63.2	62.0			orion 250A
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): 6 - 40ml vial glass, 1-1 Liter Poly

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX Containers: 40ml vials (HCL)
Method methane Containers: 40ml vials (HCL)
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD Eglin

Sampling Location ~~Homestead~~ ARB
Sampling Dates 3-31-98

GROUND WATER SAMPLING RECORD - MONITORING WELL MW-D
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-31-98 at 1700 a.m./p.m.
SAMPLE COLLECTED BY: [illegible] of Parsons ES
WEATHER: warm ~ 70°F / cloudy
DATUM FOR WATER DEPTH MEASUREMENT (Describe): (TOC) Top of casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: missing
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe): needs protective casing

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox/DI/isopro
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: model 121 interface meter

WATER DEPTH 5.96' FT. BELOW DATUM
Measured with: slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: cloud
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~2 gal
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. MW-1 (Continued) Eglin

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[✓] Pump, type: peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	20.1	20.1	19.8				YSI 55
pH	6.86	6.85	6.86				Orion 250A
Cond (µS/cm)	.133	.132	.133				Hach
DO (mg/L)	3.41	3.36	3.37				YSI 55
Redox (mV)	67.1	66.3	66.4				Orion 55
gallons purged		1	2				

7 [ ] SAMPLE CONTAINERS (material, number, size): 6 40 ml glass vials, 2-500 ml poly

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method dissolved lead Containers: 500 ml poly HNO3
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method DTX & methanol Containers: 40 ml vials HCl
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD EGLIN AFB Fl.

Sampling Location ~~Homestead ARB~~
Sampling Dates 3-25-98

GROUND WATER SAMPLING RECORD - MONITORING WELL GWRW-04
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-25-98 at 0800 a.m./p.m.
SAMPLE COLLECTED BY: LDB of Parsons ES
WEATHER: Warm Sunny ~70°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Toc Top of casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: OK
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox DI, TSP, DI
Items Cleaned (List): all equipment pumps

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: model 101 interface meter

WATER DEPTH 8.02' FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear
Odor: non
Other Comments:

4 [ ] WELL EVACUATION:
Method: Pump
Volume Removed: ~1 gal
Observations: Water (slightly - very) ~~cloudy~~ Clear
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. dwrw-04 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[X] Pump, type: peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	19.4	19.8					YSI 55
pH	6.44	6.44					orion 250A
Cond (µS/cm)	.191	.191					Hach
DO (mg/L)	5.10	5.11					YSI 55
Redox (mV)	448	449					orion 250A
gallons purged		1					

7 [ ] SAMPLE CONTAINERS (material, number, size): 3 - 40ml glass vials

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX Containers: 40ml vial (HCL)
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD

Sampling Location Eglin ~~Homestead~~ ARB
Sampling Dates 3-31-98

GROUND WATER SAMPLING RECORD - MONITORING WELL GWRW84
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-31-98 at 1630 a.m./p.m.
SAMPLE COLLECTED BY: RAB of Parsons ES
WEATHER: Warm ~ 70° F partly
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Toc Top of casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - ~~IS NOT~~) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox di, isp, di
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with: solinst 121 interface meter

WATER DEPTH 8.02' FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~1 gal
Observations: Water (~~slightly very~~) cloudy clear
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Eglin

Monitoring Well No. GWR4-4 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____

[X] Pump, type: peristaltic

[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	19.4	19.5					YSI 55
pH	6.44	6.44					orion 250A
Cond (µS/cm)	.191	.191					Hach
DO (mg/L)	5.10	5.09					YSI 55
Redox (mV)	4.48	4.49					Orion 250A
gallons purged		1					

7 [ ] SAMPLE CONTAINERS (material, number, size): 6 ml glass vials, 2-liter glass amber and 2-500ml poly.

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method dissolved lead Containers: 500 ml poly HNO3

Method _____ Containers: _____

Method _____ Containers: _____

[ ] Preservatives added:

Method Baty Containers: 40ml vial HCl

Method _____ Containers: _____

Method _____ Containers: _____

Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled

[ ] Container Lids Taped

[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD

~~Eglin~~ Eglin AFB Fl.

Sampling Location ~~Homestead ARB~~
Sampling Dates 3-25-95

GROUND WATER SAMPLING RECORD - MONITORING WELL GWMW-6
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-25-95 at 0730 a.m./p.m.
SAMPLE COLLECTED BY: RDS of Parsons ES
WEATHER: Warm ~ 70°F Sunny
DATUM FOR WATER DEPTH MEASUREMENT (Describe): (Toc) Top of casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: N/A
INNER PVC CASING CONDITION IS: OK
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH Alconox/DI, TSO, DI
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH none FT. BELOW DATUM
Measured with:

WATER DEPTH 7.4 FT. BELOW DATUM
Measured with: slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: ~~clear~~ pump
Volume Removed: ~ 1.5 gal
Observations: Water (slightly - (very) - ~~cloudy~~ - clear
Water level (rose - fell - (no change))
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. GWRW-06 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____

[X] Pump, type: peristaltic

[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	19.8	19.8					
pH	6.46	6.46					
Cond (µS/cm)	.193	~~.192~~ .192					
DO (mg/L)	5.12	5.11					
Redox (mV)	4.48	4.47					
gallons purged		1					

7 [ ] SAMPLE CONTAINERS (material, number, size): 6-40ml glass vials

1-liter glass

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____

Method _____ Containers: _____

Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX Containers: 40ml vials (HCL)

Method EDB Containers: 40ml vials (HCL)

Method _____ Containers: _____

Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled

[ ] Container Lids Taped

[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD

Sampling Location ~~Homestead ARB~~ Eglin AFB Fl.
Sampling Dates 3-26-98

GROUND WATER SAMPLING RECORD - MONITORING WELL bk mw1
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-26-98 at 1330 a.m./p.m.
SAMPLE COLLECTED BY: KDB of Parsons ES
WEATHER: Hot, Sunny ~75°F Sl Breeze 3-5 mph SE
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Ground Surface

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS / IS NOT) APPARENT
STEEL CASING CONDITION IS: basic
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS / IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox, Di, Iso, Di
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH unknown FT. BELOW DATUM
Measured with: Interface will not fit into casing

WATER DEPTH 6.87 'bgs FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Cloudy
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: Pump
Volume Removed:
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. BX MP1 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____

[X] Pump, type: Peristaltic

[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	20.7	20.4	20.5	20.4	20.4	20.4	YSI 55
pH	6.56	6.52	6.54	6.53	6.53	6.53	orion 250A
Cond (µS/cm)	.258	.247	.248	.250	.250	1250	Hach
DO (mg/L)	5.14	5.79	5.89	5.95	5.94	5.88	YSI 55
Redox (mV)	-26.1	-8.7	-3.3	11.2	21.1	33.3	orion 250A
gallons purged		1	2	3	4	5	

7 [ ] SAMPLE CONTAINERS (material, number, size): 3 - 40ml glass vials

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX Containers: 40ml vials HCl
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD Eglin

Sampling Location ~~Homestead ARB~~
Sampling Dates 3-31-98

GROUND WATER SAMPLING RECORD - MONITORING WELL Bx mP1 Temp
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-31-98 at 1330 a.m./p.m.
SAMPLE COLLECTED BY: KW of Parsons ES
WEATHER: warm ~70°F Partly
DATUM FOR WATER DEPTH MEASUREMENT (Describe): ground surface

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox, dilute, DI
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH unknown FT. BELOW DATUM
Measured with:

WATER DEPTH 6.86' bgs FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: cloudy
Odor: none
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~7 gal
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: none
Other comments:

Groundwater Sampling Record

Monitoring Well No. BX MW1 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____

[X] Pump, type: peristaltic

[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	21.3	22.0	20.8	21.1			YSI 55
pH	6.65	6.53	6.53	6.53			Orion 250A
Cond (µS/cm)	.247	.249	.249	.249			Hach
DO (mg/L)	5.05	5.80	5.75	5.90			YSI 55
Redox (mV)	-26	-7.3	2.2	3.0			Orion 250A
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): 3-40ml glass vials, 2-500ml poly's

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method dissolved lead Containers: 500ml poly HNO3
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:
Method BTEX Containers: 40ml vial HCl
Method total lead Containers: 500 ml poly HNO3
Method dissolved lead Containers: 500 ml poly HNO3
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD

Eglin AFB Fl.

Sampling Location ~~Homestead ARB~~
Sampling Dates 3-26-98

GROUND WATER SAMPLING RECORD - MONITORING WELL BX MP2 Temp.
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-26-98 at 1230 a.m./p.m.
SAMPLE COLLECTED BY: RAS of Parsons ES
WEATHER:
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Ground surface

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox, DI, ISO, DI
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH ~~none~~ unknown FT. BELOW DATUM
Measured with:

WATER DEPTH 5.76' bgs FT. BELOW DATUM
Measured with: Slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Cloudy
Odor: Hydrocarbon
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: ~5 gal
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: yes
Other comments:

Groundwater Sampling Record

Monitoring Well No BX MP2 (Continued)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[X] Pump, type: Peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	20.5	20.5	20.6	20.6	20.6	20.6	YSI 55
pH	6.40	6.52	6.51	6.51	6.54	6.54	Orion 250A
Cond (µS/cm)	.238	.197	.187	.167	.175	.175	Hach
DO (mg/L)	0.14	0.20	0.16	0.15	0.15	0.15	YSI 55
Redox (mV)	-225.6	-223.7	-227.0	-224.2	-222.0	-218.5	Orion 250A
gallons purged		1	2	3	4	5	

7 [ ] SAMPLE CONTAINERS (material, number, size): glass, 9, 40ml + glass-5-1 Liter Poly-2-500ml

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX Containers: ~~1 Liter amber~~ 40ml vials HCl
Method TRPH Containers: 1 Liter amber HCl
Method methane Containers: 40ml vials HNO3
Method Total lead Containers: 500 ml Poly HNO3
Dissolved lead 500 ml poly

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD Eglin AFB

Sampling Location ~~Homestead~~ ARB
Sampling Dates 3-31-98

GROUND WATER SAMPLING RECORD - MONITORING WELL 66 mp2 Temp
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3-31-98 at 1430 a.m./p.m.
SAMPLE COLLECTED BY: RKJ of Parsons ES
WEATHER: warm ~70°F partly
DATUM FOR WATER DEPTH MEASUREMENT (Describe): ground surface

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - ~~IS NOT~~) APPARENT
STEEL CASING CONDITION IS: rust
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off
1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox, dionized
Items Cleaned (List): all instrument probes

2 [ ] PRODUCT DEPTH unknown FT. BELOW DATUM
Measured with:

WATER DEPTH 5.77' bgs FT. BELOW DATUM
Measured with: Stape water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: cloudy
Odor: Hydrocarbon
Other Comments:

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed:
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: yes
Other comments:

Groundwater Sampling Record

Monitoring Well No. ~~MW~~ MP2 (Continued) Eglin AFB

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[X] Pump, type: peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)	20.1	20.2	20.1	20.1			YSI 55
pH	6.50	6.51	6.51	6.51			Orion 250A
Cond (µS/cm)	.198	.187	.187	.187			Hach
DO (mg/L)	0.16	0.15	0.15	0.15			YSI 55
Redox (mV)	-220.3	-227.2	-226.4	-225.3			Orion 250A
gallons purged		1	2	3			

7 [ ] SAMPLE CONTAINERS (material, number, size): 9-40ml glass vials, 4-1 liter glass
2-500ml poly

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method dissolved lead Containers: 500ml poly HNO3
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX & Methane Containers: 40ml vials HCl
Method TRPH Containers: 1-Liter amber HCl
Method Total lead Containers: 500ml poly HNO3
Method dissolved lead Containers: 500ml poly HNO3

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

GROUNDWATER SAMPLING RECORD

Sampling Location ~~Homestead ARB~~ Eglin AFB
Sampling Dates 7-21-94

GROUND WATER SAMPLING RECORD - MONITORING WELL MP3 (SB-15) Temp
(Identification)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 7-21-94 at _____ a.m./p.m.
SAMPLE COLLECTED BY: BB of Parsons ES
WEATHER: warm ~70° F pcloudy
DATUM FOR WATER DEPTH MEASUREMENT (Describe): ground surface

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - ~~IS NOT~~) APPARENT
STEEL CASING CONDITION IS: none
INNER PVC CASING CONDITION IS: ok
WATER DEPTH MEASUREMENT DATUM (IS - ~~IS NOT~~) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe): _____

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH alconox di ira, dtw
Items Cleaned (List): all sampling equipment + pumps

2 [ ] PRODUCT DEPTH contains FT. BELOW DATUM
Measured with: _____

WATER DEPTH 6.33' FT. BELOW DATUM
Measured with: slope water level indicator

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: cloud
Odor: none
Other Comments: _____

4 [ ] WELL EVACUATION:
Method: pump
Volume Removed: none
Observations: Water (slightly - very) ~~cloudy~~
Water level (rose - fell - ~~no change~~)
Water odors: none
Other comments: _____

7-31-97

Groundwater Sampling Record

Monitoring Well No. MP3 (Continued) Temp Eglin
(SB-15)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[X] Pump, type: peristaltic
[ ] Other, describe: _____

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Time							Measured with
Temp (°C)							
pH							
Cond (µS/cm)							
DO (mg/L)							
Redox (mV)							
gallons purged							

7 [ ] SAMPLE CONTAINERS (material, number, size): 3-40ml glass vials

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method BTEX Containers: 40 ml vials HCl
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

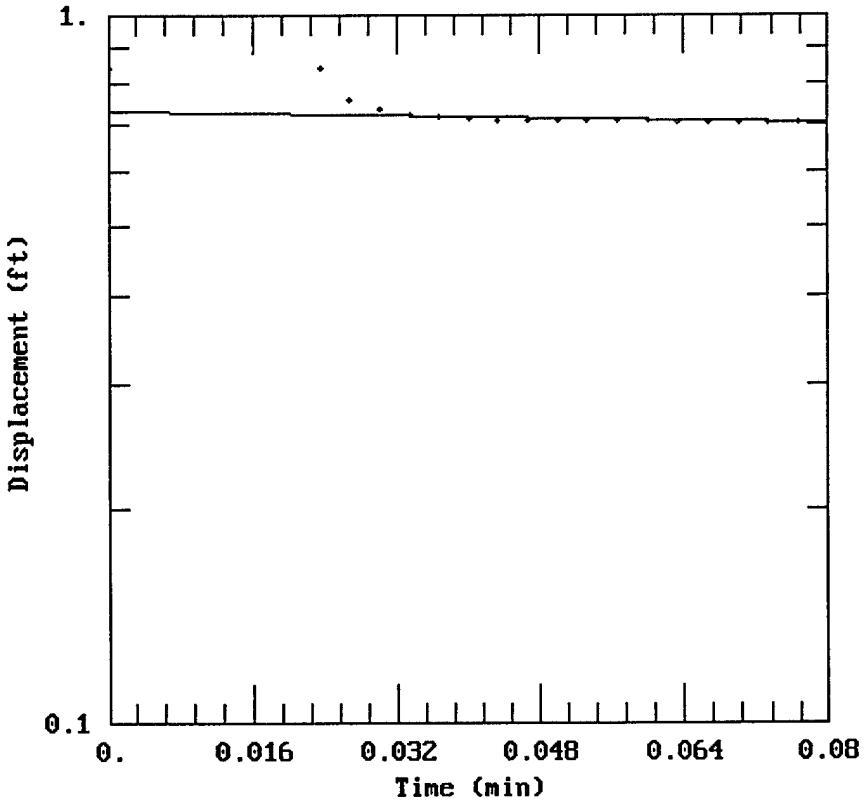
10 [ ] OTHER COMMENTS: _____

APPENDIX D

SLUG TEST DATA ANALYSIS

CLIENT: AFCEE / Eglin AFB	COMPANY: Parsons ES
LOCATION: BX Service Station	PROJECT: 731854.02000

Slug Test Analysis



DATA SET:
BX1_1.DAT
08/21/98

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 4/1/98
test well: NA
obs. well: MW-1

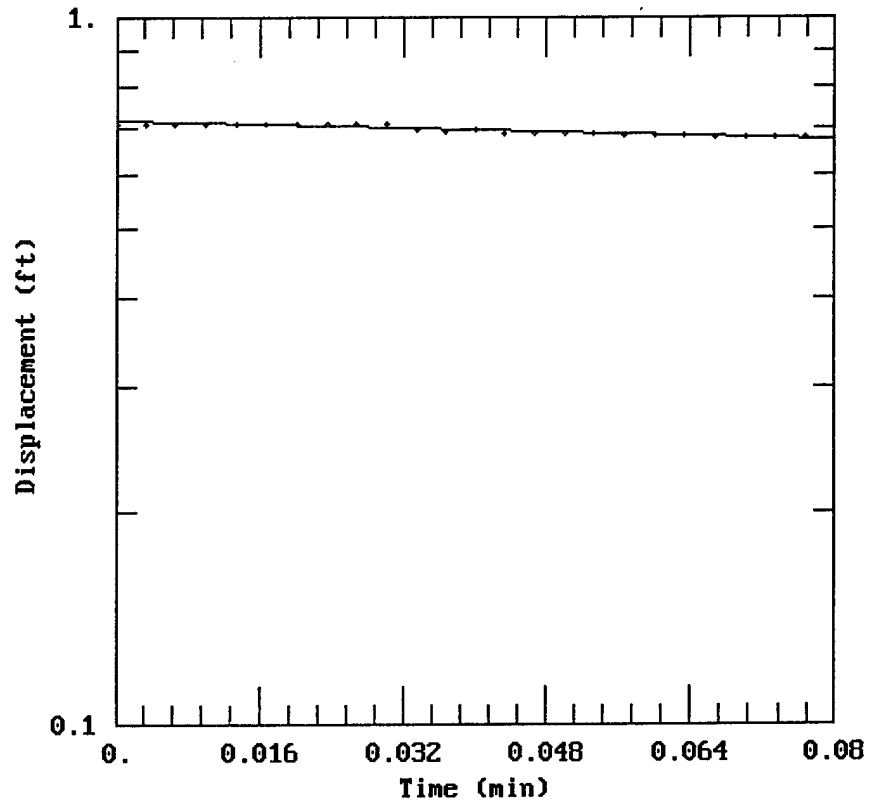
TEST DATA:
H0= 0.842 ft
r_c= 0.083 ft
r_w= 2.125 ft
L = 5. ft
b = 50. ft
H = 3.3 ft

PARAMETER ESTIMATES:
K = 0.01129 ft/min
y0 = 0.7281 ft

AQTESOLV

CLIENT: AFCEE / Eglin AFB	COMPANY: Parsons ES
LOCATION: BX Service Station	PROJECT: 731854.02000

Slug Test Analysis



DATA SET:
BX1_2.DAT
08/21/98

AQUIFER MODEL:
Unconfined
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 4/1/98
test well: NA
obs. well: MW-1

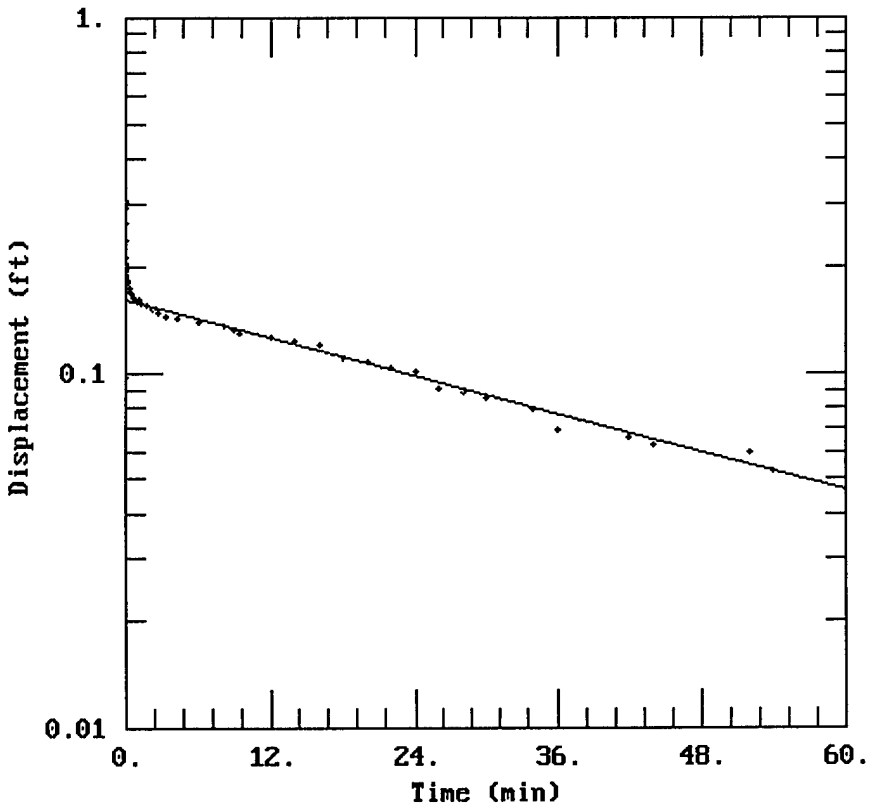
TEST DATA:
H0= 0.709 ft
r_c= 0.083 ft
r_w= 2.125 ft
L = 5. ft
b = 50. ft
H = 3.3 ft

PARAMETER ESTIMATES:
K = 0.01954 ft/min
y0 = 0.7141 ft

AQTESOLV

CLIENT: AFCEE / Eglin AFB	COMPANY: Parsons ES
LOCATION: BX Service Station	PROJECT: 731854.02000

Slug Test Analysis



DATA SET:
BX2_1.DAT
08/21/98

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 4/1/98
test well: NA
obs. well: MW-1

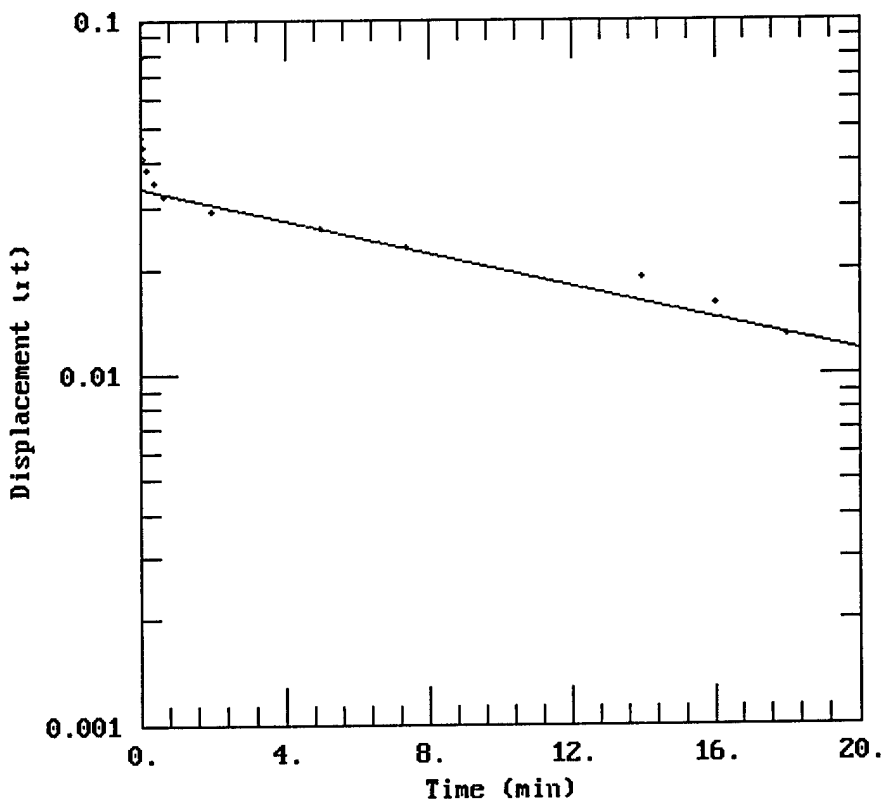
TEST DATA:
H0= 0.098 ft
r_c= 0.083 ft
r_w= 2.125 ft
L = 5. ft
b = 50. ft
H = 3.3 ft

PARAMETER ESTIMATES:
K = 0.000532 ft/min
y0 = 0.1618 ft

AQTESOLV

CLIENT: AFCEE / Eglin AFB	COMPANY: Parsons ES
LOCATION: BX Service Station	PROJECT: 731854.02000

Slug Test Analysis



DATA SET:
BX2_2.DAT
08/21/98

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 4/1/98
test well: NA
obs. well: MW-1

TEST DATA:
H0= 0.098 ft
r_c= 0.083 ft
r_w= 2.125 ft
L = 5. ft
b = 50. ft
H = 3.3 ft

PARAMETER ESTIMATES:
K = 0.001359 ft/min
y0 = 0.03393 ft

AQTESOLV

APPENDIX E

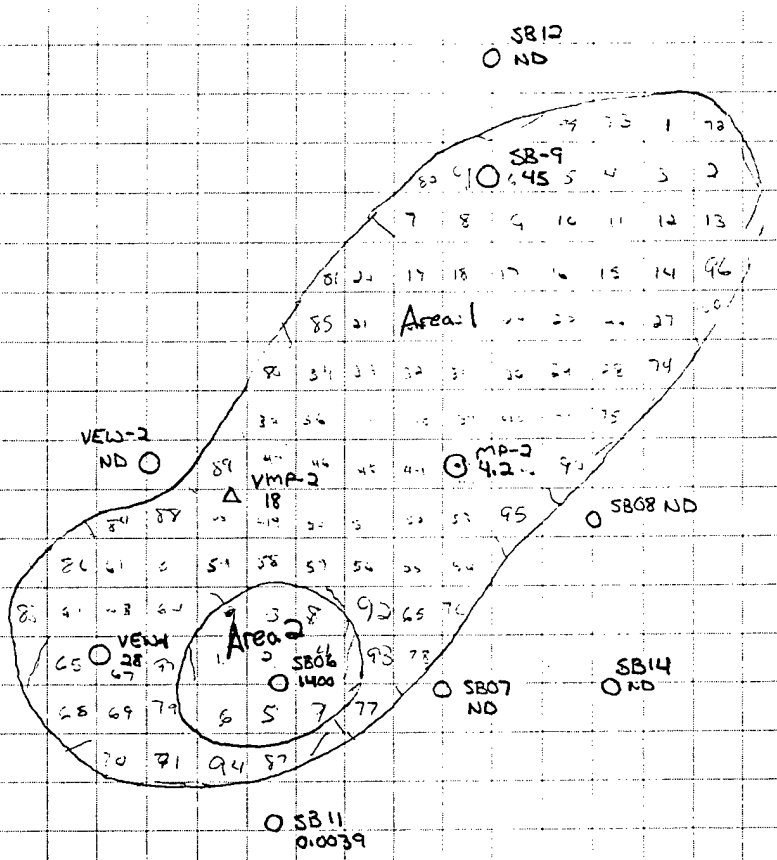
CALCULATIONS

PARSONS ENGINEERING SCIENCE, INC.

Client Eglin AFB | Job No. 731854.0200.30000 | Sheet 1 of 1

Subject Total Xylene mass for Model | By Steve Hicks | Date 3/12/99

Checked RH 3/12/99 | Rev.



Estimated Area of Soil Contamination and Detected Xylenes levels.

0 50'

Area = 12.5ft x 12.5ft = 156.25ft²

Area 1 = 101 squares

Area 2 = 9 squares

1

Area #1 $101 \text{ squares} \times \frac{156.25 \text{ ft}^2}{\text{square}} = 15,781 \text{ ft}^2$

Vol #1 $= 15,781 \text{ ft}^2 \times 2.5 \text{ ft} = 39,453 \text{ ft}^3$

$$39,453 \text{ ft}^3 \times \frac{28.32 \text{ L}}{\text{ft}^3} \times 1.72 \frac{\text{kg}}{\text{L}} \times 23.8 \frac{\text{mg}}{\text{kg}} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 45.7 \text{ kg}$$

(1.72 kg/L: bulk density)

2

Area #2 $9 \text{ square} \times \frac{156.25 \text{ ft}^2}{\text{square}} = 1406 \text{ ft}^2$

Vol #2 $1406 \text{ ft}^2 \times 2.5 \text{ ft} = 3,515.6 \text{ ft}^3$

$$3515 \text{ ft}^3 \times \frac{28.32 \text{ L}}{\text{ft}^3} \times 1.72 \frac{\text{kg}}{\text{L}} \times 1400 \frac{\text{mg}}{\text{kg}} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 239.7 \text{ kg}$$

Total Xylenes $= 45.7 \text{ kg} + 239.7 \text{ kg} = \underline{285.4 \text{ kg}}$

SITE-SPECIFIC TARGET LEVEL CALCULATIONS - SOIL [a/]
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions			SSTL Equations (combined exposure routes)
Receptor	Construction Worker		
Site-specific target level for combined exposure routes (SSTL)	chem.-specific	mg/kg [b/]	$SSTL = \frac{1}{\frac{1}{SSTL_{ing}} + \frac{1}{SSTL_{derm}} + \frac{1}{SSTL_{inhal}}}$
Site-specific target level based on soil ingestion ($SSTL_{ing}$)	chem.-specific	mg/kg	
Site-specific target level based on dermal contact with soil ($SSTL_{derm}$)	chem.-specific	mg/kg	
Site-specific target level: inhalation of volatiles/particulates from soil ($SSTL_{inh}$)	chem.-specific	mg/kg	

		RME SCENARIO [d/]				CT SCENARIO [e/]			
Contaminant	CAS Number [c/]	$SSTL_{ing}$ (mg/kg)	$SSTL_{derm}$ (mg/kg)	$SSTL_{inhal}$ (mg/kg)	$SSTL_{RME}$ (mg/kg)	$SSTL_{ing}$ (mg/kg)	$SSTL_{derm}$ (mg/kg)	$SSTL_{inhal}$ (mg/kg)	$SSTL_{CT}$ (mg/kg)
Volatile Organic Compounds									
Ethylbenzene	100-41-4	2.96E+04	** [f/]	1.10E+04	**8.03E+03**	2.13E+05	**	3.31E+04	**2.86E+04**
Xylenes, total	1330-20-7	5.91E+05	**	7.83E+04	**6.92E+04**	4.26E+06	**	2.35E+05	**2.23E+05**

[a/] SSTL calculations based on combining the following exposure routes: incidental ingestion, dermal contact, and inhalation of volatiles/particulates from soil.

[b/] mg/kg = milligram per kilogram

[c/] CAS = Chemical Abstracts Service number.

[d/] RME = reasonable maximum exposure

[e/] CT = central tendency

[f/] ** = per USEPA (1992), dermal absorption was assumed to be insignificant for volatile organic compounds

SITE-SPECIFIC TARGET LEVEL CALCULATIONS - GROUNDWATER [a/]
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker	
Site-specific target level for combined exposure routes (SSTL)	chem.-specific	µg/L [b/]
Site-specific target level based on incidental ingestion of groundwater ($SSTL_{ing}$)	chem.-specific	µg/L
Site-specific target level based on dermal contact with groundwater ($SSTL_{derm}$)	chem.-specific	µg/L
Site-specific target level based on aboveground inhalation of contaminants volatilized from groundwater ($SSTL_{inh\text{-}above}$)	chem.-specific	µg/L
Site-specific target level based on inhalation of contaminants volatilized from groundwater into the trench ($SSTL_{inh\text{-}trench}$)	chem.-specific	µg/L

SSTL Equation (combined exposure routes)

$$SSTL = \frac{1}{\frac{1}{SSTL_{ing}} + \frac{1}{SSTL_{derm}} + \frac{1}{SSTL_{inhal-above}} + \frac{1}{SSTL_{inhal-trench}}}$$

		RME SCENARIO [d/]					CT SCENARIO [e/]				
Contaminant	CAS Number [c/]	$SSTL_{ing}$ (µg/L)	$SSTL_{derm}$ (µg/L)	$SSTL_{inhal\text{-}above}$ (µg/L)	$SSTL_{inhal\text{-}trench}$ (µg/L)	$SSTL_{RME}$ (µg/L)	$SSTL_{ing}$ (µg/L)	$SSTL_{derm}$ (µg/L)	$SSTL_{inhal\text{-}above}$ (µg/L)	$SSTL_{inhal\text{-}trench}$ (µg/L)	$SSTL_{CT}$ (µg/L)
Volatile Organic Compounds											
Benzene	71-43-2	1.34E+05	5.44E+03	5.44E+05	3.31E+04	**4.48E+03**	1.64E+06	4.30E+04	1.62E+06	1.01E+05	**2.91E+04**
Ethylbenzene	100-41-4	5.55E+06	4.64E+04	8.76E+07	6.44E+06	**4.57E+04**	6.81E+07	3.67E+05	2.61E+08	1.98E+07	**3.58E+05**
Toluene	108-88-3	1.11E+07	1.45E+05	3.45E+07	2.41E+06	**1.34E+05**	1.36E+08	1.28E+06	1.03E+08	7.38E+06	**1.07E+06**
Xylenes, total	1330-20-7	1.11E+08	8.93E+05	6.00E+08	4.09E+07	**8.66E+05**	1.36E+09	7.42E+06	1.79E+09	1.25E+08	**6.94E+06**
Polynuclear Aromatic Hydrocarbons											
Naphthalene	91-20-3	2.22E+06	2.13E+04	1.07E+06	2.54E+04	**1.14E+04**	2.73E+07	1.69E+05	3.20E+06	7.80E+04	**5.24E+04**
Metals											
Lead	7439-92-1	--	--	--	--	--	--	--	--	--	--

[a/] SSTL calculations based on combining the following exposure routes: incidental ingestion, dermal contact, inhalation of contaminates volatilized from groundwater into aboveground ambient air, and inhalation of contaminants volatilized from groundwater into ambient air in a trench/excavation pit.

[c/] CAS = Chemical Abstracts Service number.

[b/] µg/L = micrograms per liter

[d/] RME = reasonable maximum exposure

[e/] CT = central tendency

[e/] -- = toxicity data not available.

CHEMICAL PROPERTIES FOR CONTAMINANTS
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Contaminant	CAS Number [b]	Type [c]	Chemical Properties [a]																			
			t* (hr) [d]	Ref [e]	K_p (cm/hr) [f]	Ref	t_{event} (hr/event) [g]	Ref	B (unitless)	Ref	OAF	Ref	Sf_{oral} $(mg/kg\text{-}day)^{-1}$ [h]	Ref	SF_d $(mg/kg\text{-}day)^{-1}$	RfD_{oral} (mg/kg-day)	Ref	RfD_d (mg/kg-day)	URF $(\mu g/m^3)^{-1}$ [i]	Ref	RfC $(\mu g/m^3)$	Ref
Volatile Organic Compounds																						
Benzene	71-43-2	o	6.30E-01	D	2.10E-02	D	2.60E-01	D	1.30E-02	D	0.9	1	2.90E-02	I	3.22E-02	3.00E-03	E	2.70E-03	7.80E-06	I	5.95E+00	E
Ethylbenzene	100-41-4	o	1.30E+00	D	7.40E-02	D	3.90E-01	D	1.40E-01	D	0.8	1	-- [j]	--	--	1.00E-01	I	8.00E-02	--	--	1.00E+03	I
Toluene	108-88-3	o	7.70E-01	D	4.50E-02	D	3.20E-01	D	5.40E-02	D	0.8	1	--	--	--	2.00E-01	I	1.60E-01	--	--	4.00E+02	I
Xylenes, total	1330-20-7	o	1.40E+00	D	8.00E-02	D	3.90E-01	D	1.60E-01	D	0.895	1	--	--	--	2.00E+00	H	1.79E+00	--	--	6.30E+03	X
Polynuclear Aromatic Hydrocarbons																						
Naphthalene	91-20-3	o	2.20E+00	D	6.90E-02	D	5.30E-01	D	2.00E-01	D	1	1	--	--	--	4.00E-02	W	4.00E-02	--	--	3.00E+00	I

[a] Chemical Properties are defines as follows: t* = time it takes to reach steady state, K_p = Permeability coefficient from water, t_{event} = lag time per event, B = Relative contribution of permeability coefficients, OAF = oral absorption factor, SForal = oral slope factor, SF_d = dermal slope factor (i.e., oral slope factor adjusted for gastrintestinal absorption), RFDoral = oral reference dose, RFDd = dermal reference dose (i.e., oral referenc dose adjusted for gastrointestinal absorption), URF = inhalation unit risk factor, RfC = inhalation reference concentration.

[b] CAS = Chemical Abstracts Service number.

[c] "o" indicates an organic compound, "i" indicates an inorganic compound

[d] hr = hour

[e] Ref = References as defined below.

[f] cm/hr = centimeters per hour

[g] hr/event = hours per event

[h] mg/kg-day = milligrams per kilogram-day

[i] $\mu g/m^3$ = micrograms per cubic meter

[j] -- = toxicity data were not available.

References:

D = USEPA (1992a) Dermal Exposure Assessmant: Principles and Applications .

I = USEPA (1999), Integrated Risk Information System (IRIS).

H = USEPA (1995a) Health Effects Assessment Summary Tables (HEAST).

W = Withdrawn form IRIS or HEAST per FDEP (1997).

E = USEPA National Center for Environmental Assessment (1998).

X = Per Chapter 62-770, F.A.C. (FDEP, 1997), extrapolated from RfDo assuming 70 kg body weight and 20 m3/day inhalation rate

1 = Tables 4a and 4b of Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-770, F.A.C. (FDEP, 1997).

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON SOIL INGESTION
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions			SSTL Equations
Receptor	Construction Worker: RME Scenario		Carcinogenic:
Site-specific target level based on soil ingestion ($SSTL_{ing}$)	chemical-specific	mg/kg [a/]	$SSTL_{ing-c} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_o)(IR_{soil})(EF)(ED)(FI)(CF)}$
Target cancer risk level (TR)	1.00E-06	unitless	
Body Weight (BW)	70	kg	
Averaging Time, Carcinogens (AT_c)	70	yrs	
Oral Slope Factor (SF_o)	chemical-specific	$(mg/kg\text{-}day)^{-1}$ [b/]	
Soil Ingestion Rate (IR_{soil})	480	mg/day	Noncarcinogenic:
Exposure Frequency (EF)	180	days/yr	
Exposure Duration (ED)	1	yr	
Fraction Contaminated Soil Ingested (FI)	1	unitless	$SSTL_{ing-nc} = \frac{(THQ)(BW)(RfD_o)(AT_{nc})(365day/year)}{(IR_{soil})(EF)(ED)(FI)(CF)}$
Conversion Factor (CF)	0.000001	kg/mg	
Target hazard quotient (THQ)	1	unitless	
Oral Reference Dose (RfD_o)	chemical-specific	mg/kg-day	
Averaging Time, Noncarcinogens (AT_{nc})	1	yr	

Contaminant	CAS Number[c/]	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o (mg/kg-day)	$SSTL_{ing-c}$ (mg/kg)	$SSTL_{ing-nc}$ (mg/kg)	$SSTL_{ing}$ (mg/kg)
Volatile Organic Compounds						
Ethylbenzene	100-41-4	-- [d/]	1.00E-01	--	2.96E+04	2.96E+04
Xylenes, total	1330-20-7	--	2.00E+00	--	5.91E+05	5.91E+05

[a/] mg/kg = milligram per kilogram

[b/] mg/kg-day = milligram per kilogram per day

[c/] CAS = Chemical Abstracts Service number.

[d/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON SOIL INGESTION
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - CT SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions			SSTL Equations
Receptor	Construction Worker: CT Scenario		Carcinogenic:
Site-specific target level based on soil ingestion ($SSTL_{ing}$)	chemical-specific	mg/kg [a/]	$SSTL_{ing-c} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_o)(IR_{soil})(EF)(ED)(FI)(CF)}$
Target cancer risk level (TR)	1.00E-06	unitless	
Body Weight (BW)	70	kg	
Averaging Time, Carcinogens (AT_c)	70	yrs	
Oral Slope Factor (SF_o)	chemical-specific	$(mg/kg\text{-}day)^{-1}$ [b/]	
Soil Ingestion Rate (IR_{soil})	200	mg/day	Noncarcinogenic:
Exposure Frequency (EF)	60	days/yr	
Exposure Duration (ED)	1	yr	$SSTL_{ing-nc} = \frac{(THQ)(BW)(RfD_o)(AT_{nc})(365day/year)}{(IR_{soil})(EF)(ED)(FI)(CF)}$
Fraction Contaminated Soil Ingested (FI)	1	unitless	
Conversion Factor (CF)	0.000001	kg/mg	
Target hazard quotient (THQ)	1	unitless	
Oral Reference Dose (RfD_o)	chemical-specific	mg/kg-day	
Averaging Time, Noncarcinogens (AT_{nc})	1	yr	

Contaminant	CAS Number[c/]	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o (mg/kg-day)	$SSTL_{ing-c}$ (mg/kg)	$SSTL_{ing-nc}$ (mg/kg)	$SSTL_{ing}$ (mg/kg)
Volatile Organic Compounds						
Ethylbenzene	100-41-4	-- [d/]	1.00E-01	--	2.13E+05	2.13E+05
Xylenes, total	1330-20-7	--	2.00E+00	--	4.26E+06	4.26E+06

[a/] mg/kg = milligram per kilogram

[b/] mg/kg-day = milligram per kilogram per day

[c/] CAS = Chemical Abstracts Service number.

[d/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON DERMAL CONTACT WITH SOIL
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions			SSTL Equations
Receptor	Construction Worker: RME Scenario		Carcinogenic:
Site-specific target level based on dermal contact with soil ($SSTL_{derm}$)	chemical-specific	mg/kg [a/]	
Target cancer risk level (TR)	1.00E-06	unitless	$SSTL_{derm-c} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_d)(EF)(ED)(SA)(AF)(DAF)(CF)}$
Body Weight (BW)	70	kg	
Averaging Time, Carcinogens (AT_c)	70	yrs	
Dermal Slope Factor (SF_d) (i.e., SF_o adjusted for GI absorption)	chemical-specific	$(mg/kg\text{-}day)^{-1}$ [b/]	where $SF_d = \frac{(SF_o)}{(OAF)}$ and: OAF = Oral GI absorption factor (chemical-specific; unitless)
Exposure Frequency (EF)	180	days/yr	
Exposure Duration (ED)	1	yr	Noncarcinogenic:
Exposed Body Surface Area (SA)	5300	cm^2 [c/]	
Soil-to-Skin Adherence Fraction (AF)	1	mg/cm^2-day	$SSTL_{derm-nc} = \frac{(THQ)(BW)(RfD_d)(AT_{nc})(365day/year)}{(EF)(ED)(SA)(AF)(DAF)(CF)}$
Dermal Soil Absorption Fraction (DAF)	chemical-specific	unitless	
Conversion Factor (CF)	0.000001	kg/mg	
Target hazard quotient (THQ)	1	unitless	
Dermal Reference Dose (RfD_d) (i.e., RfD_o adjusted for GI absorption)	chemical-specific	mg/kg-day	where $RfD_d = (RfD_o)(OAF)$
Averaging Time, Noncarcinogens (AT_{nc})	1	yr	

Contaminant	CAS Number [d/]	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o (mg/kg-day)	OAF (unitless)	SF_d $(mg/kg\text{-}day)^{-1}$	RfD_d (mg/kg-day)	DAF (unitless)	$SSTL_{derm-c}$ (mg/kg)	$SSTL_{derm-nc}$ (mg/kg)	$SSTL_{derm}$ (mg/kg)
Volatile Organic Compounds										
Ethylbenzene	100-41-4	-- [e/]	1.00E-01	8.00E-01	--	8.00E-02	** [f/]	--	--	--
Xylenes, total	1330-20-7	--	2.00E+00	8.95E-01	--	1.79E+00	**	--	--	--

[a/] mg/kg = milligram per kilogram

[b/] mg/kg-day = milligram per kilogram per day

[c/] cm^2 = square centimeter

[d/] CAS = Chemical Abstracts Service number.

[e/] -- = toxicity data not available.

[f/] ** = per USEPA (1992), dermal absorption was assumed to be insignificant for volatile organic compounds

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON DERMAL CONTACT WITH SOIL
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker: CT Scenario	
Site-specific target level based on dermal contact with soil ($SSTL_{derm}$)	chemical-specific	mg/kg [a/]
Target cancer risk level (TR)	1.00E-06	unitless
Body Weight (BW)	70	kg
Averaging Time, Carcinogens (AT_c)	70	yrs
Dermal Slope Factor (SF_d) (i.e., SF_o adjusted for GI absorption)	chemical-specific	(mg/kg-day)$^{-1}$ [b/]
Exposure Frequency (EF)	60	days/yr
Exposure Duration (ED)	1	yr
Exposed Body Surface Area (SA)	3160	cm^2 [c/]
Soil-to-Skin Adherence Fraction (AF)	0.2	mg/cm^2-day
Dermal Soil Absorption Fraction (DAF)	chemical-specific	unitless
Conversion Factor (CF)	0.000001	kg/mg
Target hazard quotient (THQ)	1	unitless
Dermal Reference Dose (RfD_d) (i.e., RfD_o adjusted for GI absorption)	chemical-specific	mg/kg-day
Averaging Time, Noncarcinogens (AT_{nc})	1	yr

SSTL Equations

Carcinogenic:

$$SSTL_{derm-c} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_d)(EF)(ED)(SA)(AF)(DAF)(CF)}$$

where $SF_d = \frac{(SF_o)}{(OAF)}$ and: OAF = Oral GI absorption factor (chemical-specific; unitless)

Noncarcinogenic:

$$SSTL_{derm-nc} = \frac{(THQ)(BW)(RfD_d)(AT_{nc})(365day/year)}{(EF)(ED)(SA)(AF)(DAF)(CF)}$$

where $RfD_d = (RfD_o)(OAF)$

Contaminant	CAS Number [d/]	SF_o (mg/kg-day)$^{-1}$	RfD_o (mg/kg-day)	OAF (unitless)	SF_d (mg/kg-day)$^{-1}$	RfD_d (mg/kg-day)	DAF (unitless)	$SSTL_{derm-c}$ (mg/kg)	$SSTL_{derm-nc}$ (mg/kg)	$SSTL_{derm}$ (mg/kg)
Volatile Organic Compounds										
Ethylbenzene	100-41-4	-- [e/]	1.00E-01	8.00E-01	--	8.00E-02	** [f/]	--	--	--
Xylenes, total	1330-20-7	--	2.00E+00	8.95E-01	--	1.79E+00	**	--	--	--

[a/] mg/kg = milligram per kilogram

[b/] mg/kg-day = milligram per kilogram per day

[c/] cm^2 = square centimeter

[d/] CAS = Chemical Abstracts Service number.

[e/] -- = toxicity data not available.

[f/] ** = per USEPA (1992), dermal absorption was assumed to be insignificant for volatile organic compounds

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INHALATION OF VOLATILES/PARTICULATES FROM SOIL
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker: RME Scenario	
Site-specific target level: inhalation of volatiles/particulates from soil ($SSTL_{inh}$)	chemical-specific	mg/kg [a/]
Target cancer risk level (TR)	1.00E-06	unitless
Averaging Time, Carcinogens (AT_c)	70	yrs
Inhalation unit risk factor (URF)	chemical-specific	$(\mu g/m^3)^{-1}$ [b/]
Exposure Frequency (EF)	180	days/yr
Exposure Duration (ED)	1	yr
Fraction of time breathing contaminated air during a 24 hour day (FT)	1	unitless
Conversion Factor (CF)	1.00E+03	$\mu g/mg$
Soil-to-air volatilization factor (VF)	chemical-specific	m^3/kg
Soil-to-air particulate emission factor (PEF)	1.24E+09	m^3/kg
Target hazard quotient (THQ)	1	unitless
Inhalation reference concentration (RfC)	chemical-specific	$\mu g/m^3$
Averaging Time, Noncarcinogens (AT_{nc})	1	yr

SSTL Equations

Carcinogenic:

$$SSTL_{inh-c} = \frac{(TR)(AT_c)(365\,day/year)}{(URF)(EF)(ED)(FT)(CF)\left(\frac{1}{VF}+\frac{1}{PEF}\right)}$$

Noncarcinogenic:

$$SSTL_{inh-nc} = \frac{(THQ)(RfC)(AT_{nc})(365\,day/year)}{(EF)(ED)(FT)(CF)\left(\frac{1}{VF}+\frac{1}{PEF}\right)}$$

Contaminant	CAS Number [c/]	Chemical Type [d/]	URF $(\mu g/m^3)^{-1}$	RfC $(\mu g/m^3)$	VF (m^3/kg)	$SSTL_{inh-c}$ (mg/kg)	$SSTL_{inh-nc}$ (mg/kg)	$SSTL_{inh}$ (mg/kg)
Volatile Organic Compounds								
Ethylbenzene	100-41-4	o	-- [e/]	1.00E+03	5.43E+03	--	1.10E+04	1.10E+04
Xylenes, total	1330-20-7	o	--	6.30E+03	6.13E+03	--	7.83E+04	7.83E+04

[a/] mg/kg = milligram per kilogram

[b/] $\mu g/m^3$ = micrograms per cubic meter

[c/] CAS = Chemical Abstracts Service number.

[d/] "o" = organic chemical; "i" = inorganic chemical

[e/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INHALATION OF VOLATILES/PARTICULATES FROM SOIL
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - CT SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker: CT Scenario	
Site-specific target level: inhalation of volatiles/particulates from soil ($SSTL_{inh}$)	chemical-specific mg/kg [a/]	
Target cancer risk level (TR)	1.00E-06 unitless	
Averaging Time, Carcinogens (AT_c)	70 yrs	
Inhalation unit risk factor (URF)	chemical-specific $(\mu g/m^3)^{-1}$ [b/]	
Exposure Frequency (EF)	60 days/yr	
Exposure Duration (ED)	1 yr	
Fraction of time breathing contaminated air during a 24 hour day (FT)	1 unitless	
Conversion Factor (CF)	1.00E+03 $\mu g/mg$	
Soil-to-air volatilization factor (VF)	chemical-specific m^3/kg	
Soil-to-air particulate emission factor (PEF)	1.24E+09 m^3/kg	
Target hazard quotient (THQ)	1 unitless	
Inhalation reference concentration (RfC)	chemical-specific $\mu g/m^3$	
Averaging Time, Noncarcinogens (AT_{nc})	1 yr	

SSTL Equations

Carcinogenic:

$$SSTL_{inh-c} = \frac{(TR)(AT_c)(365\,day/year)}{(URF)(EF)(ED)(FT)(CF)\left(\frac{1}{VF}+\frac{1}{PEF}\right)}$$

Noncarcinogenic:

$$SSTL_{inh-nc} = \frac{(THQ)(RfC)(AT_{nc})(365\,day/year)}{(EF)(ED)(FT)(CF)\left(\frac{1}{VF}+\frac{1}{PEF}\right)}$$

Contaminant	CAS Number[c/]	Chemical Type [d/]	URF $(\mu g/m^3)^{-1}$	RfC $(\mu g/m^3)$	VF (m^3/kg)	$SSTL_{inh-c}$ (mg/kg)	$SSTL_{inh-nc}$ (mg/kg)	$SSTL_{inh}$ (mg/kg)
Volatile Organic Compounds								
Ethylbenzene	100-41-4	o	--	1.00E+03	5.43E+03	--	3.31E+04	3.31E+04
Xylenes, total	1330-20-7	o	--	6.30E+03	6.13E+03	--	2.35E+05	2.35E+05

[a/] mg/kg = milligram per kilogram

[b/] $\mu g/m^3$ = micrograms per cubic meter

[c/] CAS = Chemical Abstracts Service number.

[d/] "o" = organic chemical; "i" = inorganic chemical

[e/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INCIDENTAL INGESTION OF GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions			SSTL Equations
Receptor	Construction Worker: RME Scenario		Carcinogenic:
Site-specific target level based on incidental ingestion of groundwater ($SSTL_{ing}$)	chemical-specific	µg/L [a/]	$SSTL_{ing-c} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_o)(IR_w)(EF)(ED)(ET)(CF)}$
Target cancer risk level (TR)	1.00E-06	unitless	
Body Weight (BW)	70	kg	
Averaging Time, Carcinogens (AT_c)	70	yrs	
Oral Slope Factor (SF_o)	chemical-specific	$(mg/kg\text{-}day)^{-1}$ [b/]	
Water Ingestion Rate (IR_w)	0.005	L/hr	Noncarcinogenic:
Exposure Frequency (EF)	46	days/yr	
Exposure Duration (ED)	1	yr	
Exposure Time (ET)	2	hr/day	$SSTL_{ing-nc} = \frac{(THQ)(BW)(RfD_o)(AT_{nc})(365day/year)}{(IR_w)(EF)(ED)(ET)(CF)}$
Conversion Factor (CF)	0.001	mg/µg	
Target hazard quotient (THQ)	1	unitless	
Oral Reference Dose (RfD_o)	chemical-specific	mg/kg-day	
Averaging Time, Noncarcinogens (AT_{nc})	1	yr	

Contaminant	CAS Number [c/]	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o (mg/kg-day)	$SSTL_{ing-c}$ (µg/L)	$SSTL_{ing-nc}$ (µg/L)	$SSTL_{ing}$ (µg/L)
Volatile Organic Compounds						
Benzene	71-43-2	2.90E-02	3.00E-03	1.34E+05	1.67E+05	1.34E+05
Ethylbenzene	100-41-4	-- [d/]	1.00E-01	--	5.55E+06	5.55E+06
Toluene	108-88-3	--	2.00E-01	--	1.11E+07	1.11E+07
Xylenes, total	1330-20-7	--	2.00E+00	--	1.11E+08	1.11E+08
Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3	--	4.00E-02	--	2.22E+06	2.22E+06
Metals						
Lead	7439-92-1	--	--	--	--	--

[a/] µg/L = microgram per liter

[b/] mg/kg-day = milligram per kilogram-day

[c/] CAS = Chemical Abstracts Service number.

[d/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INCIDENTAL INGESTION OF GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - CT SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker: CT Scenario	
Site-specific target level based on incidental ingestion of groundwater ($SSTL_{ing}$)	chemical-specific	µg/L [a/]
Target cancer risk level (TR)	1.00E-06	unitless
Body Weight (BW)	70	kg
Averaging Time, Carcinogens (AT_c)	70	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/kg\text{-}day)^{-1}$ [b/]
Water Ingestion Rate (IR_w)	0.0025	L/hr
Exposure Frequency (EF)	15	days/yr
Exposure Duration (ED)	1	yr
Exposure Time (ET)	1	hr/day
Conversion Factor (CF)	0.001	mg/µg
Target hazard quotient (THQ)	1	unitless
Oral Reference Dose (RfD_o)	chemical-specific	mg/kg-day
Averaging Time, Noncarcinogens (AT_{nc})	1	yr

SSTL Equations

Carcinogenic:

$$SSTL_{ing-c} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_o)(IR_w)(EF)(ED)(ET)(CF)}$$

Noncarcinogenic:

$$SSTL_{ing-nc} = \frac{(THQ)(BW)(RfD_o)(AT_{nc})(365day/year)}{(IR_w)(EF)(ED)(ET)(CF)}$$

Contaminant	CAS Number[c/]	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o (mg/kg-day)	$SSTL_{ing-c}$ (µg/L)	$SSTL_{ing-nc}$ (µg/L)	$SSTL_{ing}$ (µg/L)
Volatile Organic Compounds						
Benzene	71-43-2	2.90E-02	3.00E-03	1.64E+06	2.04E+06	1.64E+06
Ethylbenzene	100-41-4	-- [d/]	1.00E-01	--	6.81E+07	6.81E+07
Toluene	108-88-3	--	2.00E-01	--	1.36E+08	1.36E+08
Xylenes, total	1330-20-7	--	2.00E+00	--	1.36E+09	1.36E+09
Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3	--	4.00E-02	--	2.73E+07	2.73E+07
Metals						
Lead	7439-92-1	--	--	--	--	--

[a/] µg/L = microgram per liter

[b/] mg/kg-day = milligram per kilogram-day

[c/] CAS = Chemical Abstracts Service number.

[d/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON DERMAL CONTACT WITH GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Input Parameters			SSTL Equations
Receptor	Construction Worker: RME Scenario		For inorganics:
Site-specific target level based on dermal contact with groundwater ($SSTL_{derm}$)	chemical-specific	µg/L [a/]	$SSTL_{derm-inorg} = \frac{(DA_{event})(CF)}{(K_p)(t_{event})}$
Dose absorbed per unit area per event (DA_{event})	chemical-specific	mg/cm²-event [b/]	
Conversion Factor (CF)	1.00E+06	(ml/L) x (µg/mg) [c/]	
Permeability coefficient from water (K_p)	Chemical-specific	cm/hr [d/]	For organics:
Duration of event (t_{event})	2	hr/event [e/]	If $t_{event} < t^*$, then:
Time it takes to reach steady state (t^*)	Chemical-specific	hr/event	$SSTL_{derm-org} = \frac{(DA_{event})(CF)}{2K_p\sqrt{\frac{6\tau_{event}t_{event}}{\pi}}}$
Lag time per event (τ_{event})	Chemical-specific	hr/event	
Relative contribution of permeability coefficients in stratetum corneum and viable epidermis (B)	Chemical-specific	unitless	If $t_{event} > t^*$, then:

$$SSTL_{derm-org} = \frac{(DA_{event})(CF)}{K_p\left[\frac{t_{event}}{1+B} + 2\tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]}$$

Contaminant	Type [f/]	K_p (cm/hr)	t^* (hr/event)	τ_{event} (hr/event)	B (unitless)	DA_{event} (mg/cm²-event)	$SSTL_{derm-c}$ (µg/L)	$SSTLd_{derm-nc}$ (µg/L)	$SSTL_{derm}$ (µg/L)
Volatile Organic Compounds									
Benzene	o	2.10E-02	6.30E-01	2.60E-01	1.30E-02	2.28E-04		5.44E+03	5.44E+03
Ethylbenzene	o	7.40E-02	1.30E+00	3.90E-01	1.40E-01	8.38E-03		4.64E+04	4.64E+04
Toluene	o	4.50E-02	7.70E-01	3.20E-01	5.40E-02	1.68E-02		1.45E+05	1.45E+05
Xylenes, total	o	8.00E-02	1.40E+00	3.90E-01	1.60E-01	1.88E-01		8.93E+05	8.93E+05
Polynuclear Aromatic Hydrocarbons									
Naphthalene	o	6.90E-02	2.20E+00	5.30E-01	2.00E-01	4.19E-03		2.13E+04	2.13E+04
Metals									
Lead	i	1.00E-04	--	--	--	--			--

[a/] µg/L = micrograms per liter
[b/] mg/cm²-event = milligrams per centimeter-event
[c/] (ml/L) x (µg/mg) = milliliter per liter times microgram per milligram
[d/] cm/hr = centimeters per hour
[e/] hr/event = hours per event
[f/] "o" indicates an organic compound, "i" indicates an inorganic compound
[d/] -- = toxicity data not available.

DA_{event} CALCULATIONS FOR DERMAL CONTACT WITH GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker: RME Scenario	
Dose absorbed per unit area per event (DA_{event})	chemical-specific	mg/cm^2-event [a/]
Target cancer risk level (TR)	1.00E-06	unitless
Body Weight (BW)	70	kg
Averaging Time, Carcinogens (AT_c)	70	yrs
Dermal Slope Factor (SF_d) (i.e., SF_o adjusted for GI absorption)	chemical-specific	(mg/kg-day)$^{-1}$ [b/]
Exposure Frequency (EF)	46	days/yr [c/]
Exposure Duration (ED)	1	yr
Event Frequency (EV)	1	events/day
Fraction of Estimated Time in Contact with Water (EC)	1	unitless
Exposed Body Surface Area (SA)	5300	cm^2
Target hazard quotient (THQ)	1	unitless
Dermal Reference Dose (RfD_d) (i.e., RfD_o adjusted for GI absorption)	chemical-specific	mg/kg-day
Averaging Time, Noncarcinogens (AT_{nc})	1	yr

SSTL Equations

Carcinogenic:

$$DAevent_{carc} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_d)(EF)(ED)(EV)(EC)(SA)}$$

where $SF_d = \frac{(SF_o)}{(OAF)}$ and: OAF = Oral GI absorption factor (chemical-specific; unitless)

Noncarcinogenic:

$$DAevent_{nc} = \frac{(THQ)(BW)(RfD_d)(AT_{nc})(365day/year)}{(EF)(ED)(EV)(EC)(SA)}$$

where $RfD_d = (RfD_o)(OAF)$

Contaminant	CAS Number [d/]	SF_o (mg/kg-day)$^{-1}$	RfD_o (mg/kg-day)	OAF (unitless)	SF_d (mg/kg-day)$^{-1}$	RfD_d (mg/kg-day)	$DAevent_{carc}$ (mg/cm^2-event)	$DAevent_{nc}$ (mg/cm^2-event)	DAevent (mg/cm^2-event)
Volatile Organic Compounds									
Benzene	71-43-2	2.90E-02	3.00E-03	9.00E-01	3.22E-02	2.70E-03	2.28E-04	2.83E-04	2.28E-04
Ethylbenzene	100-41-4	-- [e/]	1.00E-01	8.00E-01	--	8.00E-02	--	8.38E-03	8.38E-03
Toluene	108-88-3	--	2.00E-01	8.00E-01	--	1.60E-01	--	1.68E-02	1.68E-02
Xylenes, total	1330-20-7	--	2.00E+00	8.95E-01	--	1.79E+00	--	1.88E-01	1.88E-01
Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	--	4.00E-02	1.00E+00	--	4.00E-02	--	4.19E-03	4.19E-03
Metals									
Lead	7439-92-1	--	--	--	--	--	--	--	--

[a/] mg/cm^2 = milligram per square centimeter.

[b/] mg/kg-day = milligram per kilogram-day

[c/] days/yr = days per year

[d/] CAS = Chemical Abstracts Service number.

[e/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON DERMAL CONTACT WITH GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - CT SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Input Parameters			SSTL Equations
Receptor	Construction Worker: CT Scenario		For inorganics:
Site-specific target level based on dermal contact with groundwater ($SSTL_{derm}$)	chemical-specific	µg/L [a/]	$SSTL_{derm-inorg} = \frac{(DA_{event})(CF)}{(K_p)(t_{event})}$
Dose absorbed per unit area per event (DA_{event})	chemical-specific	mg/cm²-event [b/]	
Conversion Factor (CF)	1.00E+06	(ml/L) x (µg/mg) [c/]	
Permeability coefficient from water (K_p)	Chemical-specific	cm/hr [d/]	For organics:
Duration of event (t_{event})	1	hr/event [e/]	If $t_{event} < t^*$, then:
Time it takes to reach steady state (t*)	Chemical-specific	hr/event	
Lag time per event (τ_{event})	Chemical-specific	hr/event	$SSTL_{derm-org} = \frac{(DA_{event})(CF)}{2K_p\sqrt{\frac{6\tau_{event}t_{event}}{\pi}}}$
Relative contribution of permeability coefficients in strateium corneum and viable epidermis (B)	Chemical-specific	unitless	If $t_{event} > t^*$, then:

$$SSTL_{derm-org} = \frac{(DA_{event})(CF)}{K_p\left[\frac{t_{event}}{1+B} + 2\tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]}$$

Contaminant	Type [f/]	K_p (cm/hr)	t* (hr/event)	τ_{event} (hr/event)	B (unitless)	DA_{event} (mg/cm²-event)	$SSTL_{derm-c}$ (µg/L)	$SSTLd_{derm-nc}$ (µg/L)	$SSTL_{derm}$ (µg/L)
Volatile Organic Compounds									
Benzene	o	2.10E-02	6.30E-01	2.60E-01	1.30E-02	1.27E-03		4.30E+04	4.30E+04
Ethylbenzene	o	7.40E-02	1.30E+00	3.90E-01	1.40E-01	4.68E-02		3.67E+05	3.67E+05
Toluene	o	4.50E-02	7.70E-01	3.20E-01	5.40E-02	9.37E-02		1.28E+06	1.28E+06
Xylenes, total	o	8.00E-02	1.40E+00	3.90E-01	1.60E-01	1.05E+00		7.42E+06	7.42E+06
Polynuclear Aromatic Hydrocarbons									
Naphthalene	o	6.90E-02	2.20E+00	5.30E-01	2.00E-01	2.34E-02		1.69E+05	1.69E+05
Metals									
Lead	i	1.00E-04	--	--	--	--			--

[a/] µg/L = micrograms per liter
[b/] mg/cm²-event = milligrams per centimeter-event
[c/] (ml/L) x (µg/mg) = milliliter per liter times microgram per milligram
[d/] cm/hr = centimeters per hour
[e/] hr/event = hours per event
[f/] "o" indicates an organic compound, "i" indicates an inorganic compound
[d/] -- = toxicity data not available.

DA_{event} CALCULATIONS FOR DERMAL CONTACT WITH GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - CT SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker: CT Scenario	
Dose absorbed per unit area per event (DA_{event})	chemical-specific	mg/cm^2-event [a/]
Target cancer risk level (TR)	1.00E-06	unitless
Body Weight (BW)	70	kg
Averaging Time, Carcinogens (AT_c)	70	yrs
Dermal Slope Factor (SF_d) (i.e., SF_o adjusted for GI absorption)	chemical-specific	(mg/kg-day)$^{-1}$ [b/]
Exposure Frequency (EF)	15	days/yr [c/]
Exposure Duration (ED)	1	yr
Event Frequency (EV)	1	events/day
Fraction of Estimated Time in Contact with Water (EC)	1	unitless
Exposed Body Surface Area (SA)	2910	cm^2
Target hazard quotient (THQ)	1	unitless
Dermal Reference Dose (RfD_d) (i.e., RfD_o adjusted for GI absorption)	chemical-specific	mg/kg-day
Averaging Time, Noncarcinogens (AT_{nc})	1	yr

SSTL Equations

Carcinogenic:

$$DAevent_{carc} = \frac{(TR)(BW)(AT_c)(365day/year)}{(SF_d)(EF)(ED)(EV)(EC)(SA)}$$

where $SF_d = \frac{(SF_o)}{(OAF)}$ and: OAF = Oral GI absorption factor (chemical-specific; unitless)

Noncarcinogenic:

$$DAevent_{nc} = \frac{(THQ)(BW)(RfD_d)(AT_{nc})(365day/year)}{(EF)(ED)(EV)(EC)(SA)}$$

where $RfD_d = (RfD_o)(OAF)$

Contaminant	CAS Number [d/]	SF_o (mg/kg-day)$^{-1}$	RfD_o (mg/kg-day)	OAF (unitless)	SF_d (mg/kg-day)$^{-1}$	RfD_d (mg/kg-day)	$DAevent_{carc}$ (mg/cm^2-event)	$DAevent_{nc}$ (mg/cm^2-event)	DAevent (mg/cm^2-event)
Volatile Organic Compounds									
Benzene	71-43-2	2.90E-02	3.00E-03	9.00E-01	3.22E-02	2.70E-03	1.27E-03	1.58E-03	1.27E-03
Ethylbenzene	100-41-4	-- [e/]	1.00E-01	8.00E-01	--	8.00E-02	--	4.68E-02	4.68E-02
Toluene	108-88-3	--	2.00E-01	8.00E-01	--	1.60E-01	--	9.37E-02	9.37E-02
Xylenes, total	1330-20-7	--	2.00E+00	8.95E-01	--	1.79E+00	--	1.05E+00	1.05E+00
Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	--	4.00E-02	1.00E+00	--	4.00E-02	--	2.34E-02	2.34E-02
Metals									
Lead	7439-92-1	--	--	--	--	--	--	--	--

[a/] mg/cm^2 = milligram per square centimeter.

[b/] mg/kg-day = milligram per kilogram-day

[c/] days/yr = days per year

[d/] CAS = Chemical Abstracts Service number.

[e/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INHALATION OF VOLATILES FROM GROUNDWATER: ABOVEGROUND
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions			SSTL Equations
Receptor	Construction Worker: RME Scenario		Carcinogenic:
Site-specific target level: aboveground inhalation of volatiles from groundwater ($SSTL_{inh}$)	chemical-specific	$\mu g/L$ [a/]	
Target cancer risk level (TR)	1.00E-06	unitless	$SSTL_{inh-c} = \frac{(TR)(AT_c)(365day/year)}{(URF)(EF)(ED)(FT)(VF_{wamb})}$
Averaging Time, Carcinogens (AT_c)	70	yrs	
Inhalation unit risk factor (URF)	chemical-specific	$(\mu g/m^3)^{-1}$ [b/]	
Exposure Frequency (EF) (180 - 46 days/year = 134 days/year aboveground)	134	days/yr	
Exposure Duration (ED)	1	yr	
Fraction of time breathing aboveground contaminated air during a 24 hour day (FT) (8 hr/24 hr)	0.3	unitless	Noncarcinogenic:
Cross-media groundwater-to-ambient (outdoor) air volatilization factor (VF_{wamb})	chemical-specific	$(mg/m^3\text{-air})/(mg/L\text{-water})$ [c/]	
Target hazard quotient (THQ)	1	unitless	
Inhalation reference concentration (RfC)	chemical-specific	$\mu g/m^3$	$SSTL_{inh-nc} = \frac{(THQ)(RfC)(AT_{nc})(365day/year)}{(EF)(ED)(FT)(VF_{wamb})}$
Averaging Time, Noncarcinogens (AT_{nc})	1	yr	

Contaminant	CAS Number [d/]	Chemical Type [e/]	URF $(\mu g/m^3)^{-1}$ [d/]	RfC $(\mu g/m^3)$	VF_{wamb}	$SSTL_{inh-c}$ $(\mu g/L)$	$SSTL_{inh-nc}$ $(\mu g/L)$	$SSTL_{inh}$ $(\mu g/L)$
Volatile Organic Compounds								
Benzene	71-43-2	o	7.80E-06	5.95E+00	8.93E-05	8.21E+05	5.44E+05	5.44E+05
Ethylbenzene	100-41-4	o	-- [f/]	1.00E+03	9.33E-05	--	8.76E+07	8.76E+07
Toluene	108-88-3	o	--	4.00E+02	9.47E-05	--	3.45E+07	3.45E+07
Xylenes, total	1330-20-7	o	--	6.30E+03	8.58E-05	--	6.00E+08	6.00E+08
Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	o	--	3.00E+00	2.28E-05	--	1.07E+06	1.07E+06
Metals								
Lead	7439-92-1	i	--	--	--	--	--	--

[a/] $\mu g/L$ = microgram per liter

[b/] $\mu g/m^3$ = microgram per cubic meter

[c/] $(mg/m^3\text{-air})/(mg/L\text{-water})$ = (milligram per cubic meter air) per (milligram per liter water)

[d/] CAS = Chemical Abstracts Service number.

[e/] "o" = organic; "i" = inorganic

[f/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INHALATION OF VOLATILES FROM GROUNDWATER: ABOVEGROUND
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		
Receptor	Construction Worker: RME Scenario	
Site-specific target level: aboveground inhalation of volatiles from groundwater ($SSTL_{inh}$)	chemical-specific $\mu g/L$ [a/]	
Target cancer risk level (TR)	1.00E-06 unitless	
Averaging Time, Carcinogens (AT_c)	70 yrs	
Inhalation unit risk factor (URF)	chemical-specific $(\mu g/m^3)^{-1}$ [b/]	
Exposure Frequency (EF) (60 - 15 days/year = 45 days/year aboveground)	45 days/yr	
Exposure Duration (ED)	1 yr	
Fraction of time breathing aboveground contaminated air during a 24 hour day (FT) (8 hr/24 hr)	0.3 unitless	
Cross-media groundwater-to-ambient (outdoor) air volatilization factor (VF_{wamb})	chemical-specific $(mg/m^3\text{-air})/(mg/L\text{-water})$ [c/]	
Target hazard quotient (THQ)	1 unitless	
Inhalation reference concentration (RfC)	chemical-specific $\mu g/m^3$	
Averaging Time, Noncarcinogens (AT_{nc})	1 yr	

SSTL Equations

Carcinogenic:

$$SSTL_{inh-c} = \frac{(TR)(AT_c)(365day/year)}{(URF)(EF)(ED)(FT)(VF_{wamb})}$$

Noncarcinogenic:

$$SSTL_{inh-nc} = \frac{(THQ)(RfC)(AT_{nc})(365day/year)}{(EF)(ED)(FT)(VF_{wamb})}$$

Contaminant	CAS Number [d/]	Chemical Type [e/]	URF $(\mu g/m^3)^{-1}$ [d/]	RfC $(\mu g/m^3)$	VF_{wamb}	$SSTL_{inh-c}$ $(\mu g/L)$	$SSTL_{inh-nc}$ $(\mu g/L)$	$SSTL_{inh}$ $(\mu g/L)$
Volatile Organic Compounds								
Benzene	71-43-2	o	7.80E-06	5.95E+00	8.93E-05	2.45E+06	1.62E+06	1.62E+06
Ethylbenzene	100-41-4	o	-- [f/]	1.00E+03	9.33E-05	--	2.61E+08	2.61E+08
Toluene	108-88-3	o	--	4.00E+02	9.47E-05	--	1.03E+08	1.03E+08
Xylenes, total	1330-20-7	o	--	6.30E+03	8.58E-05	--	1.79E+09	1.79E+09
Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	o	--	3.00E+00	2.28E-05	--	3.20E+06	3.20E+06
Metals								
Lead	7439-92-1	i	--	--	--	--	--	--

[a/] $\mu g/L$ = microgram per liter

[b/] $\mu g/m^3$ = microgram per cubic meter

[c/] $(mg/m^3\text{-air})/(mg/L\text{-water})$ = (milligram per cubic meter air) per (milligram per liter water)

[d/] CAS = Chemical Abstracts Service number.

[e/] "o" = organic; "i" = inorganic

[f/] -- = toxicity data not available.

CROSS-MEDIA GROUNDWATER-TO-AMBIENT (OUTDOOR) AIR VOLATILIZATION FACTOR
SITE SS-15A
SEVENTH STREET SERVICE STATION

EGLIN AFB, FLORIDA

Equations		Input Parameter Definition	Input Parameters
Cross-Media Groundwater-to-Ambient (Outdoor) Air Volatilization Factor	VF_{wamb}	Cross-media groundwater-to-ambient (outdoor) air volatilization factor (mg/m^3-air)/(mg/L-water) [a/]	Calculated
$VF_{wamb} = \frac{H}{1+\left[\frac{U_{air}\delta_{air}L_{GW}}{WD^{eff}_{ws}}\right]} x10^3 \frac{L}{m^3}$	H	Henry's law constant (cm^3-water)/(cm^3-air) [b/]	Chemical-specific
	U_{air}	Wind speed above ground surface in ambient mixing zone (cm/s) [c/]	447
	δ_{air}	Ambient air mixing zone height (cm) [d/]	200
Effective Diffusion Coefficient Between Ground Water and Soil Surface	L_{GW}	Depth to ground water = $h_{cap} + h_v$ (cm)	152
	W	Width of source area parallel to wind, or ground water flow direction (cm)	6000
$D^{eff}_{ws} = (h_{cap} + h_v)\left[\frac{h_{cap}}{D^{eff}_{cap}} + \frac{h_v}{D^{eff}_{s}}\right]^{-1}$	D^{eff}_{ws}	Effective diffusion coefficient between ground water and soil surface (cm^2/s) [e/]	Calculated
	h_{cap}	Thickness of capillary fringe (cm)	5
	h_v	Thickness of vadose zone (cm)	147
Effective Diffusion Through Capillary Fringe	D^{eff}_{cap}	Effective diffusion coefficient through capillary fringe (cm^2/s)	Calculated
$D^{eff}_{cap} = D^{air}\frac{\theta^{3.33}_{acap}}{\theta^2_T} + D^{wat}\frac{1}{H}\frac{\theta^{3.33}_{wcap}}{\theta^2_T}$	D^{eff}_{s}	Effective diffusion coefficient in soil based on vapor-phase concentration (cm^2/s)	Calculated
	D^{air}	Diffusion coefficient in air (cm^2/s)	Chemical-specific
	θ_{acap}	Volumetric air content in capillary fringe soils (cm^3-air/cm^3 total volume) [f/]	0.038
Effective Diffusion Coefficient in Soil Based on Vapor-Phase Concentration	θ_T	Total soil porosity (cm^3/cm^3-soil) [g/]	0.3
	θ_{wcap}	Volumetric water content in capillary fringe soils (cm^3-water/cm^3-soil) [h/]	0.342
$D^{eff}_{s} = D^{air}\frac{\theta^{3.33}_{as}}{\theta^2_T} + D^{wat}\frac{1}{H}\frac{\theta^{3.33}_{ws}}{\theta^2_T}$	D^{wat}	Diffusion coefficient in water (cm^2/s)	Chemical-specific
	θ_{as}	Volumetric air content in vadose zone soils (cm^3-air/cm^3-soil)	0.26
	θ_{ws}	Volumetric water content in vadose zone soils (cm^3-water/cm^3-soil)	0.12

Contaminant	H (cm^3-water)/(cm^3-air)	D^{air} (cm^2/s)	D^{wat} (cm^2/s)	D^{eff}_{s} (cm^2/s)	D^{eff}_{cap} (cm^2/s)	D^{eff}_{ws} (cm^2/s)	VF_{wamb}
Volatile Organic Compounds							
Benzene	2.28E-01	8.80E-02	9.80E-06	1.10E-02	3.16E-05	8.87E-04	8.93E-05
Ethylbenzene	3.23E-01	7.50E-02	7.80E-06	9.39E-03	2.31E-05	6.54E-04	9.33E-05
Toluene	2.72E-01	8.70E-02	8.60E-06	1.09E-02	2.79E-05	7.89E-04	9.47E-05
Xylenes, total	2.13E-01	8.70E-02	1.00E-05	1.09E-02	3.27E-05	9.13E-04	8.58E-05
Polynuclear Aromatic Hydrocarbons							
Naphthalene	1.98E-02	5.90E-02	7.50E-06	7.39E-03	1.30E-04	2.61E-03	2.28E-05
Metals [i/]							
Lead	0.00E+00	-- [i/]	--	--	--	--	--

[a/] (mg/m^3-air)/(mg/L-water) = milligrams per cubic meter of air per milligrams per liter of water
[b/] (cm^3-water)/(cm^3-air) = cubic centimeters of water per cubic centimeters of air
[c/] cm/s = centimeters per second
[d/] cm = centimeter
[e/] cm^2/s = square centimeters per second
[f/] cm^3-air/cm^3-total volume = cubic centimeters air per cubic centimeters total volume
[g/] cm^3/cm^3-soil = cubic centimeters per cubic centimeters-soil
[h/] cm^3-water/cm^3-soil = cubic centimeters water per cubic centimeters soil
[i/] -- = Parameters not necessary given that inhalation toxicity data were not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INHALATION OF VOLATILES IN TRENCH FROM GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Input Parameters			SSTL Equations
Receptor	Construction Worker: RME Scenario		
Site-specific target level: inhalation of volatiles in trench from groundwater ($SSTL_{inhal-trench}$)	chemical-specific	µg/L [a/]	$SSTL_{inhal-trench} = \frac{(C_{air})(LS)(V)(MH)}{(K)(A)(CF)}$
Air concentration at target risk/hazard levels (C_{air})	chemical-specific	µg/m^3 [b/]	
Length of side perpendicular to wind (LS)	15	m [c/]	
Average wind speed (V)	4.47	m/s [d/]	where:
Mixing height above water (MH)	2	m	
Mass transfer coefficient (K)	Chemical-specific	cm/s [e/]	$K = \left[\frac{1}{K_l} + \frac{(8.2E-05\ atm \cdot m^3/mol \cdot °K)(298°K)}{(H)(K_g)}\right]^{-1}$
Area of the trench (A)	3.00E+05	cm^2	
Liquid mass transfer coefficient (K_l)	Chemical-specific	cm/s	and:
Henry's Law Constant (H)	Chemical-specific	atm-m^3/mol [f/]	
Gas mass transfer coefficient (K_g)	Chemical-specific	cm/s	$K_l = \left(\frac{32g/mol}{MW}\right)^{0.5}(0.0061cm/s)$
Molecular weight (MW)	Chemical-specific	g/mol	
Conversion Factor (CF)	0.001	L/cm^3	$K_g = \left(\frac{18g/mol}{MW}\right)^{0.335}(1.39cm/s)$

Contaminant	H (atm-m^3/mol)	MW (g/mol)	K_l (cm/s)	K_g (cm/s)	K (cm/s)	C_{air} (µg/m^3)	$SSTL_{inhal-trench}$ (µg/L)
Volatile Organic Compounds							
Benzene	5.56E-03	78.11	3.90E-03	8.50E-01	3.83E-03	2.83E+02	3.31E+04
Ethylbenzene	7.88E-03	106.16	3.35E-03	7.67E-01	3.30E-03	4.76E+04	6.44E+06
Toluene	6.63E-03	92.13	3.60E-03	8.04E-01	3.54E-03	1.90E+04	2.41E+06
Xylenes, total	5.20E-03	106.16	3.35E-03	7.67E-01	3.28E-03	3.00E+05	4.09E+07
Polynuclear Aromatic Hydrocarbons							
Naphthalene	4.83E-04	128.16	3.05E-03	7.20E-01	2.51E-03	1.43E+02	2.54E+04
Metals							
Lead	0.00E+00	-- [h/]	--	--	--	--	--

[a/] µg/L = microgram per liter

[b/] µg/m^3 = microgram per cubic meter

[c/] m = meter

[d/] m/s = meter per second

[e/] Preliminary COPC = preliminary chemical of potential concern after site-attribution analysis and essential-nutrient screening (Table 17.3.2.2-1).

[f/] cm/s = centimeter per second

[g/] atm/m^3-mol = atmospher per cubic meter per mole

[h/] -- = not calculated given the lack of toxicity data

C_{air} CALCULATIONS BASED ON INHALATION OF VOLATILES FROM GROUNDWATER: TRENCH
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - RME SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		C_{air} Equations
Receptor	Construction Worker: RME Scenario	Carcinogenic:
Air concentration at target risk/hazard levels (C_{air})	chemical-specific $\mu g/m^3$ [a/]	
Target cancer risk level (TR)	1.00E-06 unitless	$C_{air-c} = \frac{(TR)(AT_c)(365\ day\ /\ year)}{(URF)(EF)(ED)(FT)}$
Averaging Time, Carcinogens (AT_c)	70 yrs	
Inhalation unit risk factor (URF)	chemical-specific $(\mu g/m^3)^{-1}$	
Exposure Frequency (EF)	46 days/yr	
Exposure Duration (ED)	1 yr	
Fraction of time breathing aboveground contaminated air during a 24 hour day (FT) (assumed 1/2 of work day in trench: 4 hr/24 hr)	0.2 unitless	Noncarcinogenic:
Target hazard quotient (THQ)	1 unitless	
Inhalation reference concentration (RfC)	chemical-specific $\mu g/m^3$	
Averaging Time, Noncarcinogens (AT_{nc})	1 yr	$C_{air-nc} = \frac{(THQ)(RfC)(AT_{nc})(365day\ /\ year)}{(EF)(ED)(FT)}$

Contaminant	CAS Number [b/]	Chemical Type [c/]	URF $(\mu g/m^3)^{-1}$ [d/]	RfC $(\mu g/m^3)$	C_{air-c} $(\mu g/m^3)$	C_{air-nc} $(\mu g/m^3)$	C_{air} $(\mu g/m^3)$
Volatile Organic Compounds							
Benzene	71-43-2	o	7.80E-06	5.95E+00	4.27E+02	2.83E+02	2.83E+02
Ethylbenzene	100-41-4	o	-- [e/]	1.00E+03	--	4.76E+04	4.76E+04
Toluene	108-88-3	o	--	4.00E+02	--	1.90E+04	1.90E+04
Xylenes, total	1330-20-7	o	--	6.30E+03	--	3.00E+05	3.00E+05
Polynuclear Aromatic Hydrocarbons							
Naphthalene	91-20-3	o	--	3.00E+00	--	1.43E+02	1.43E+02
Metals							
Lead	7439-92-1	i	--	--	--	--	--

[a/] $\mu g/m^3$ = microgram per cubic meter

[b/] CAS = Chemical Abstracts Service number.

[c/] "o" = organic; "i" = inorganic

[d/] -- = toxicity data not available.

SITE-SPECIFIC TARGET LEVEL CALCULATIONS BASED ON INHALATION OF VOLATILES IN TRENCH FROM GROUNDWATER
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - CT SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Input Parameters			SSTL Equations
Receptor	Construction Worker: CT Scenario		
Site-specific target level: inhalation of volatiles in trench from groundwater ($SSTL_{inhal-trench}$)	chemical-specific	µg/L [a/]	$SSTL_{inhal-trench} = \frac{(C_{air})(LS)(V)(MH)}{(K)(A)(CF)}$
Air concentration at target risk/hazard levels (C_{air})	chemical-specific	µg/m^3 [b/]	
Length of side perpendicular to wind (LS)	15	m [c/]	
Average wind speed (V)	4.47	m/s [d/]	where:
Mixing height above water (MH)	2	m	$K = \left[\frac{1}{K_l} + \frac{(8.2E-05\ atm \cdot m^3/mol \cdot °K)(298°K)}{(H)(K_g)}\right]^{-1}$
Mass transfer coefficient (K)	Chemical-specific	cm/s [e/]	
Area of the trench (A)	3.00E+05	cm^2	
Liquid mass transfer coefficient (K_l)	Chemical-specific	cm/s	and:
Henry's Law Constant (H)	Chemical-specific	atm-m^3/mol [f/]	$K_l = \left(\frac{32g/mol}{MW}\right)^{0.5}(0.0061cm/s)$
Gas mass transfer coefficient (K_g)	Chemical-specific	cm/s	
Molecular weight (MW)	Chemical-specific	g/mol	$K_g = \left(\frac{18g/mol}{MW}\right)^{0.335}(1.39cm/s)$
Conversion factor (CF)	0.001	L/cm^3	

Contaminant	H (atm-m^3/mol)	MW (g/mol)	K_l (cm/s)	K_g (cm/s)	K (cm/s)	C_{air} (µg/m^3)	$SSTL_{inhal-trench}$ (µg/L)
Volatile Organic Compounds							
Benzene	5.56E-03	78.11	3.90E-03	8.50E-01	3.83E-03	8.69E+02	1.01E+05
Ethylbenzene	7.88E-03	106.16	3.35E-03	7.67E-01	3.30E-03	1.46E+05	1.98E+07
Toluene	6.63E-03	92.13	3.60E-03	8.04E-01	3.54E-03	5.84E+04	7.38E+06
Xylenes, total	5.20E-03	106.16	3.35E-03	7.67E-01	3.28E-03	9.20E+05	1.25E+08
Polynuclear Aromatic Hydrocarbons							
Naphthalene	4.83E-04	128.16	3.05E-03	7.20E-01	2.51E-03	4.38E+02	7.80E+04
Metals							
Lead	0.00E+00	-- [h/]	--	--	--	--	--

[a/] µg/L = microgram per liter

[b/] µg/m^3 = microgram per cubic meter

[c/] m = meter

[d/] m/s = meter per second

[e/] Preliminary COPC = preliminary chemical of potential concern after site-attribution analysis and essential-nutrient screening (Table 17.3.2.2-1).

[f/] cm/s = centimeter per second

[g/] atm/m^3-mol = atmospher per cubic meter per mole

[h/] -- = not calculated given the lack of toxicity data

C_{air} CALCULATIONS BASED ON INHALATION OF VOLATILES FROM GROUNDWATER: TRENCH
INDUSTRIAL LAND USE - CONSTRUCTION SCENARIO - CT SCENARIO
SEVENTH STREET SERVICE STATION
EGLIN AFB, FLORIDA

Exposure Assumptions		C_{air} Equations
Receptor	Construction Worker: CT Scenario	Carcinogenic:
Air concentration at target risk/hazard levels (C_{air})	chemical-specific $\mu g/m^3$ [a/]	
Target cancer risk level (TR)	1.00E-06 unitless	$C_{air-c} = \frac{(TR)(AT_c)(365\ day\ /\ year)}{(URF)(EF)(ED)(FT)}$
Averaging Time, Carcinogens (AT_c)	70 yrs	
Inhalation unit risk factor (URF)	chemical-specific $(\mu g/m^3)^{-1}$	
Exposure Frequency (EF)	15 days/yr	
Exposure Duration (ED)	1 yr	
Fraction of time breathing aboveground contaminated air during a 24 hour day (FT) (assumed 1/2 of work day in trench: 4 hr/24 hr)	0.2 unitless	Noncarcinogenic:
Target hazard quotient (THQ)	1 unitless	
Inhalation reference concentration (RfC)	chemical-specific $\mu g/m^3$	
Averaging Time, Noncarcinogens (AT_{nc})	1 yr	$C_{air-nc} = \frac{(THQ)(RfC)(AT_{nc})(365day\ /\ year)}{(EF)(ED)(FT)}$

Contaminant	CAS Number [b/]	Chemical Type [c/]	URF $(\mu g/m^3)^{-1}$ [d/]	RfC $(\mu g/m^3)$	C_{air-c} $(\mu g/m^3)$	C_{air-nc} $(\mu g/m^3)$	C_{air} $(\mu g/m^3)$
Volatile Organic Compounds							
Benzene	71-43-2	o	7.80E-06	5.95E+00	1.31E+03	8.69E+02	8.69E+02
Ethylbenzene	100-41-4	o	-- [e/]	1.00E+03	--	1.46E+05	1.46E+05
Toluene	108-88-3	o	--	4.00E+02	--	5.84E+04	5.84E+04
Xylenes, total	1330-20-7	o	--	6.30E+03	--	9.20E+05	9.20E+05
Polynuclear Aromatic Hydrocarbons							
Naphthalene	91-20-3	o	--	3.00E+00	--	4.38E+02	4.38E+02
Metals							
Lead	7439-92-1	i	--	--	--	--	--

[a/] $\mu g/m^3$ = microgram per cubic meter

[b/] CAS = Chemical Abstracts Service number.

[c/] "o" = organic; "i" = inorganic

[d/] -- = toxicity data not available.

KEESLER AFB IEUBK MODEL INPUT AND OUTPUT

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 21.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: Multiple Source Analysis

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	8.7	16.1
1-2	8.7	16.1
2-3	8.7	16.1
3-4	8.7	16.1
4-5	8.7	16.1
5-6	8.7	16.1
6-7	8.7	16.1

Additional Dust Sources: None DEFAULT
Soil contribution conversion factor: 0.70
Air contribution conversion factor: 100.0

PAINT Intake: 0.00 ug Pb/day DEFAULT

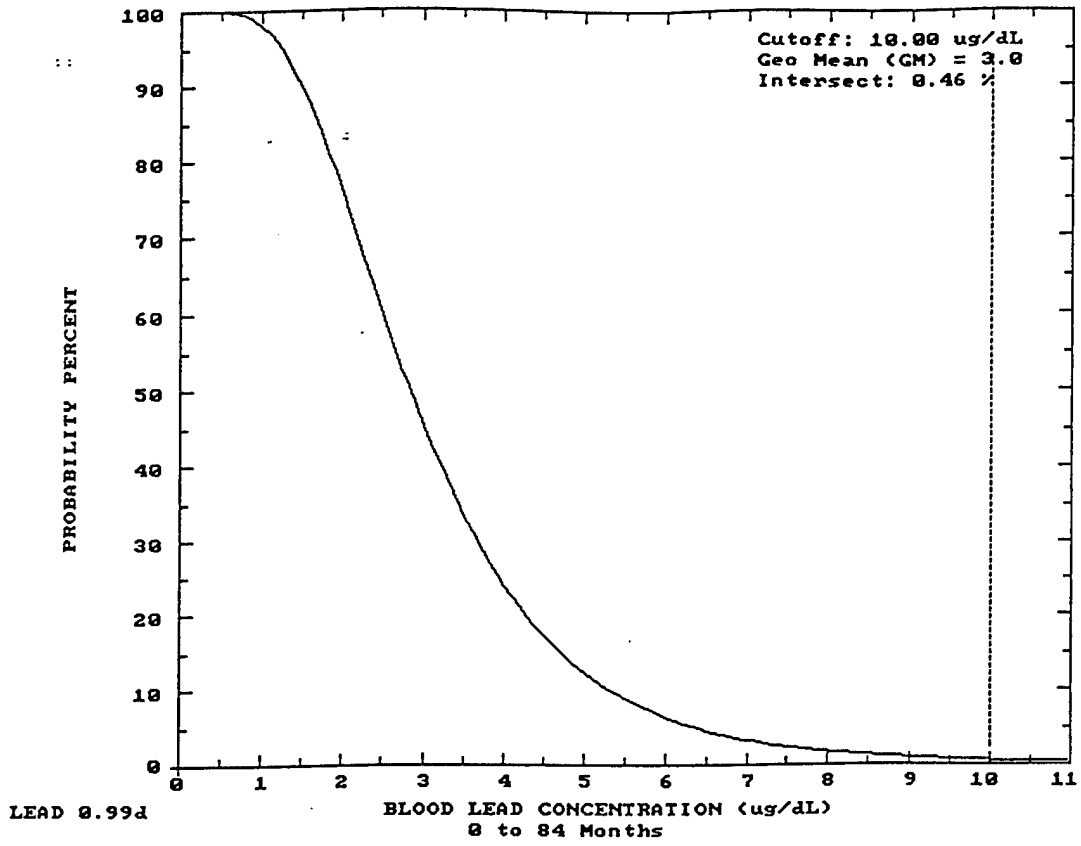
MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.7	4.93	0.31
1-2:	3.3	8.10	0.48
2-3:	3.2	8.71	0.48
3-4:	3.1	8.77	0.49
4-5:	2.9	8.80	0.37
5-6:	2.8	9.28	0.33
6-7:	2.7	9.69	0.31

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.61	1.99	0.00	0.02

1-2:	2.69	4.89	0.00	0.03
2-3:	3.04	5.12	0.00	0.06
3-4:	2.95	5.27	0.00	0.07
4-5:	2.86	5.51	0.00	0.07
5-6:	3.03	5.82	0.00	0.09
6-7:	3.35	5.94	0.00	0.09


Cutoff: 10.00 ug/dL
Geo Mean (GM) = 3.0
Intersect: 0.46 %
PROBABILITY PERCENT
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
11
BLOOD LEAD CONCENTRATION (ug/dL)
0 to 84 Months
LEAD 0.99d

APPENDIX F

BIOSCREEN INPUT AND OUTPUT

Alternative 1 – No Source Removal

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version 1.4*

Eglin AFB
7th St Service Sta.
Run Name

Data Input Instructions:

115 / or / 0.02 — 1. Enter value directly....or 2. Calculate by filling in grey cells below. (To restore formulas, hit button below).

Variable* ▸ Data used directly in model.

20 ▸ Value calculated by model. (Don't enter any data).

1. HYDROGEOLOGY

Seepage Velocity*	Vs	123.0	(ft/yr)
or		or	
Hydraulic Conductivity	K	7.4E-03	(cm/sec)
Hydraulic Gradient	i	0.004	(ft/ft)
Porosity	n	0.25	(-)

2. DISPERSION

Longitudinal Dispersivity*	alpha x	40.0	(ft)
Transverse Dispersivity*	alpha y	4.0	(ft)
Vertical Dispersivity*	alpha z	0.0	(ft)
or		or	
Estimated Plume Length	Lp	400	(ft)

3. ADSORPTION

Retardation Factor*	R	1.6	(-)
or		or	
Soil Bulk Density	rho	1.72	(kg/l)
Partition Coefficient	Koc	395	(L/kg)
FractionOrganicCarbon	foc	2.5E-4	(-)

4. BIODEGRADATION

1st Order Decay Coeff*	lambda	2.9E+0	(per yr)
or		or	
Solute Half-Life	t-half	0.24	(year)
or Instantaneous Reaction Model			
Delta Oxygen*	DO	1.4	(mg/L)
Delta Nitrate*	NO3	0.48	(mg/L)
Observed Ferrous Iron*	Fe2+	0.1	(mg/L)
Delta Sulfate*	SO4	15.75	(mg/L)
Observed Methane*	CH4	0.52	(mg/L)

5. GENERAL

Modeled Area Length*	1300	(ft)
Modeled Area Width*	200	(ft)
Simulation Time*	20	(yr)



6. SOURCE DATA

Source Thickness in Sat.Zone* 2.5 (ft)

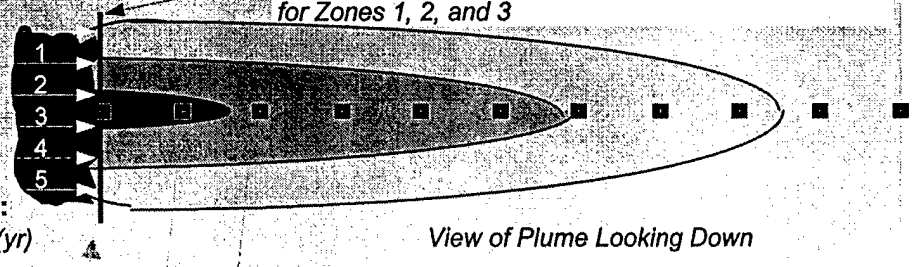
Source Zones:

Width* (ft)	Conc. (mg/L)*
30	2
25	5
20	10
25	5
30	2

Source Halflife (see Help):

80	200	(yr)
Inst. React.	1st Order	
Soluble Mass	280	(Kg)
In Source NAPL, Soil		

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Dist. from Source (ft)	0	130	260	390	520	650	780	910	1040	1170	1300
Concentration (mg/L)											

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE — **View Output**

RUN ARRAY — **View Output**

Help

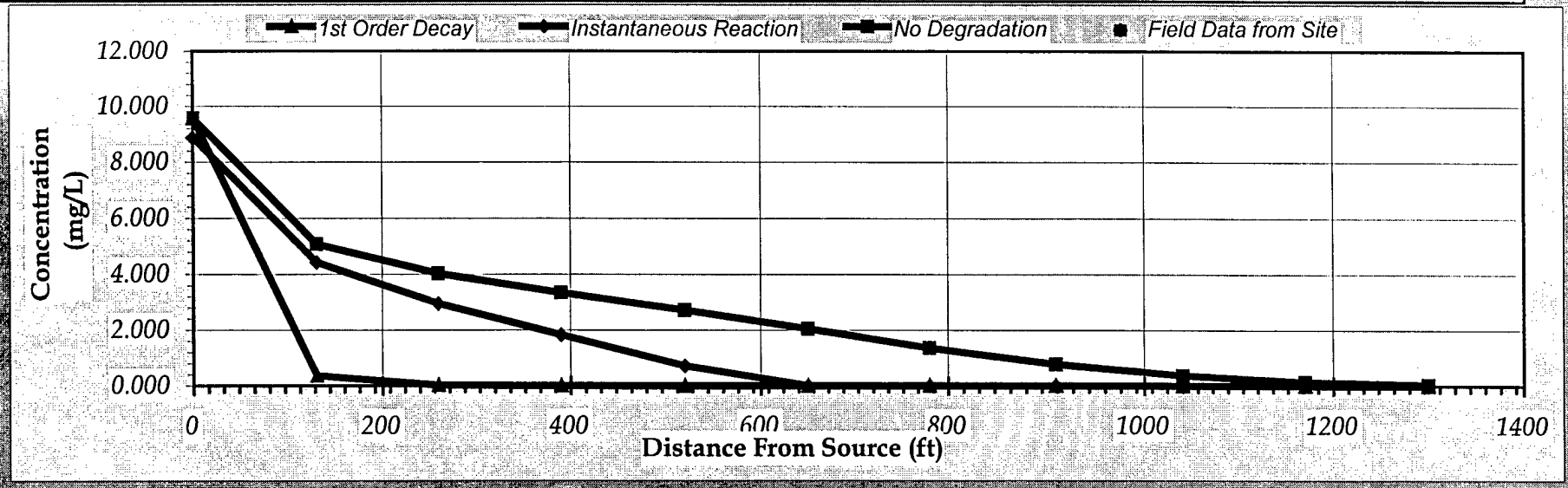
Recalculate This Sheet

Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

TYPE OF MODEL	Distance from Source (ft) 0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	9.567	5.081	4.033	3.343	2.714	2.047	1.369	0.775	0.364	0.138	0.042
1st Order Decay	9.567	0.355	0.020	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	8.870	4.432	2.962	1.835	0.718	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

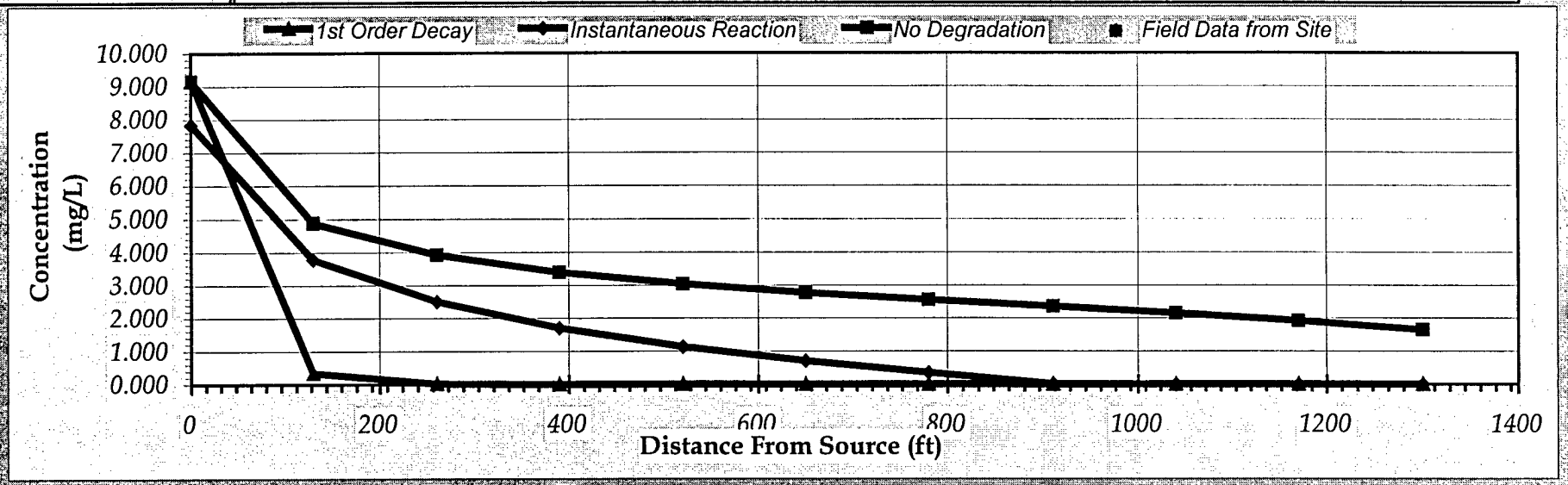
Time: 10 Years

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	9.152	4.883	3.929	3.394	3.037	2.773	2.557	2.360	2.153	1.916	1.639
1st Order Decay	9.152	0.340	0.019	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	7.832	3.782	2.509	1.698	1.132	0.703	0.345	0.007	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

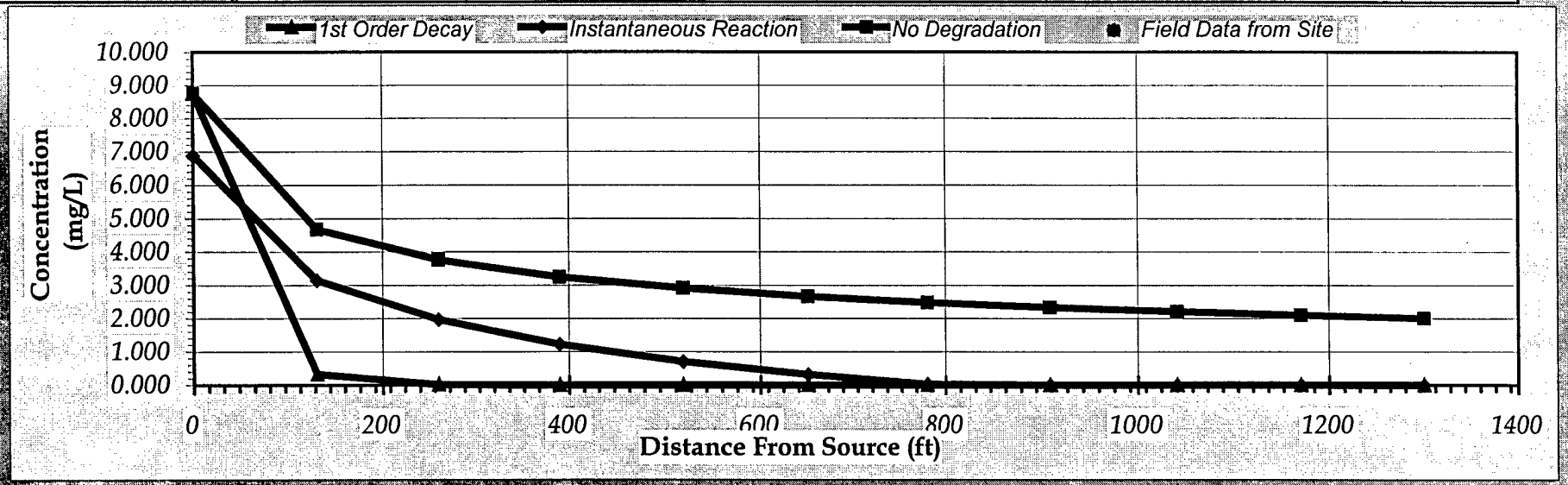
Time: 20 Years

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	8.756	4.672	3.760	3.248	2.910	2.665	2.479	2.330	2.208	2.103	2.009
1st Order Decay	8.756	0.325	0.018	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	6.879	3.146	1.965	1.216	0.698	0.316	0.022	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

30 Years

Calculate Animation

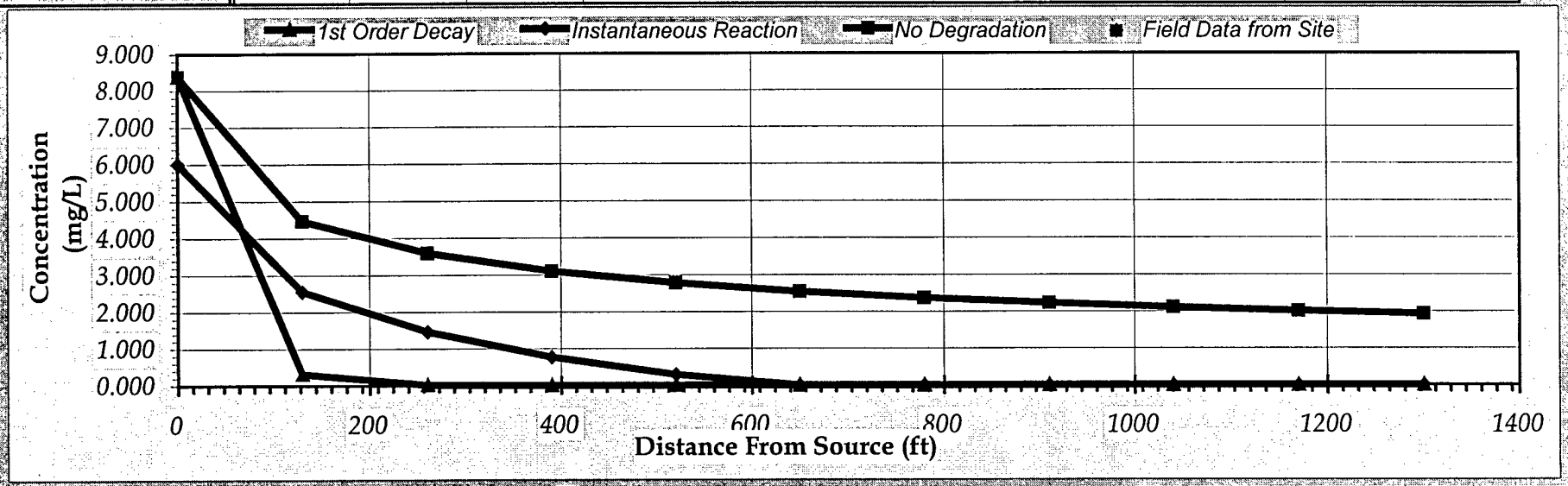
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	8.377	4.469	3.597	3.107	2.784	2.550	2.372	2.230	2.115	2.019	1.937
1st Order Decay	8.377	0.311	0.017	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	6.003	2.562	1.464	0.771	0.291	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

40 Years

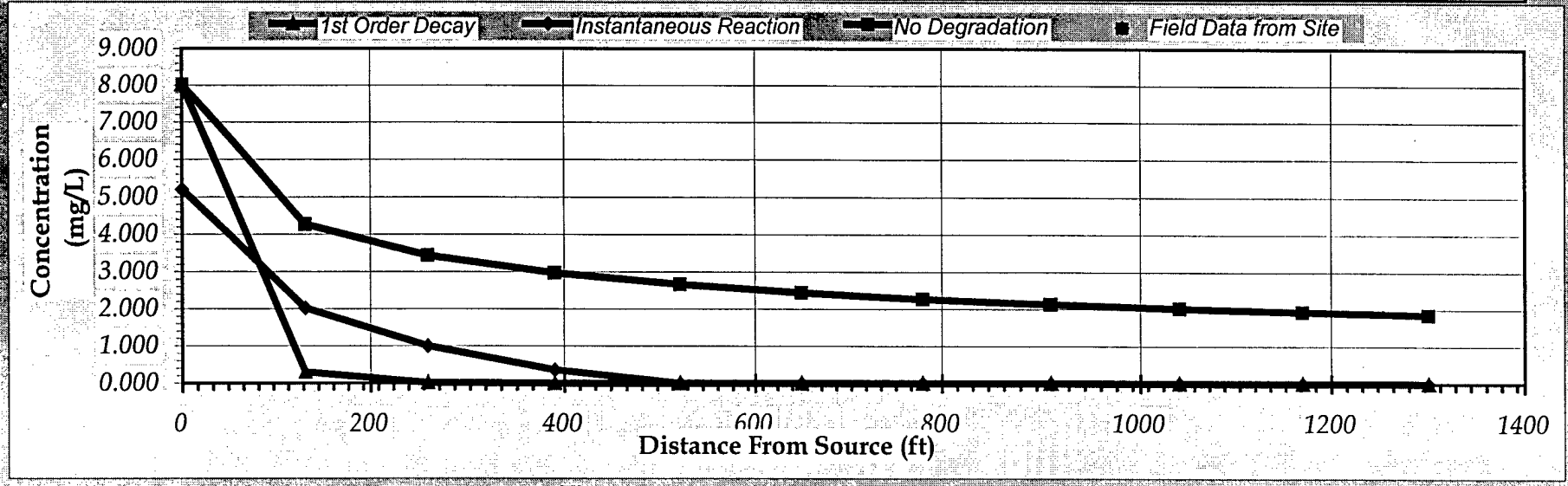
Calculate Animation

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

TYPE OF MODEL	Distance from Source (ft) 0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	8.014	4.276	3.441	2.973	2.663	2.440	2.269	2.134	2.023	1.931	1.853
1st Order Decay	8.014	0.297	0.017	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	5.198	2.025	1.004	0.361	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time: 50 Years

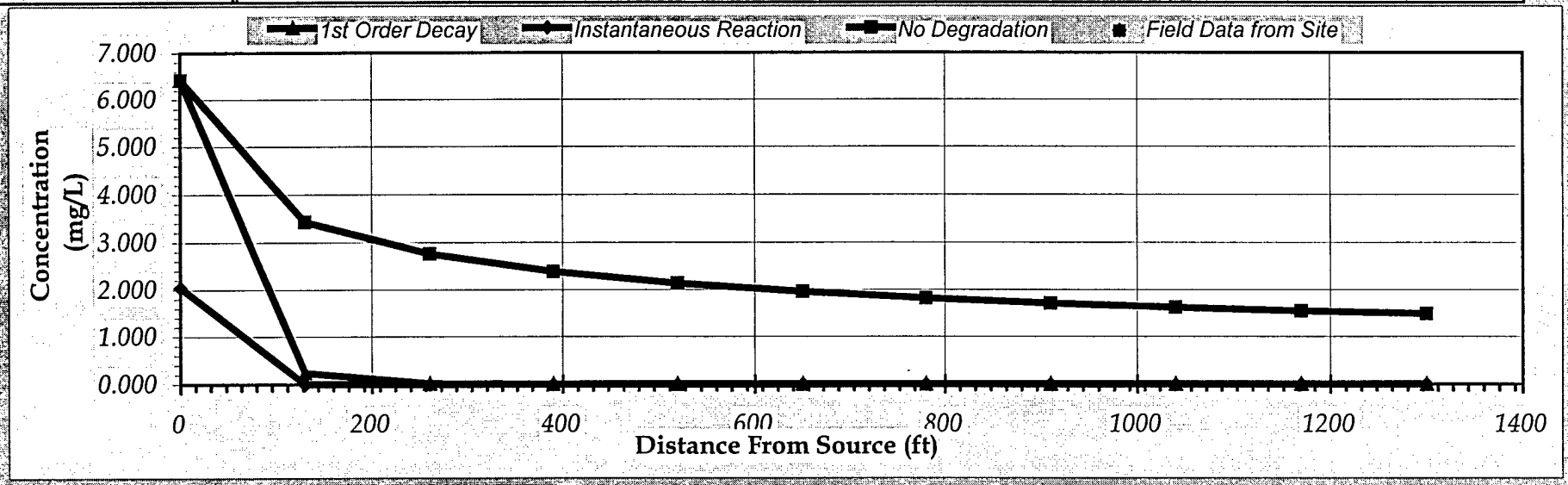
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	6.422	3.426	2.757	2.382	2.134	1.955	1.818	1.710	1.621	1.548	1.485
1st Order Decay	6.422	0.238	0.013	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	2.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time:

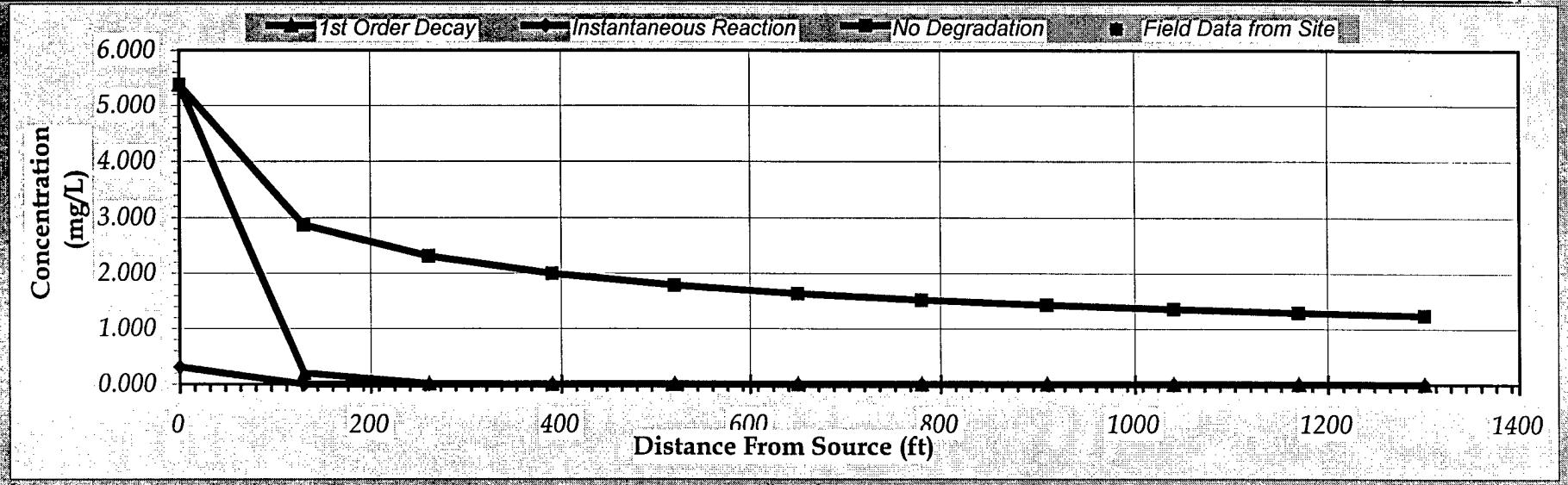
100 Years

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	5.379	2.870	2.310	1.995	1.788	1.638	1.523	1.432	1.358	1.296	1.244
1st Order Decay	5.379	0.200	0.011	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.310	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

140 Years

Calculate Animation

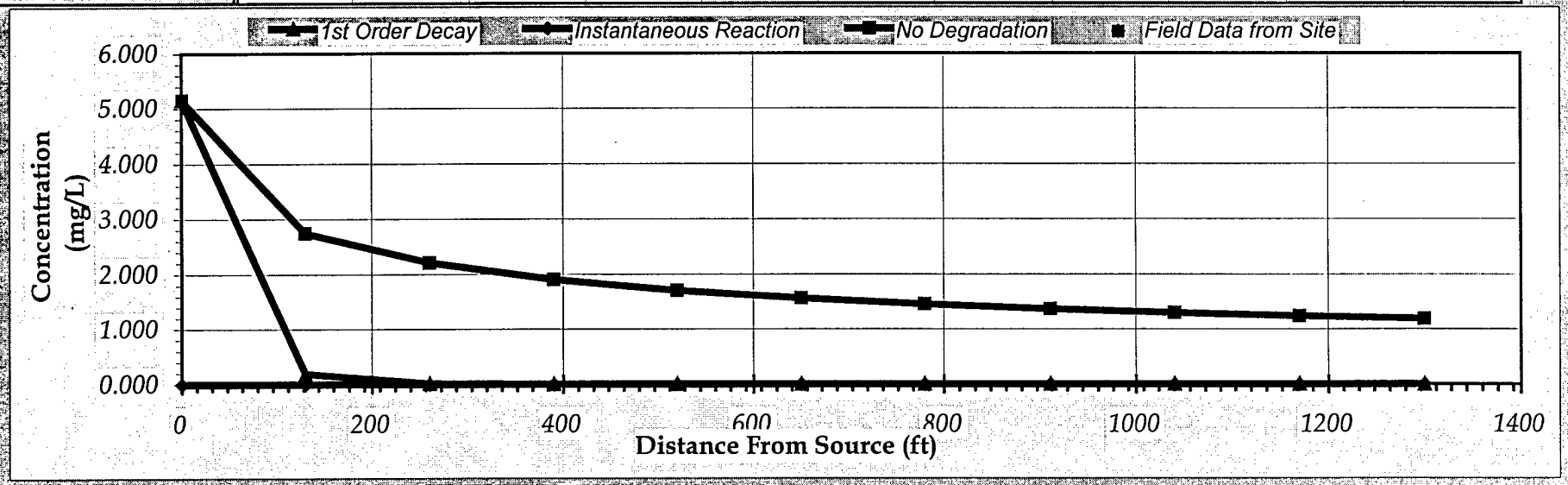
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	5.146	2.746	2.210	1.909	1.710	1.567	1.457	1.370	1.299	1.240	1.190
1st Order Decay	5.146	0.191	0.011	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

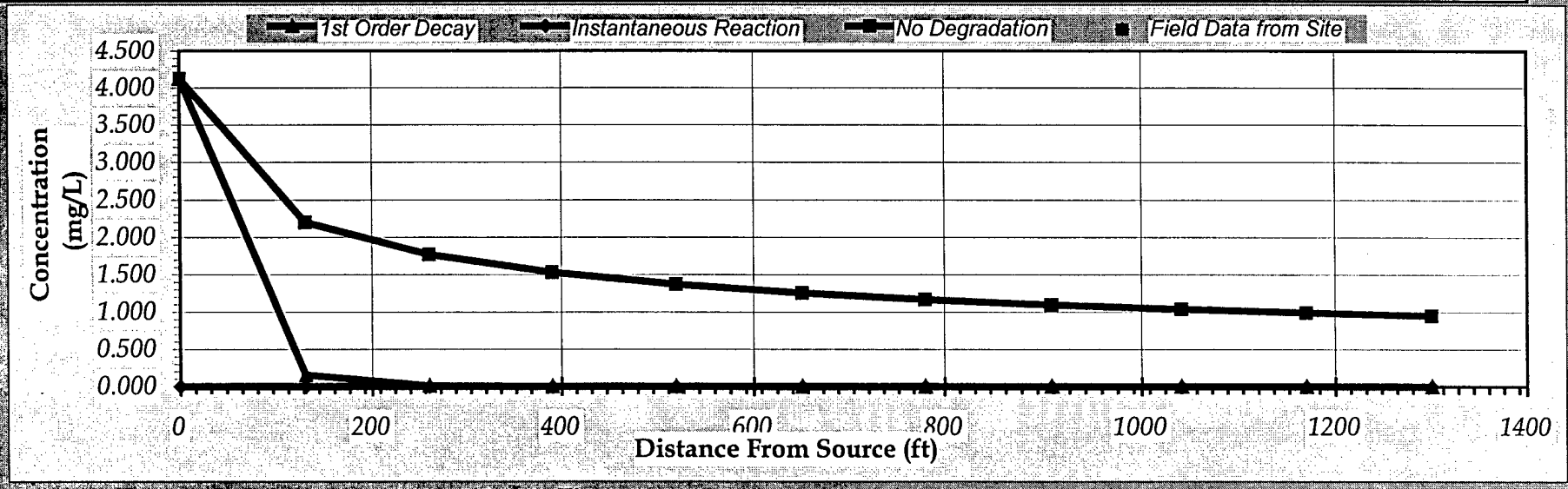
Time: 150 Years

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	4.124	2.200	1.771	1.530	1.370	1.255	1.168	1.098	1.041	0.994	0.954
1st Order Decay	4.124	0.153	0.009	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time:

200 Years

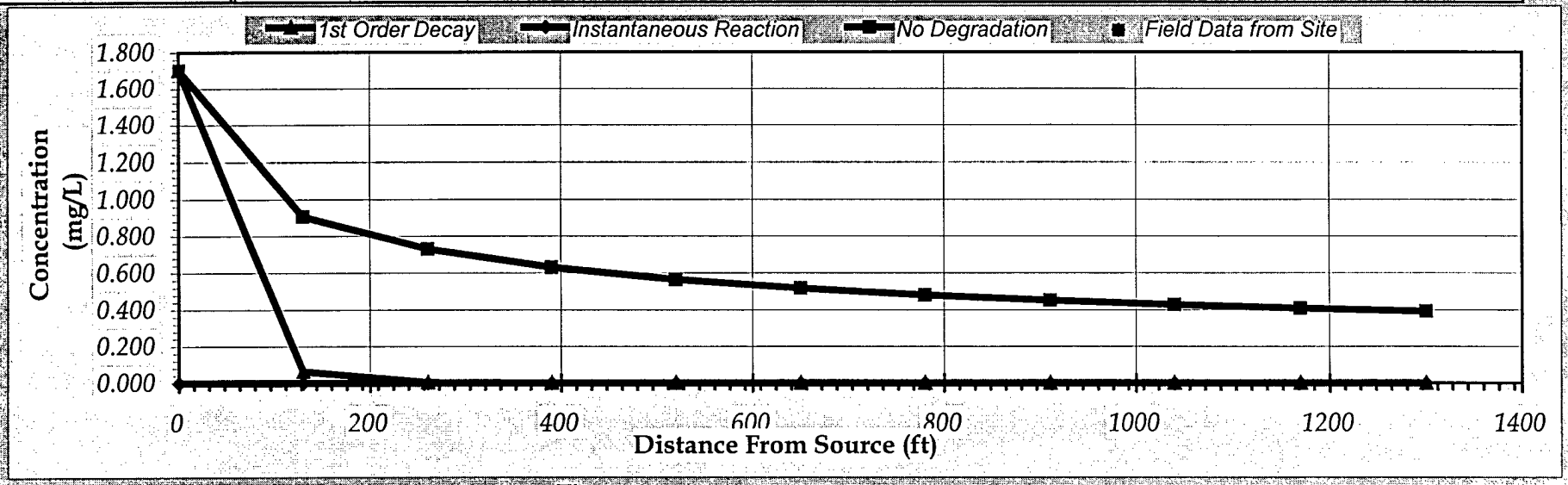
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	1.701	0.907	0.730	0.631	0.565	0.518	0.482	0.453	0.429	0.410	0.393
1st Order Decay	1.701	0.063	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time: 400 Years

Return to Input

Recalculate This Sheet

Alternative 2 – 80% Source Removal

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version 1.4*

Eglin AFB
7th St Service Sta.
Run Name

Data Input Instructions:

115 or 0.02 — 1. Enter value directly....or 2. Calculate by filling in grey cells below. (To restore formulas, hit button below).

Variable* — Data used directly in model.

20 — Value calculated by model. (Don't enter any data).

1. HYDROGEOLOGY

Seepage Velocity*	Vs	123.0	(ft/yr)
or		↑ or	
Hydraulic Conductivity	K	7.4E-03	(cm/sec)
Hydraulic Gradient	i	0.004	(ft/ft)
Porosity	n	0.25	(-)

2. DISPERSION

Longitudinal Dispersivity*	alpha x	40.0	(ft)
Transverse Dispersivity*	alpha y	4.0	(ft)
Vertical Dispersivity*	alpha z	0.0	(ft)
or		↑ or	
Estimated Plume Length	Lp	400	(ft)

3. ADSORPTION

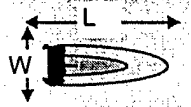
Retardation Factor*	R	1.6	(-)
or		↑ or	
Soil Bulk Density*	rho	1.72	(kg/l)
Partition Coefficient*	Koc	395	(L/kg)
Fraction Organic Carbon	foc	2.5E-4	(-)

4. BIODEGRADATION

1st Order Decay Coeff*	lambda	2.9E+0	(per yr)
or		↑ or	
Solute Half-Life	t-half	0.24	(year)
or Instantaneous Reaction Model			
Delta Oxygen*	DO	1.4	(mg/L)
Delta Nitrate*	NO3	0.48	(mg/L)
Observed Ferrous Iron*	Fe2+	0.1	(mg/L)
Delta Sulfate*	SO4	15.75	(mg/L)
Observed Methane*	CH4	0.52	(mg/L)

5. GENERAL

Modeled Area Length*	1300	(ft)
Modeled Area Width*	200	(ft)
Simulation Time*	20	(yr)



6. SOURCE DATA

Source Thickness in Sat.Zone* 2.5 (ft)

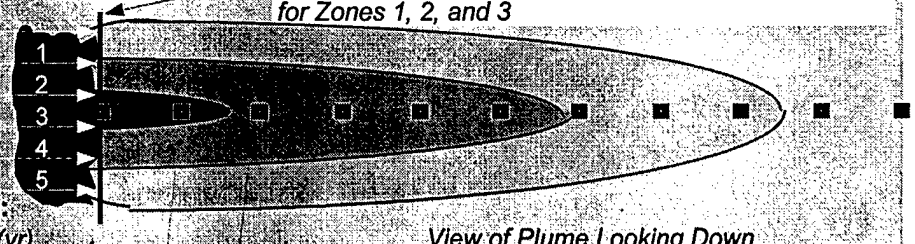
Source Zones:

Width* (ft)	Conc. (mg/L)*
30	2
25	5
20	10
25	5
30	2

Source Halflife (see Help):

20	30	(yr)
Inst. React	1st Order	
Soluble Mass	56	(Kg)
In Source NAPL, Soil		

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Dist. from Source (ft)	0	130	260	390	520	650	780	910	1040	1170	1300
Concentration (mg/L)											

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE — View Output

RUN ARRAY — View Output

Help

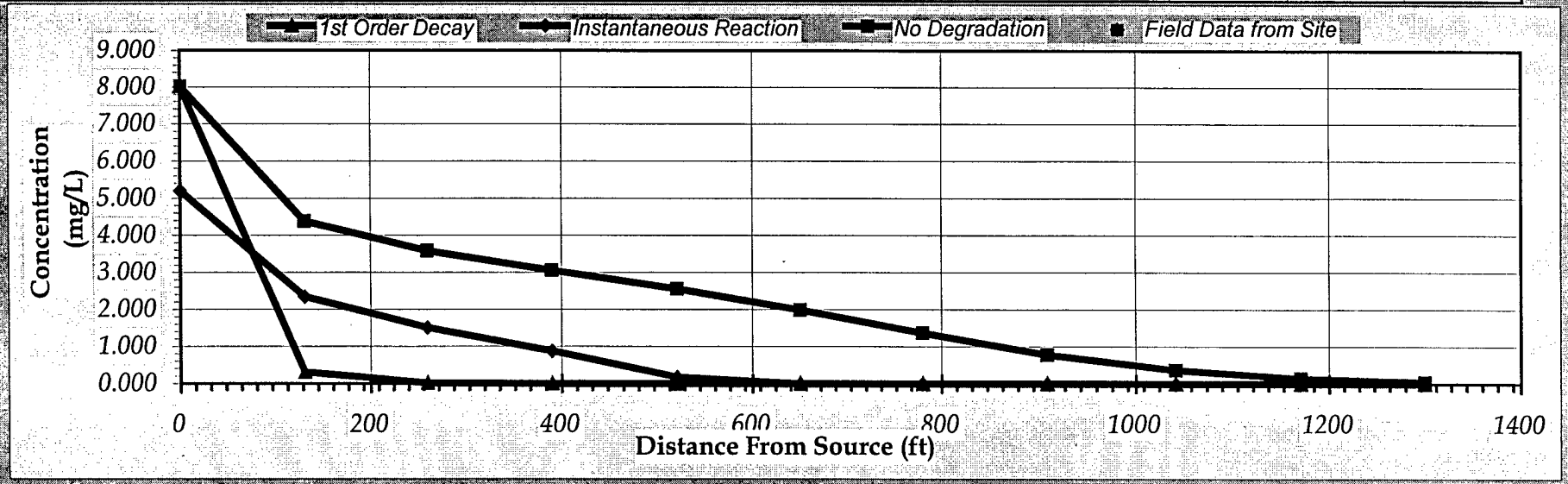
Recalculate This Sheet

Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	8.014	4.383	3.583	3.058	2.557	1.987	1.368	0.775	0.364	0.138	0.042
1st Order Decay	8.014	0.306	0.018	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	5.198	2.345	1.510	0.877	0.172	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

10 Years

Calculate Animation

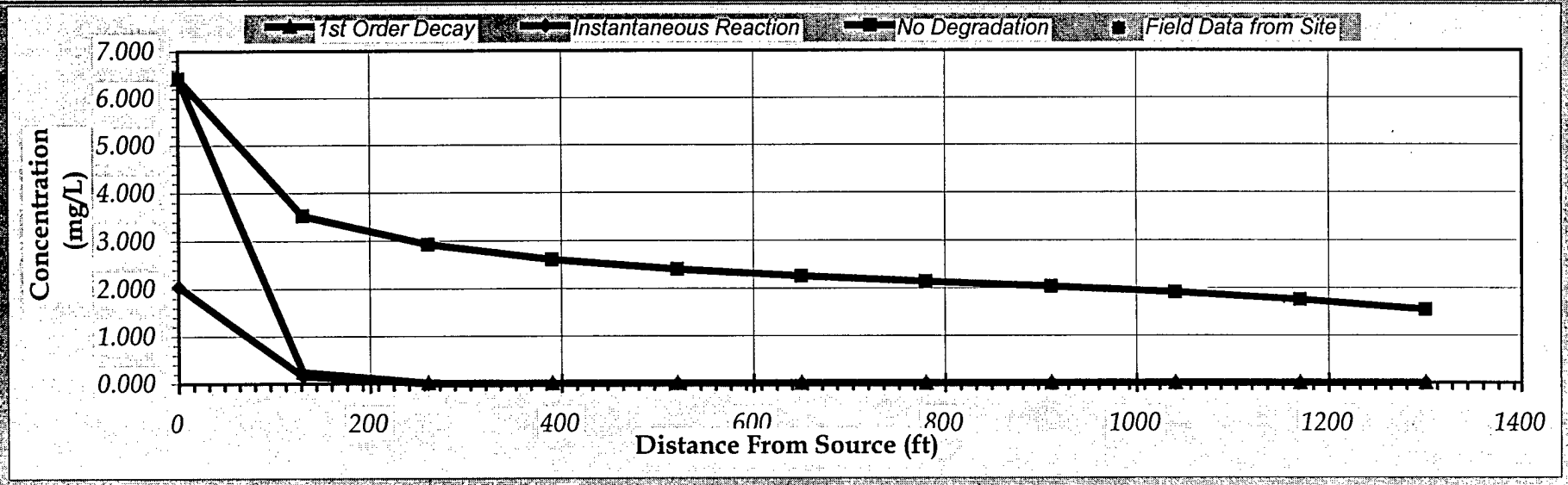
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	6.422	3.529	2.924	2.601	2.397	2.254	2.141	2.034	1.911	1.752	1.543
1st Order Decay	6.422	0.245	0.014	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	2.044	0.149	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

20 Years

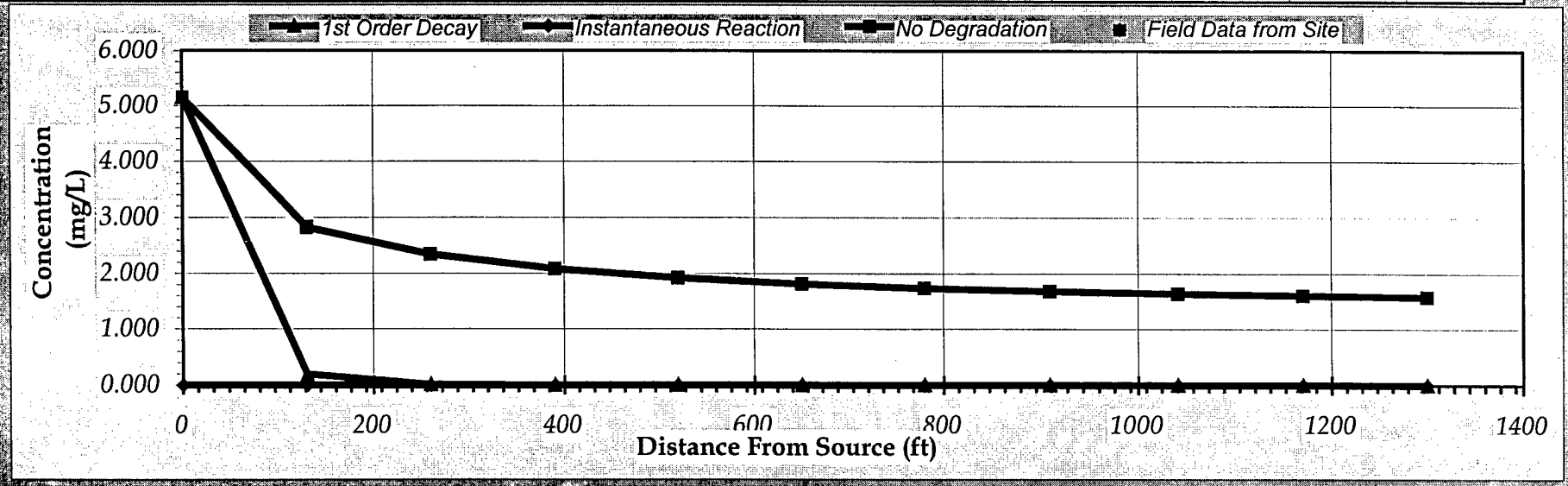
Calculate Animation

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

TYPE OF MODEL	Distance from Source (ft) 0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	5.146	2.828	2.343	2.085	1.923	1.815	1.738	1.683	1.642	1.611	1.584
1st Order Decay	5.146	0.197	0.011	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time:
30 Years

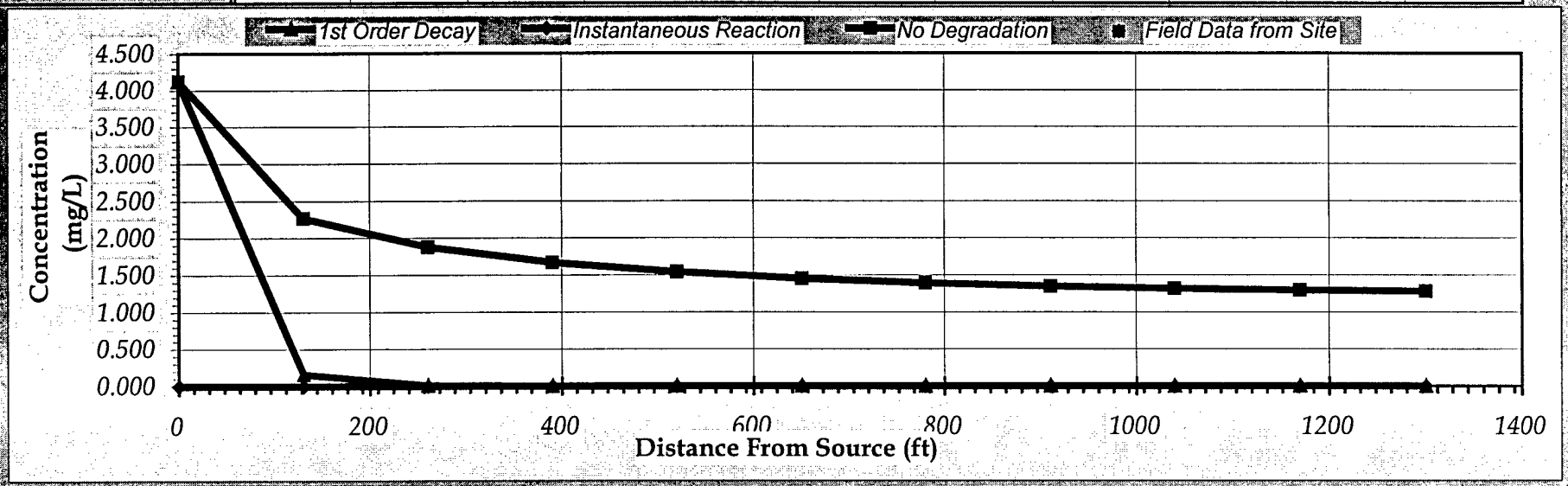
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	4.124	2.266	1.878	1.671	1.541	1.454	1.393	1.349	1.317	1.295	1.279
1st Order Decay	4.124	0.158	0.009	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time:

40 Years

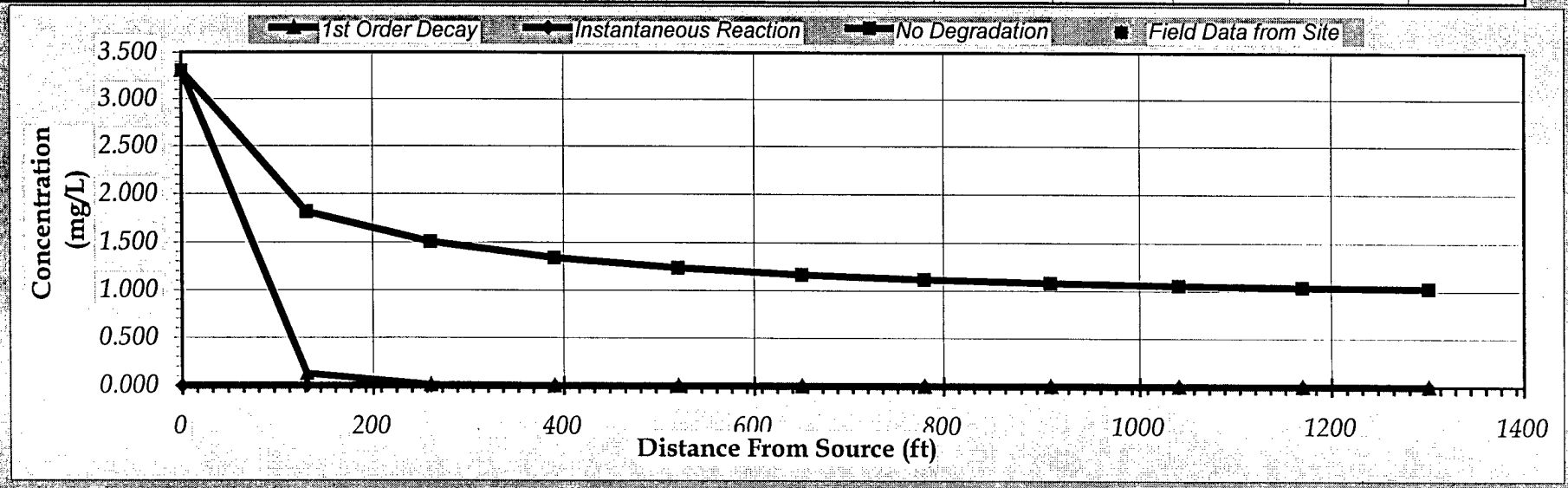
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	3.305	1.816	1.505	1.339	1.235	1.165	1.116	1.081	1.056	1.038	1.025
1st Order Decay	3.305	0.126	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time: 50 Years

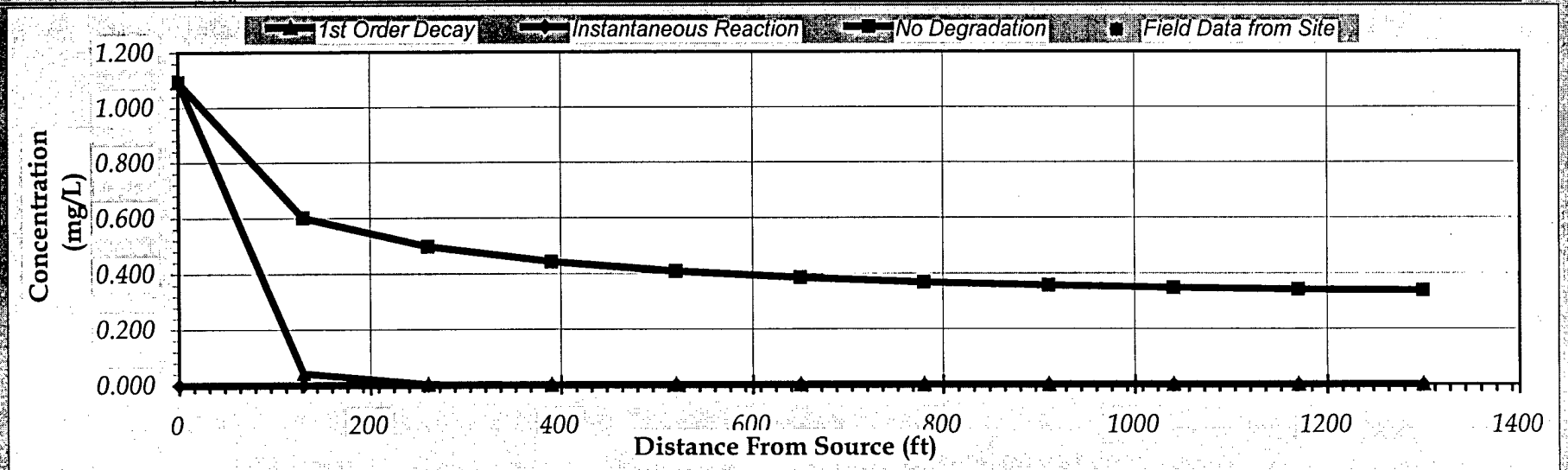
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	1.092	0.600	0.497	0.442	0.408	0.385	0.369	0.357	0.349	0.343	0.339
1st Order Decay	1.092	0.042	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time:

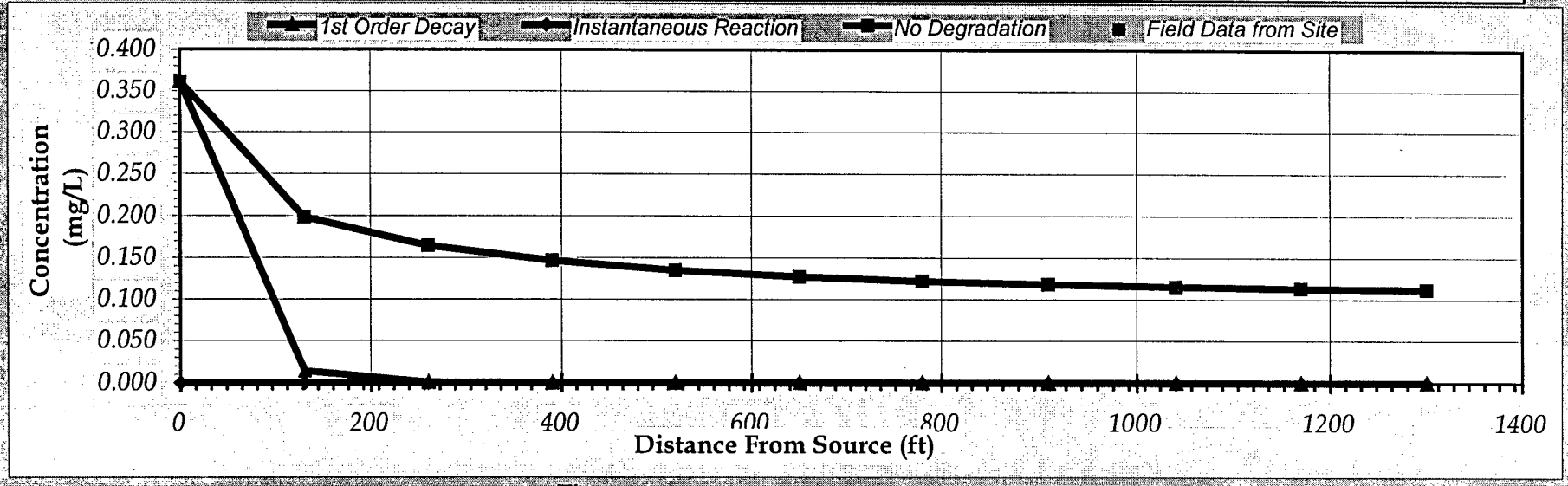
100 Years

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

TYPE OF MODEL	Distance from Source (ft) 0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	0.361	0.198	0.164	0.146	0.135	0.127	0.122	0.118	0.115	0.113	0.112
1st Order Decay	0.361	0.014	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time: 150 Years

Calculate Animation

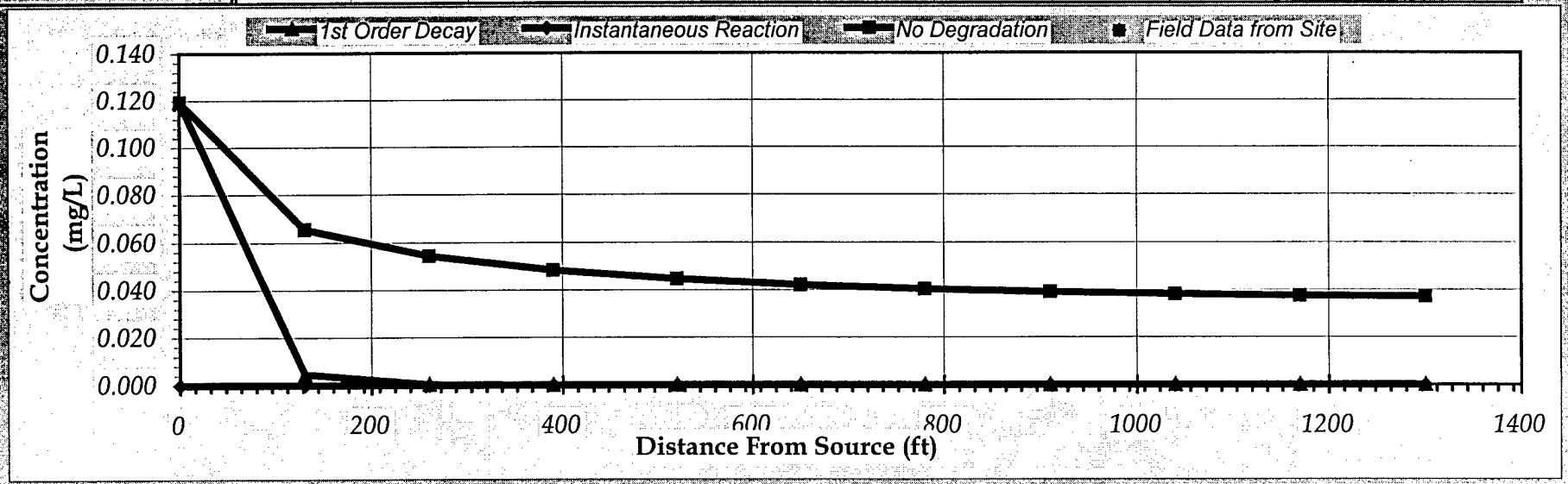
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	0.119	0.066	0.054	0.048	0.045	0.042	0.040	0.039	0.038	0.037	0.037
1st Order Decay	0.119	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

200 Years

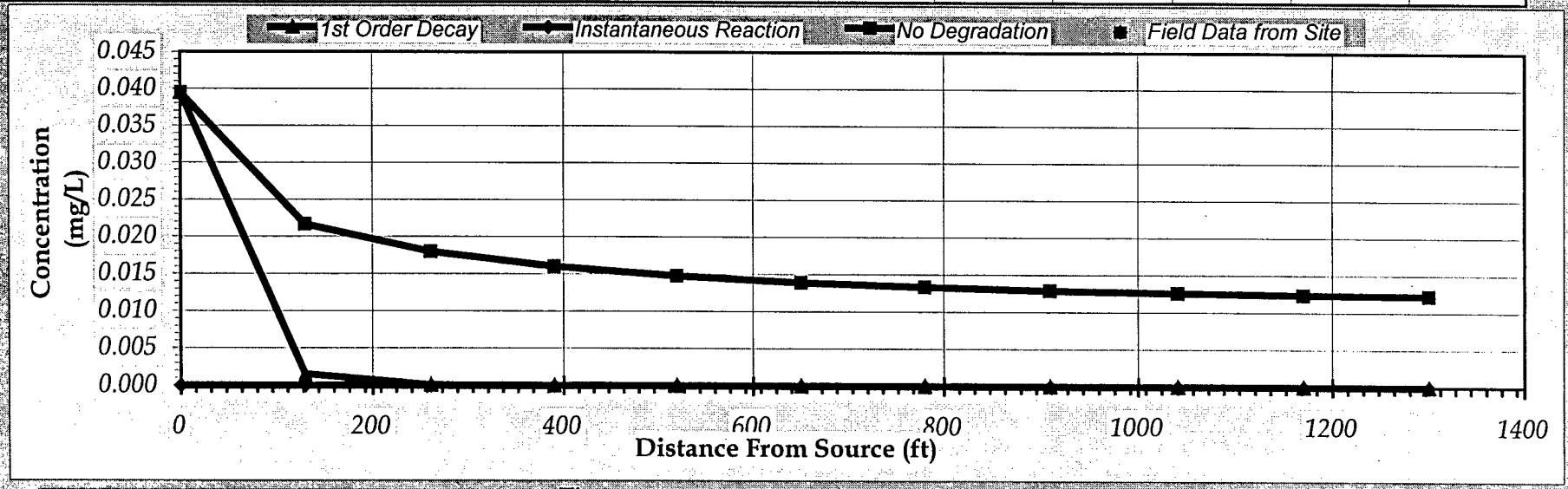
Calculate Animation

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

TYPE OF MODEL	Distance from Source (ft) 0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	0.039	0.022	0.018	0.016	0.015	0.014	0.013	0.013	0.013	0.012	0.012
1st Order Decay	0.039	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time: 250 Years

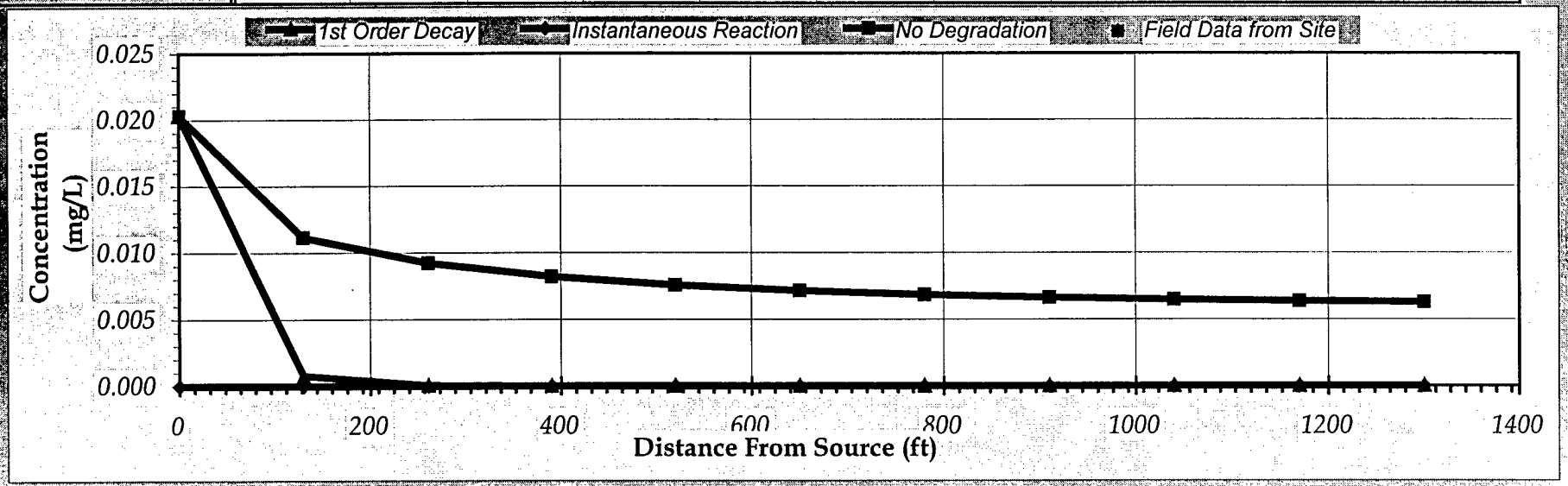
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	0.020	0.011	0.009	0.008	0.008	0.007	0.007	0.007	0.006	0.006	0.006
1st Order Decay	0.020	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

280 Years

Calculate Animation

Return to Input

Recalculate This Sheet

Benzene Simulation

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version 1.4*

Eglin AFB
7th St Service Sta.
Run Name

Data Input Instructions:

115 or 0.02

1. Enter value directly....or
2. Calculate by filling in grey cells below. (To restore formulas, hit button below).

Variable* ▸ Data used directly in model.
20 ▸ Value calculated by model. (Don't enter any data).

1. HYDROGEOLOGY

Seepage Velocity*	Vs	123.0	(ft/yr)
or		or	
Hydraulic Conductivity	K	7.4E-03	(cm/sec)
Hydraulic Gradient	i	0.004	(ft/ft)
Porosity	n	0.25	(-)

2. DISPERSION

Longitudinal Dispersivity*	alpha x	40.0	(ft)
Transverse Dispersivity*	alpha y	4.0	(ft)
Vertical Dispersivity*	alpha z	0.0	(ft)
or		or	
Estimated Plume Length	Lp	400	(ft)

3. ADSORPTION

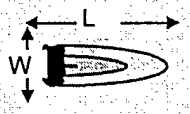
Retardation Factor*	R	1.1	(-)
or		or	
Soil Bulk Density	rho	1.72	(kg/l)
Partition Coefficient	Koc	395	(L/kg)
FractionOrganicCarbon	foc	2.5E-4	(-)

4. BIODEGRADATION

1st Order Decay Coeff*	lambda	2.9E+0	(per yr)
or		or	
Solute Half-Life	t-half	0.24	(year)
or Instantaneous Reaction Model			
Delta Oxygen*	DO	1.4	(mg/L)
Delta Nitrate*	NO3	0.48	(mg/L)
Observed Ferrous Iron*	Fe2+	0.1	(mg/L)
Delta Sulfate*	SO4	15.75	(mg/L)
Observed Methane*	CH4	0.52	(mg/L)

5. GENERAL

Modeled Area Length*	1300	(ft)
Modeled Area Width*	200	(ft)
Simulation Time*	20	(yr)



6. SOURCE DATA

Source Thickness in Sat.Zone* 2.5 (ft)

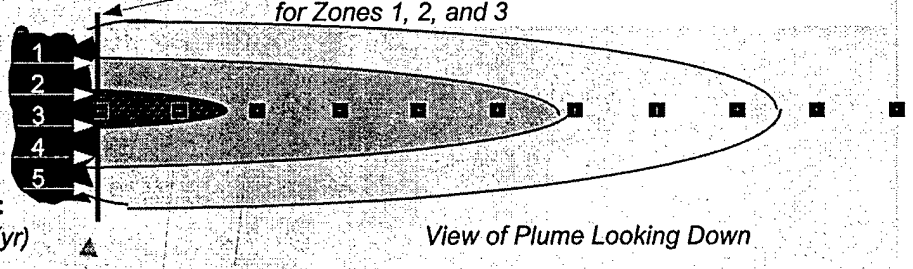
Source Zones:

Width* (ft)	Conc. (mg/L)*
30	0.01
25	0.05
20	0.08
25	0.05
30	0.01

Source Halflife (see Help):

<1	70	(yr)
Inst. React.	1st Order	
Soluble Mass	1.1	(Kg)
In Source NAPL, Soil		

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Dist. from Source (ft)	0	130	260	390	520	650	780	910	1040	1170	1300
Concentration (mg/L)											

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE — View Output

RUN ARRAY — View Output

Help

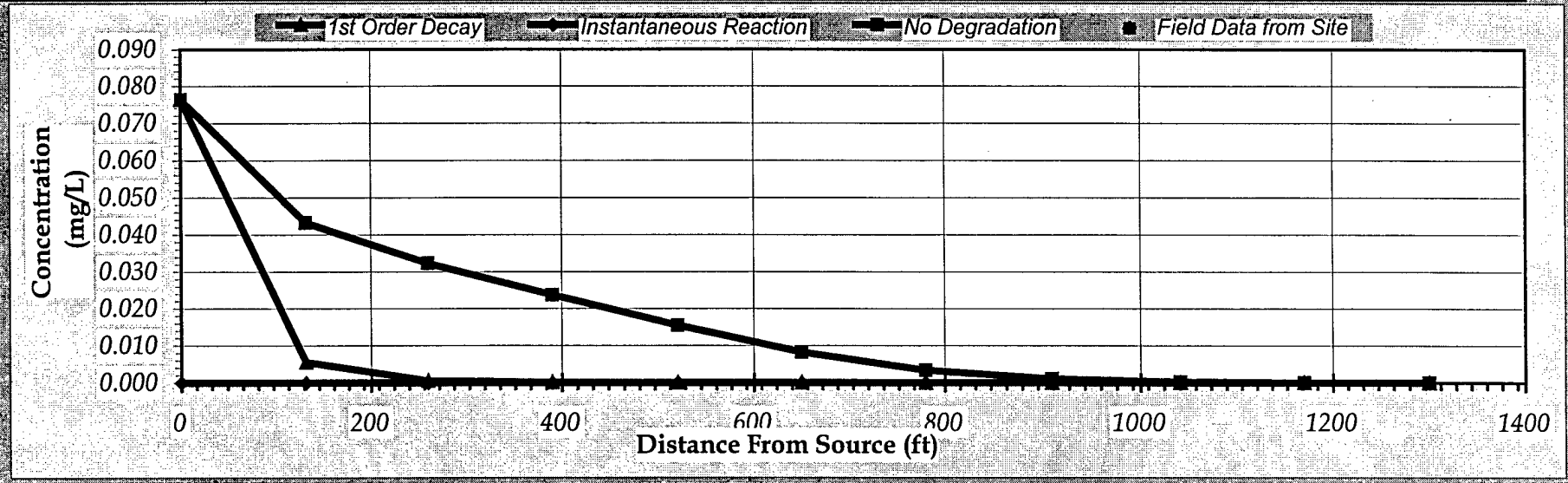
Recalculate This Sheet

Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

	Distance from Source (ft)										
TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	0.076	0.043	0.032	0.024	0.015	0.008	0.003	0.001	0.000	0.000	0.000
1st Order Decay	0.076	0.006	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time:

5 Years

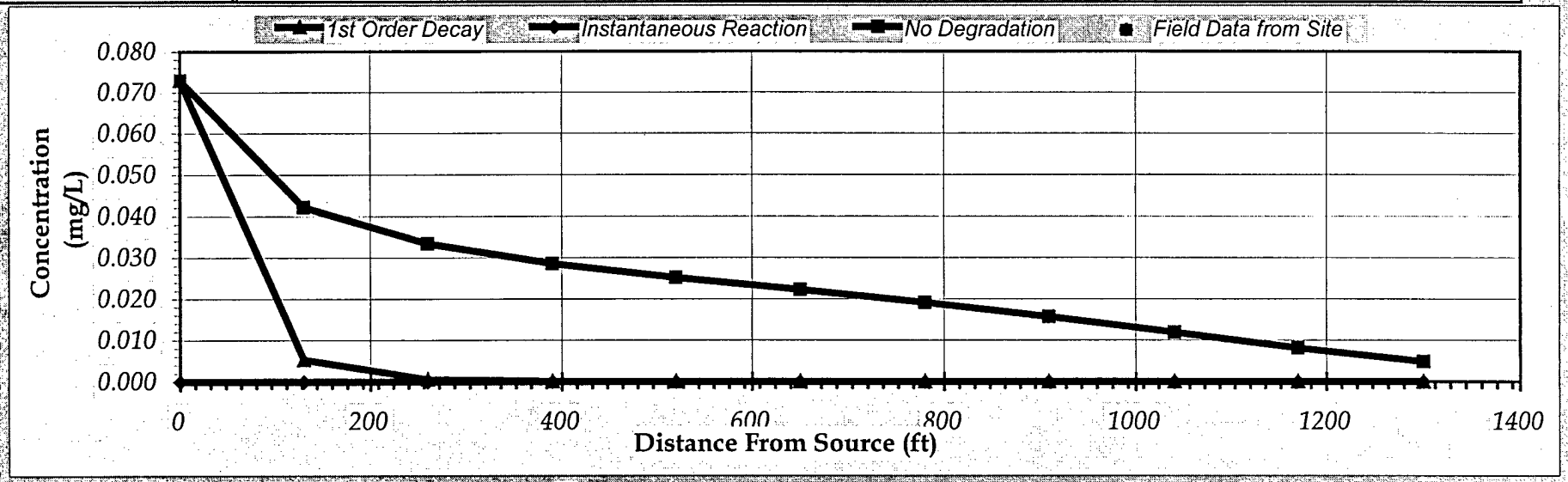
Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	0.073	0.042	0.033	0.029	0.025	0.022	0.019	0.016	0.012	0.008	0.005
1st Order Decay	0.073	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Calculate Animation

Time:

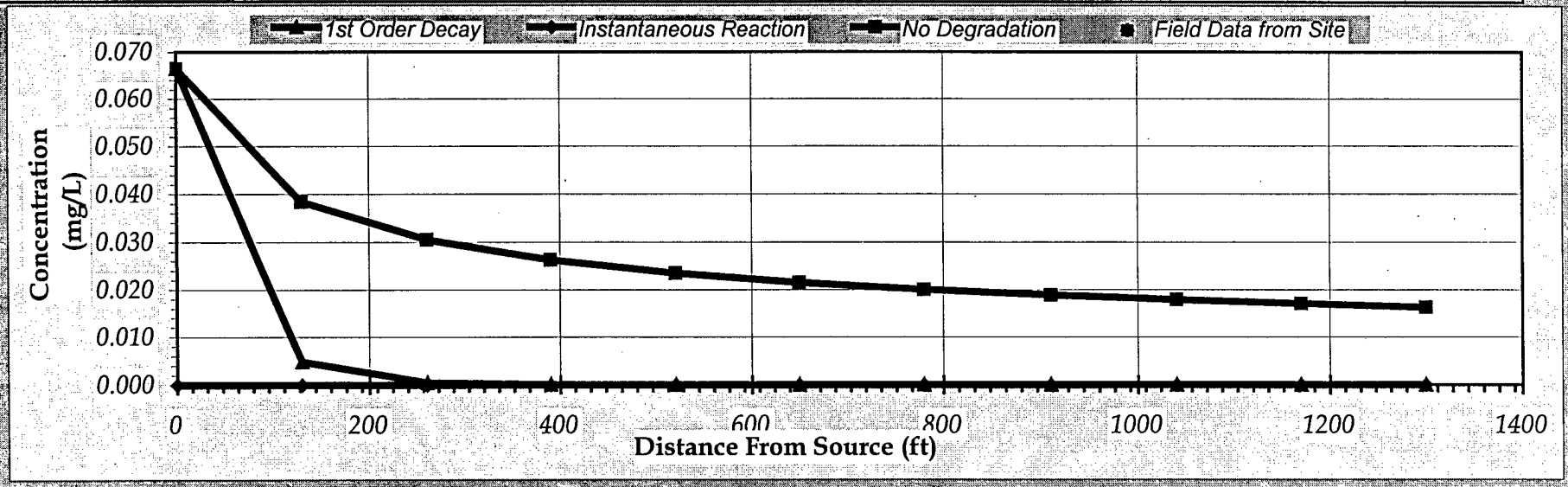
10 Years

Return to Input

Recalculate This Sheet

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

TYPE OF MODEL	Distance from Source (ft) 0	130	260	390	520	650	780	910	1040	1170	1300
No Degradation	0.066	0.038	0.031	0.026	0.023	0.022	0.020	0.019	0.018	0.017	0.016
1st Order Decay	0.066	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											



Time:

20 Years

Calculate Animation

Return to Input

Recalculate This Sheet

APPENDIX G

COST CALCULATIONS FOR REMEDIAL ALTERNATIVES

Tyndall AFB BX Service Station Backup Calculations

Long-Term Monitoring

Misc calculations

Number of LTM wells:		
Number of wells:	1	
Depth each:	13	ft

Cost calculations

Description	Unit	Qty.	Unit Price	Subtotal	Total	Source (If applicable)
Well Installation					$ 1,380	
Mobilization	ea	1	$ 500	$ 500		
Well Installation	ln ft	13	$ 60	$ 780		
Soil Disposal	drum	1	$ 100	$ 100		

Design/Construct 1 LTM Well Eglin AFB BX Service Station

Standard Rate Schedule

Billing Category Cost Code/(Billing Category)	Billing Rate	Task 1 (hrs)	Install New LTM/POC Wells ($)	Task 2 (hrs)	Subcon-tracting ($)	Task 3 (hrs)	Reporting & PM ($)
Word Processor 88/(15)	$30	0	$0	2	$60	2	$60
CADD Operator 58/(25)	$47	0	$0	0	$0	5	$235
Technician 42/(50)	$40	5	$200	0	$0	0	$0
Staff Level 16/(65)	$57	10	$570	30	$1,710	8	$456
Project Level 12/(70)	$65	4	$260	8	$520	2	$130
Senior Level 10/(80)	$85	2	$170	2	$170	2	$170
Principal 02/(85)	$97	0	$0	0	$0	0	$0
Total Labor (hrs|$)		21	$1,200	42	$2,460	19	$1,051
ODCs							
Phone			$20		$20		$0
Photocopy			$10		$0		$10
Mail			$0		$10		$20
Computer			$0		$20		$20
CAD			$0		$0		$50
WP			$0		$20		$20
Travel			$150		$0		$0
Per Diem			$0		$0		$0
Eqpt. & Supplies			$150		$0		$0
Total ODCs			$330		$200		$120
Outside Services							
LTM/POC Well Installation Costs			$1,380		$0		$0
Surveying			$400		$0		$0
Other: Maintain Institutional Controls			$0		$0		$0
Total Outside Services			$1,780		$0		$0

Proposal Estimate	Task 1	Task 2	Task 3
Labor	$1,200	$2,460	$1,051
ODC's	$330	$200	$120
Outside Services	$1,780	$0	$0
Total by Task	$3,310	$2,660	$1,171

Total Labor	$4,711
Total ODCs	$650
Total Outside Services	$1,780
Total Project	$7,141

Task 1: Install 1 New LTM wells

Task 2: Subcontracting/Permitting

Task 3: Reporting/PM per Event.

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Groundwater Sampling - Years 1999 - 2004

6 Long-Term Monitoring Wells
5 QA/QC (1 dupl, 1 field blank, 1 trip blank, 1 MS, 1 MSD)
11 Total Samples

Sampling Labor	36 hours x		$60	/hour	$2,160
Analytical Subcontractor					
	11 BTEX		$55	/each	$605
	11 TRPH		$45	/each	$495
	11 naphthalene		$101	/each	$1,111
	11 total lead		$10	/each	$110
	11 methane		$75	/each	$825
	7 sulfate			/each	$0
	7 ferrous iron			/each	$0
	9 nitrate		$20	/each	$180
	6 Field Parameters		$20	/each	$120
Supplies			$500	lump sum	$500
Travel			$400	lump sum	$400
Per Diem	5	days x	$88	/day	$440
Data Management	25	hours x	$60	/hr	$1,500
Data Validation	20	hours x	$60	/hr	$1,200
Reporting/Project Management Labor					
Word Processing	8	hours x	$25	/hour	$200
CADD	10	hours x	$50	/hour	$500
Reproduction	8	hours x	$20	/hour	$160
Staff Level	40	hours x	$60	/hour	$2,400
Proj. Manager	20	hours x	$80	/hour	$1,600
Editor	5	hours x	$60	/hour	$300
Reporting/Project Management ODCs			$400	lump sum	$400
			Total for 1 Sampling Event		$15,206

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Groundwater Sampling - Years 2005 -- 2029

6 Long-Term Monitoring Wells
5 QA/QC (1 dupl, 1 field blank, 1 trip blank, 1 MS, 1 MSD)
11 Total Samples

Sampling Labor	36	hours x	$60	/hour	$2,160
Analytical Subcontractor					
11 BTEX			$55	/each	$605
11 TRPH			$45	/each	$495
11 naphthalene			$101	/each	$1,111
11 methane			$75	/each	$825
7 sulfate				/each	$0
7 ferrous iron				/each	$0
9 nitrate			$20	/each	$180
6 Field Parameters			$20	/each	$120
Supplies			$500	lump sum	$500
Travel			$400	lump sum	$400
Per Diem	5	days x	$88	/day	$440
Data Management	25	hours x	$60	/hr	$1,500
Data Validation	20	hours x	$60	/hr	$1,200
Reporting/Project Management Labor					
Word Processing	8	hours x	$25	/hour	$200
CADD	10	hours x	$50	/hour	$500
Reproduction	8	hours x	$20	/hour	$160
Staff Level	40	hours x	$60	/hour	$2,400
Proj. Manager	20	hours x	$80	/hour	$1,600
Editor	5	hours x	$60	/hour	$300
Reporting/Project Management ODCs			$400	lump sum	$400
			Total for 1 Sampling Event		$15,096

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Summary of Capital and Present Worth Costs

Capital Costs

Design/Construct 1 LTM Well in 1999		$7,141	
P/F i=7% n=1	Total Present Worth Cost		$6,674

Monitoring Costs

Biannual Monitoring of 6 wells, 1999-2003 (10 events)

Cost per Event		$15,206
P/A i=7%, n=0.5	1999	$14,700.20
P/A i=7%, n=1.0	1999	$14,211.21
P/A i=7%, n=1.5	2000	$13,738.50
P/A i=7%, n=2.0	2000	$13,281.51
P/A i=7%, n=2.5	2001	$12,839.72
P/A i=7%, n=3.0	2001	$12,412.63
P/A i=7%, n=3.5	2002	$11,999.74
P/A i=7%, n=4.0	2002	$11,600.58
P/A i=7%, n=4.5	2003	$11,214.71
P/A i=7%, n=5.0	2003	$10,841.67
Total Present Worth Cost		$126,840

Biennial Monitoring of 6 wells, 2005-2029 (13 events)

Cost per Event		$15,096
P/A i=7%, n=7	2005	$9,401.03
P/A i=7%, n=9	2007	$8,211.22
P/A i=7%, n=11	2009	$7,172.00
P/A i=7%, n=13	2011	$6,264.30
P/A i=7%, n=15	2013	$5,471.49
P/A i=7%, n=17	2015	$4,779.01
P/A i=7%, n=19	2017	$4,174.17
P/A i=7%, n=21	2019	$3,645.88
P/A i=7%, n=23	2021	$3,184.45
P/A i=7%, n=25	2023	$2,781.43
P/A i=7%, n=27	2025	$2,429.40
P/A i=7%, n=29	2027	$2,121.94
P/A i=7%, n=31	2029	$1,853.38
Total Present Worth Cost		$61,490

Site Management every year (30 years)

Annual Cost	$6,000	
P/A i=7% n=30	PWF = 12.4090412	
Present Worth Cost		$74,454

Total Capital and Present Worth Costs of LTM Program $269,458

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Capital Costs

Biosparging Pilot Test Performance					
Pilot Test Workplan					$5,000
Pilot Test Kit Rental (blower, accessories, etc.)	5 days x	$500	/day		$2,500
Labor	112 hours	$70	/hour		$7,840
Per Diem	14 days	$88	/day		$1,232
Mob/Demob/Data Analysis	100 hours	$70	/hour		$7,000
Travel (1 tround trip from Denver @ $1500 and one trip from Atlanta @ $200)		$1,700	lump sum		$1,700
Misc. Supplies			lump sum		$1,000
Contingency (10%)					$2,627
				Subtotal	$28,899
Installation of the Biosparging System					
# biosparging wells = 25					
Design/Procure/Install System	700 hours x	$70	/hour		$49,000
Blower, accessories, etc.		$5,000	lump sum		$5,000
Asphalt Cutting/ Well point Installation/trenching		$10,000	lump sum		$10,000
Electrical Subcontractor		$5,000	lump sum		$5,000
Per Diem	30 days x	$88	/day		$2,640
Travel		$2,000	lump sum		$2,000
Geoprobe Rental (2 weeks)		$4,000	lump sum		$4,000
O & M Manual Preparation	90 hours x	$60	/hour		$5,400
Contingency (10%)					$8,304
				Subtotal	$91,344
Installation of 2 SVE wells and tie-in to existing SVE System					
Design/Install SVE wells	130 hours x	$70	/hour		$9,100
Asphalt Cutting/ Tie-in to existing system		$2,500	lump sum		$2,500
Electrical Subcontractor (included with biosparging system above)					$0
Per Diem	10 days x	$88	/day		$880
Travel		$1,500	lump sum		$1,500
O & M Manual Preparation	40 hours x	$60	/hour		$2,400
Contingency (10%)					$1,638
				Subtotal	$18,018

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Future Costs

Confirmatory Soil Sampling at 6 Locations (after 3 years of treatment)

12 Soil Samples
5 QA/QC
17 Total Samples

Sampling Labor	60 hours x	$60	/hour	$3,600
Analytical Subcontractor				
17 BTEX		$108	/each	$1,836
17 naphthalene		$101	/each	$1,717
17 TRPH		$60	/each	$1,020
Geoprobe Rental	2 days x	$500	/day	$1,000
Supplies		$500	lump sum	$500
Travel		$1,500	lump sum	$1,500
Per Diem	4 days x	$88	day	$352
Office ODC		$300	lump sum	$300
Contingency (10%)				$1,183
			Total Future Cost	$13,008

Annual and Operational Costs (3 years of system operation)

Operation and Maintenance of the Biosparging/SVE System -1 trip per month

System Monitoring				
Monitoring Labor	180 hours x	$60	/hour	$10,800
Travel		$1,200	lump sum	$1,200
Per Diem	12 days x	$88	/day	$1,056
Equipment Rental		$1,200	lump sum	$1,200
Electrical Usage		$4,000	lump sum	$4,000
			Annual O&M Cost	$18,256

Soil Gas Sampling/ Respiration Testing at 6 Locations - Annually

Soil Gas Analysis (EPA TO-3)	6 samples x	$130	/sample	$780
Sampling Labor	64 hours x	$60	/hour	$3,840
Sample Shipping		$250	lump sum	$250
Per Diem	8 days x	$88	/day	$704
Travel		$200	lump sum	$200
Equipment Rental (Meters)		$500	lump sum	$500
Progress Report	20 hours x	$70	/hour	$1,400
Contingency (10%)				$767
			Subtotal	$8,441

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Summary of Capital Costs

Biosparging System Pilot Test		$28,899
Installation of 25 Biosparging Wells and Biosparging System		$91,344
Installation of 2 SVE wells and tie-in to existing SVE System		$18,018
	Total Capital Costs =	$138,261

Summary of Future Costs

Confirmation Soil Sampling (after 3 years of system operation)		Cost $13,008	
P/F I=7%, n=4		**Present Worth of Future Costs =**	$9,923.36

Summary of Annual Costs

Operation & Maintenance of Biosparging/SVE System (3 years)		Annual Cost $18,256	
P/A i=7%, n=3	PWF = 2.62432	Present Worth Cost	$47,910
Soil Gas Sampling Annually (3 years)		Annual Cost $8,441	
P/A i=7%, n=3	PWF = 2.62432	Present Worth Cost	$22,153
		Total Present Worth of Annual Costs =	$70,062

LTM Plan (from Alternative 1)	**Total Present Worth of LTM Program =**	$269,458
	Total Cost Estimate of Alternative 2 =	$487,705

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				Seventh Street Service Station, Eglin AFB, FL

Capital Costs

Installation of 2 SVE Wells and Tie-in to Existing System

Design/Install Wells	130 hours x	$70	/hour	$9,100
Asphalt Cutting/ Tie-in to existing system		$2,500	lump sum	$2,500
Electrical Subcontractor		$2,500	lump sum	$2,500
Per Diem	10 days x	$88	/day	$880
Travel		$1,500	lump sum	$1,500
O & M Manual Preparation	40 hours x	$60	/hour	$2,400
Contingency (10%)				$1,888
			Subtotal	$20,768

Installation of 3 Recovery Wells and Tie-in to Existing System

Labor--Design, Procure, Construct three 4-inch wells	300 hours x	$70	/hour	$21,000
Drilling Subcontractor	50 feet x	$70	linear foot	$3,500
Drums	10 drums	$35	each	$350
Drum Staging	2 hours x	$100	/hour	$200
Pumps	3 pumps	$1,000	each	$3,000
System Controls	1	$4,500	lump sum	$4,500
Asphalt Cutting/ Tie-in to existing system		$2,000	lump sum	$2,000
Per Diem in Field	24 days	$88	/day	$2,112
Travel	1	$1,500	lump sum	$1,500
Electrical Subcontractor	1	$6,000	lump sum	$6,000
Contingency (10%)				$4,416
			Subtotal	$48,578

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	10/1/98	CMN	JRH	RNA + LTM + Groundwater Extraction + Bioventing
				Seventh Street Service Station, Eglin AFB, FL

Future Costs

Confirmatory Soil Sampling at 4 Locations

8 Soil Samples
1 QA/QC
9 Total Samples

Sampling Labor	80 hours x	$60	/hour		$4,800
Analytical Subcontractor	9 BTEX	$85	/each		$765
	9 Naphthal	$240	/each		$2,160
	9 TRPH	$60	/each		$540
Geoprobe Rental	2 days x	$500	/day		$1,000
Supplies		$500	lump sum		$500
Travel		$1,500	lump sum		$1,500
Per Diem	4 days x	$88	day		$352
Office ODC		$300	lump sum		$300
Contingency (10%)					$1,192
				Subtotal	$13,109

Annual Operating Costs (3 years of system operation)

Operation and Maintenance--GW Pump-and-Treat and SVE Systems

Labor--	Weekly System Checks (4 hr x 52 wk/yr x $60/hr)				$12,480
	Monthly Sampling (12 hr x 12 mo x $60/hr)				$8,640
	Monthly Reporting (12 hr x 12 mo x $60/hr)				$8,640
	Maintenance (12 hr x 12 mo x $60/hr)				$8,640
Analytical--	BTEX	4 /month x	12 months x	$55 /each	$2,640
	Naphthalene	4 /month x	12 months x	$101 /each	$4,848
Per Diem			18 days x	$88 /day	$1,584
Travel			12 trips x	$100 /trip	$1,200
Equipment Replacement					$5,000
Electricity					$5,000
Contingency (10%)					$5,867.20
				Subtotal	$64,539

Soil Gas Sampling/Respiration Testing at 6 Locations - Annually

Soil Gas Analysis (EPA TO-3)	6 samples x	$130	/sample	$780
Sampling Labor	64 hours x	$60	/hour	$3,840
Sample Shipping		$250	lump sum	$250
Per Diem	8 days x	$88	/day	$704
Travel		$1,500	lump sum	$1,500
Equipment Rental (Meters)		$500	lump sum	$500
Progress Report	20 hours x	$70	/hour	$1,400
Contingency (10%)				$897.40
			Subtotal	$9,871

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Summary of Capital Costs

Installation of 2 SVE Wells and Tie-in to Existing System		$20,768
Installation of 3 Recovery Wells and Tie-in to Existing System		$48,578
	Total Capital Costs =	$69,346

Summary of Future Costs

Confirmatory Soil Sampling (after 3 years of system operation)		Cost	$13,109
P/F I=7%, n=4	**Total Present Worth of Future Costs =**		$10,001

Summary of Annual Costs

O&M for GW and SVE systems (3 years)		Annual Cost $64,539	
P/A i=7%, n=3	PWF = 2.624316	Present Worth Cost	$169,371
Soil Gas Sampling Annually for 3 years		Annual Cost $9,871	
P/A i=7%, n=3	PWF = 2.624316	Present Worth Cost	$25,906
	Total Present Worth of Annual Costs =		$195,277

LTM Plan (from Alternative 1)	**Total Present Worth of LTM Program =**	$269,458

Total Cost Estimate of Proposed Corrective Action = $544,082