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CLOSURE REPORT FOR FIRE TRAINING AREA 2 WITH TRANSMITTAL LETTER NAS FORT WORTH TX
7/3/1997
CARSWELL AIR FORCE BASE

File: 17G
A.F.

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NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 355

File:
A.F. 17B-9
335 325

CLOSURE DOCUMENT FOR FIRE TRAINING AREA 2 (SWMUs 19, 20, AND 21) NAS JRB FORT WORTH, TX

HQ Air Force Center for Environmental Excellence
Brooks Air Force Base, Texas 78235-3528

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Closure Document for Fire Training Area 2 (SWMUs 19, 20, & 21) NAS JRB Fort Worth, TX

DEPARTMENT OF THE AIR FORCE
AIR FORCE BASE CONVERSION AGENCY

335 4

3 July 1997

MEMORANDUM FOR TNRCC
Industrial and Hazardous Waste Division
Attn: Mr. Mark Weegar
Park 35 Circle, Bldg D, MC 127
12015 N. IH-35
Austin, TX 78753

FROM: AFBCA DC Carswell
6550 White Settlement Road
Fort Worth, TX 76114-3520

SUBJECT: Closure of Fire Training Area 2 (SWMU's 19, 20, 21), Naval Air Station Joint Reserve Base, Ft. Worth (NAS JRB Ft. Worth)

This letter report is provided in support of closure of the referenced site under the Texas Natural Resources Conservation Commission (TNRCC) Risk Reduction Standard Number 2 (RRSN 2) as promulgated under Subpart S, Risk Reduction Standards, Sections 335.551 through 335.569 of Title 30, Texas Administrative Codes. This site has been remediated to health-based standards, and all waste, waste residue, leachate, and contaminated media decontaminated or controlled to regulated standards and criteria such that any substantial present or future threat to human health or the environment is eliminated or reduced to the maximum extent practicable.

The RRSN 2 regulations require characterization of the nature and extent of contamination, evaluation of the potential for constituent migration, and calculation of proposed media cleanup levels. The nature, extent, direction of movement, volume, and composition of contamination has been described in previous investigative reports. Applicable portions of the Remedial Investigation/Feasibility Study Report by Radian Corporation (Radian), the Remedial Investigation Report by Dames and Moore, and the Law Environmental, Inc. (Law) Final Site Characterization/Risk Assessment Report are provided as attachments to document efforts undertaken by the Air Force to close this site.

The potential for constituent migration is minimal. The site was excavated to a depth of 3 feet and contaminated soil was removed. Remediated surface soils at the site are covered with grass and graded to drain away from the Fire Training Area (FTA) 2 area. A low permeability clay liner is in place beneath the bioremediated soils, which should retard the downward movement of rainwater and prevent percolation into the underlying soils (Law 1996). Ground water and

subsurface soils are not media of concern at the FTA 2 site. As described above, no contaminants are likely to leach into the ground water due to the clay layer. A ground-water remediation system and phytoremediation system are currently in place down-gradient of FTA 2 to remove trichloroethene (TCE) from the uppermost aquifer in the vicinity of AF Plant 4. Constituents of concern in subsurface soils at FTA 2 are not a concern for exposure to receptors, provided that deed restrictions are established to prevent soil excavation. No other viable pathways involving subsurface soil exist.

Post-remediation verification sampling performed by Law indicated that benzene, toluene, ethylbenzene, and xylene (BTEX) isomers in the surface soil were below detection limits after remediation. No semivolatile organic compound (SVOC) analyses or metal analyses were conducted during the verification sampling; however, no pathways exist for contaminants to reach receptors. In order for contaminants to pose a threat to human health or the environment, a pathway must be present for the contaminant to reach the receptor. A pathway is composed of four elements: source, transport medium, point of receptor contact, and exposure route. Incomplete pathways, without all four elements, should be eliminated from further consideration.

A baseline risk assessment addressing the surface soils and their proposed media cleanup levels was conducted by Law (1996) and supports closure based on the following:

- Cross-media contamination from surface soil to air or soil to surface water is unlikely because surface soils have been remediated, soils are covered by grass, and FTA 2 is graded to encourage runoff.
- Cross-media contamination from subsurface soil to ground water is unlikely because of the presence of a low permeability clay liner and the grading of FTA 2.
- Constituents of concern in subsurface soils at FTA 2 are not an exposure concern provided that deed restrictions are established to prevent soil excavation.

The ultimate end use of the site is as an airport taxiway that will continue to be a restricted area with limited access. In the case of surface soils, any concentration above media-specific concentrations (MSCs) are controlled at the site. No pathways for human exposure exist because the site is restricted, has a clay cap, and is graded to encourage surface run-off instead of infiltration.

Using the most plausible exposure scenario of inhalation of contaminant vapors emanating from the soil by a groundskeeper mowing grass, the maximum carcinogenic and noncarcinogenic risks were calculated as 3×10^{-6} and 0.03, respectively. In addition, the assessment concluded that the ground-water

remediation system activated in 1994 and the clay liner installed in 1995 are sufficient to prevent migration of contaminants in the soil to the ground water and any receptors. Deed restrictions/certifications have been filed and are attached.

Based on the above discussion, no further action is recommended for the FTA 2. If you have need of further information in this matter, please contact me at (817) 731-8284 or Mr. Charles Rice at (210) 536-6452.

Olen Long, GM-13
Installation Management Officer

1 Atch
Closure Documentation for FTA-02, Carswell AFB

cc: See Distribution

ENCLOSURE 1:

STATE OF TEXAS

335 7

TARRANT COUNTY Industrial Solid Waste
Certification of Remediation

KNOW ALL MEN BY THESE PRESENTS THAT:

Pursuant to the rules of the Texas Natural Resource Conservation Commission pertaining to Industrial Solid Waste Management, this document is hereby filed in the Deed Records of Tarrant County, Texas in compliance with the recordation requirements of said rules:

I

Naval Air Station Joint Reserve Base, Ft. Worth, (NAS JRB Ft. Worth) formally Carswell Air Force Base has performed a remediation of the land described herein. A copy of the **Solid Waste Registration 65004, including a description of the facility, is attached hereto** and is made part of this filling. A list of the known waste constituents, including known concentrations (i.e., soil and ground water, if applicable), which have been left in place is attached hereto and is made part of this filing. Further information concerning this matter may be found by an examination of company records or in the Solid Waste Registration 65004 files, which are available for inspection upon request at the central office of the Texas Natural Resource Conservation Commission in Austin, Texas.

The Texas Natural Resource Conservation Commission derives its authority to review the remediation of this tract of land from the Texas Solid Waste Disposal Act ♣361.002, Texas Health and Safety Code, Chapter 361, which enables the Texas Natural Resource Conservation Commission to promulgate closure and remediation standards to safeguard the heath, welfare and physical property of the people of the State and to protect the environment by controlling the management of solid waste. In addition pursuant to the Texas Water Code ♣5.012 and ♣5.013, Texas Water Code, Annotated, Chapter 5, the Texas Natural Resource Conservation Commission is given primary responsibility for implementing the laws of the State of Texas relating to water and shall adopt any rules necessary to carry out its powers and duties under the Texas Water Code. In accordance with this authority, the Texas Natural Resource Conservation Commission requires certain persons to provide certification and/or recordation in the real property records to notify the public of the conditions of the land and/or the occurrence of remediation. This deed certification is not a representation or warranty by the Texas Natural Resource Conservation Commission of the suitability of this land for any purpose, nor does it constitute any guarantee by the Texas Natural Resource Conservation Commission that the remediation standards specified in this certification have been met by NAS JRB Ft. Worth.

II

Being a 2.01 acre tract, more or less, out of The J.M. SHREEVE SURVEY A-1456 TARRANT COUNTY TEXAS:

COMMENCING AT THE SOUTH WEST CORNER OF THE JOINT RESERVE BASE CARSWELL FIELD. SAID COMMENCING POINT BEING A CORPS OF ENGINEER'S MONUMENT BRASS DISK IN CONCRETE AND MARKED 106.
THENCE NORTH 4912.57'
THENCE EAST 2714.51' TO THE POINT BEGINNING.
BEGINNING AT THE SOUTH WEST CORNER OF THE FT-02(FIRE TRAINING AREA)
TRACT SITUATED IN THE JOINT RESERVE BASE AT CARSWELL FIELD.
THENCE: N86°35'51"E A DISTANCE OF 333.72' TO A POINT.
THENCE: NOO♦07'48"W A DISTANCE OF 249.12' TO A POINT.
THENCE: N88♦35'27"W A DISTANCE OF 331.64' TO A POINT.
THENCE: SOO♦12'42"W A DISTANCE OF 277.10' TO THE POINT OF BEGINING
AND CONTAINING 2.01 ACRES OF 87,439 SQ. FEET MORE OR LESS

For Standard 2 cleanups: Contaminants and waste deposited hereon have been remediated to meet non-residential (i.e., industrial/commercial) soil criteria, in accordance with a plan designed to meet the Texas Natural Resource Conservation Commission's requirements in 30 Texas Administrative Code ♣335.555), which mandates that the remedy be designed to eliminate substantial present and future risk such that no post-closure care or engineering or institutional control measures are required to protect human health and the environment. Future land use is considered suitable for non-residential (i.e., industrial/commercial) purposes in accordance with risk reduction standards applicable at the time of this filing. Future land use is intended to be non-residential.

III

The owner of the site is **NAS JRB Ft. Worth**, and its address is **301st Fighter Wing, 1654 Lyons Drive Fort Worth, Texas 76127-6200**, where more specific information may be obtained from the **Installation Management Officer.**

EXECUTED this the 9 day of July, 1997

(NAS JRB Ft. Worth)

Mr. Olen R. Long
Installation Management Officer

STATE OF TEXAS
(TRRANT) COUNTY

BEFORE ME, on this the 9th day of July, 1997, personally appeared of Naval Air Station Joint Reserve Base Ft. Worth Federal Facility, known to me to be the person and agent of said corporation whose name is subscribed to the foregoing instrument, and he acknowledged to me that he executed the same for the purposes and in the capacity therein expressed.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, this the 9th of the July, 1997

Ronald J. Surprenant
Notary Public in and for the State of Texas, County of Tarrant

10-28-98
My Commission Expires

RONALD J. SURPRENANT
NOTARY PUBLIC
State of Texas
Comm. Exp. 10-28-98

FT-02 (FIRE TRAINING AREA)
DESCRIPTION

PROPERTY DESCRIPTION:

BEING A 2.01 ACRE TRACT SITUATED IN THE J.M. SHREEVE SURVEY A-1456 TARRANT COUNTY TEXAS .

COMMENCING AT THE SOUTH WEST CORNER OF THE JOINT RESERVE BASE CARSWELL FIELD. SAID COMMENCING POINT BEING A CORPS OF ENGINEER'S MONUMENT BRASS DISK IN CONCRETE AND MARKED 106.

THENCE NORTH 4912.57'

THENCE EAST 2714.51' TO THE POINT OF BEGINNING.

BEGINNING AT THE SOUTH WEST CORNER OF THE FT-02(FIRE TRAINING AREA) TRACT SITUATED IN THE JOINT RESERVE BASE AT CARSWELL FIELD.

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THENCE: N88°35'27"W A DISTANCE OF 331.64' TO A POINT.

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AND CONTAINING 2.01 ACRES OF 87,439 SQ.FEET MORE OR LESS

DUNAWAY ASSOCIATES, Inc.
ENGINEERS - PLANNERS - SURVEYORS
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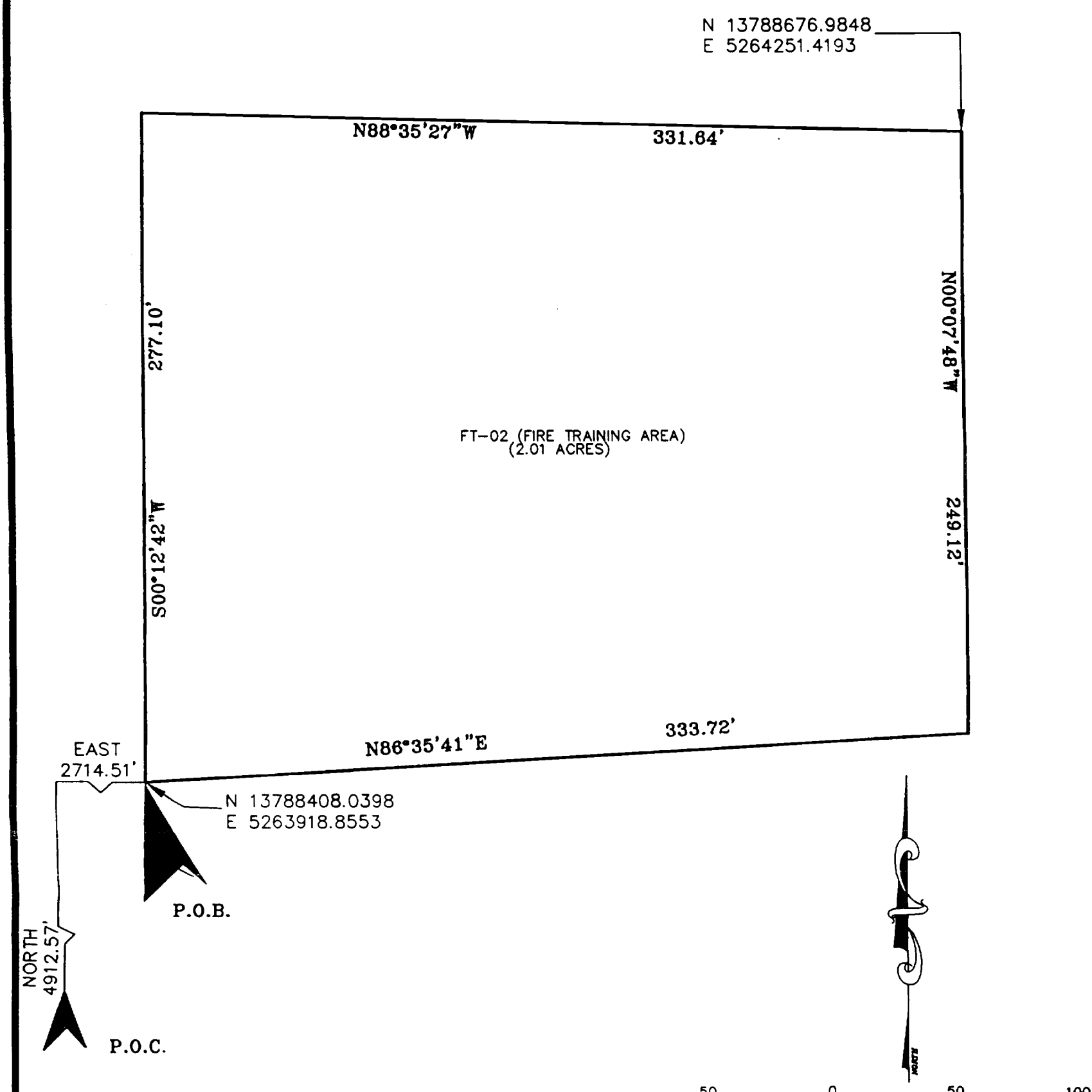

PROPERTY DESCRIPTION:

BEING A 2.01 ACRE TRACT SITUATED IN THE J.M. SHREEVE SURVEY A-1456 TARRANT COUNTY TEXAS .

COMMENCING AT THE SOUTH WEST CORNER OF THE JOINT RESERVE BASE CARSWELL FIELD. SAID COMMENCING POINT BEING A CORPS OF ENGINEER'S MONUMENT BRASS DISK IN CONCRETE AND MARKED 106.

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AND CONTAINING 2.01 ACRES OF 87,439 SQ.FEET MORE OR LESS.

AN EXHIBIT SHOWING A 2.01 ACRE TRACT AT

THE JOINT RESERVE BASE AT CARSWELL FIELD

DUNAWAY ASSOCIATES, Inc

ENGINEERS - PLANNERS - SURVEYORS
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FORT WORTH, TEXAS 76107
PH.(817)335-1121 METRO(817)429-2135
FAX(817)336-7437

TAB

1

Final Site Characterization/Risk Assessment Technical Report Law Engineering, Inc.

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

May 1, 1996

Mr. Charles A. Rice, Team Chief
Air Force Center for Environmental Excellence
HQ AFCEE/ERB
3207 North Road, Building 532
Brooks Air Force Base, TX 78235-5363

Subject: **Final Site Characterization/Risk Assessment Technical Report for Fire Training Area 2 Naval Air Station Fort Worth Joint Reserve Base, Carswell Field Contract No. F41624-94-D-8050, Delivery Order No. 0009**

Dear Mr. Rice:

Law Environmental, Inc., is pleased to submit the enclosed nine copies of the Final Site Characterization/Risk Assessment Report for Fire Training Area 2 to the Air Force Center for Environmental Excellence (AFCEE).

If you have questions or comments, please contact us at (770) 499-6800.

Sincerely,

LAW ENVIRONMENTAL, INC.

James R. Forbes, P.E.
Project Manager

E. Fred Sharpe, Jr., P.E.
Principal

JRF/EFS:dcl

3517-3209.28

GOVERNMENT SERVICES DIVISION
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ONE OF THE LAW COMPANIES

REPORT DOCUMENTATION PAGE

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SITE CHARACTERIZATION/RISK ASSESSMENT TECHNICAL REPORT
FOR FIRE TRAINING AREA 2

5. FUNDING NUMBERS
CONTRACT NO.
F41624-94-D-8050

6. AUTHOR(S)
LAW ENVIRONMENTAL, INC. (LAW)

7. PERFORMANCE ORGANIZATION NAME(S) AND ADDRESS(ES)
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8. PERFORMING ORGANIZATION REPORT NUMBER
(N/A)

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BASE RESTORATION DIVISION
BROOKS AFB, TEXAS 78235-5363

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LAW ENVIRONMENTAL, INC. (LAW), UNDER THE AIR FORCE INSTALLATION RESTORATION PROGRAM (IRP), HAS PREPARED A SITE CHARACTERIZATION/RISK ASSESSMENT TECHNICAL REPORT FOR FIRE TRAINING AREA NUMBER 2 AT THE NAVAL AIR STATION FORT WORTH JOINT RESERVE BASE, CARSWELL FIELD.

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INSTALLATION RESTORATION PROGRAM (IRP)
FINAL SITE CHARACTERIZATION/RISK ASSESSMENT TECHNICAL REPORT
FIRE TRAINING AREA 2

FOR

NAVAL AIR STATION FORT WORTH
JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

APRIL 1996

Prepared by:

Law Environmental, Inc.
114 TownPark Drive
Kennesaw, Georgia 30144

United States Air Force
Air Force Center for Environmental Excellence (AFCEE/ERB)
Brooks Air Force Base, Texas 78235-5363

Contract No. F41624-94-D-8050
Delivery Order 0009

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This report has been prepared for the United States Air Force by Law Environmental, Inc., (LAW) for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP). As the report relates to actual or possible releases of potentially hazardous substances, its release prior to an Air Force final decision on remedial action may be in the public's interest. The limited objectives associated with this assessment and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and human health, must be considered when evaluating this document. Also, subsequent facts may become known which may make this document premature or inaccurate. Acceptance of this document in performance of the contract under which it is prepared does not mean that the United States Air Force adopts the conclusions, recommendations or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
cm^2	square centimeters
COPCs	constituents of potential concern
FTA-2	Fire Training Area 2
GWP-Ind	Ground-Water Protection Standard for Industrial Use
LAW	Law Environmental, Inc.
mg/day	milligrams per day
mg/kg	milligrams per kilogram
MSCs	media-specific concentrations
ppm	parts per million
RAGS	Risk Assessment Guidance for Superfund
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
RRS	Risk Reduction Standard
SAI-Ind	Soil/Air and Ingestion Standard for Industrial Use
SF	Slope Factor
SWMU	solid waste management unit
TAC	Texas Administrative Codes
TCE	trichloroethene
THI	target hazard index
TNRCC	Texas Natural Resources Conservation Commission
TPH	total petroleum hydrocarbon
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

Law Environmental, Inc. (LAW) has been contracted by the United States Air Force Center for Environmental Excellence (AFCEE) to perform environmental investigations at the Naval Air Station Fort Worth Joint Reserve Base, Carswell Field. This facility, formerly known as Carswell Air Force Base (AFB), is located in Fort Worth, Texas.

The purpose of this report is to provide a site characterization/risk assessment in support of closure for contaminated soils at Solid Waste Management Unit 19 (SWMU 19), Fire Training Area 2 (FTA-2). The primary focus of this report is soils because a ground-water remediation system is currently in place downgradient of the FTA-2.

This report uses data from the Remedial Investigation/Feasibility Study conducted by Radian Corporation in 1988, and remediation activities conducted by Dames & Moore in 1995. Near-surface soils from the FTA-2 were excavated and bioremediated by Dames & Moore. Also, before the remediated soils were returned to the excavation, a low permeability compacted clay liner was placed over subsurface soils to prevent infiltration of rainwater and generation of leachate. Finally, the FTA-2 was graded to a gentle slope to encourage runoff, and the surface was seeded with grass.

A conceptual site model was prepared and an exposure assessment was conducted to evaluate pathways for exposure under current and potential future conditions. A plausible scenario for exposure was deemed to be exposure to a groundskeeper during mowing of the grass that covers the FTA-2. It was determined that there is currently no plausible exposure pathway for exposure to subsurface soil, and future exposures can be prevented by the use of deed restrictions. Exposure to ground water was not considered because it is believed that the impermeable clay liner at the FTA-2 prevents percolating rainwater from reaching the contaminated subsurface soils.

A baseline risk assessment was prepared to evaluate the potential risk to groundskeepers potentially exposed to surface soil. Using reasonable maximum exposure assumptions, the estimated carcinogenic and noncarcinogenic risks did not exceed threshold levels.

In accordance with the Texas Natural Resource Conservation Commission's Risk Reduction Standard (RRS) 3, media cleanup levels were calculated for surface soil using a target risk range of 1×10^{-5} for carcinogens, and a threshold level of one for noncarcinogens. The concentrations of constituents detected in surface soils by previous investigations at the FTA-2 were all below the calculated media cleanup levels.

This document shows that, using RRS 3, closure with no additional removal is appropriate since:

- Concentrations of constituents in surface soil do not exceed media cleanup levels.
- Cross-media contamination from surface soil to air or soil to surface water is unlikely because surface soils have been remediated, soils are covered by grass, and the FTA-2 is graded to encourage runoff.
- Cross-media contamination from subsurface soil to ground water is unlikely because of the low permeability clay liner in place and the grading of the FTA-2.
- Constituents of concern in subsurface soils at the FTA-2 are not a concern for exposure to receptors provided that deed restrictions are established to prevent soil excavation.

1.0 INTRODUCTION

Law Environmental, Inc., (LAW) has been contracted by the United States Air Force Center for Environmental Excellence (AFCEE) to perform environmental investigations at the Naval Air Station Fort Worth Joint Reserve Base, Carswell Field (NAS Fort Worth). This facility, formerly known as Carswell Air Force Base (AFB), is located in Fort Worth, Texas.

1.1 PURPOSE OF REPORT

The purpose of this report is to provide a site characterization/risk assessment in support of closure for contaminated soils at Solid Waste Management Unit 19 (SWMU 19), Fire Training Area 2 (FTA-2). The primary focus of this report is soils because a ground-water remediation system is currently in place downgradient of the FTA-2. The ground-water extraction and treatment system is designed to remove trichloroethene (TCE) in the uppermost aquifer in the Terrace Alluvium Deposits (IT, 1994).

This report has been prepared in accordance with Title 31, Texas Administrative Codes (TAC), Sections 335.551 through 335.569 (Subchapter S, Risk Reduction Standards). Based on the currently available site information it appears that the most applicable standard is Risk Reduction Standard (RRS) 3. Data included in this report show that constituents in environmental media at the site exceed the levels set for RRS 2. The requirements of RRS 3 call for a discussion of the nature and extent of contamination, an evaluation of the potential for constituent migration, a baseline risk assessment, and calculation of proposed media cleanup levels. The nature and extent of contamination has been described in reports by previous investigators, as presented in Section 1.2.

1.2 BACKGROUND INFORMATION

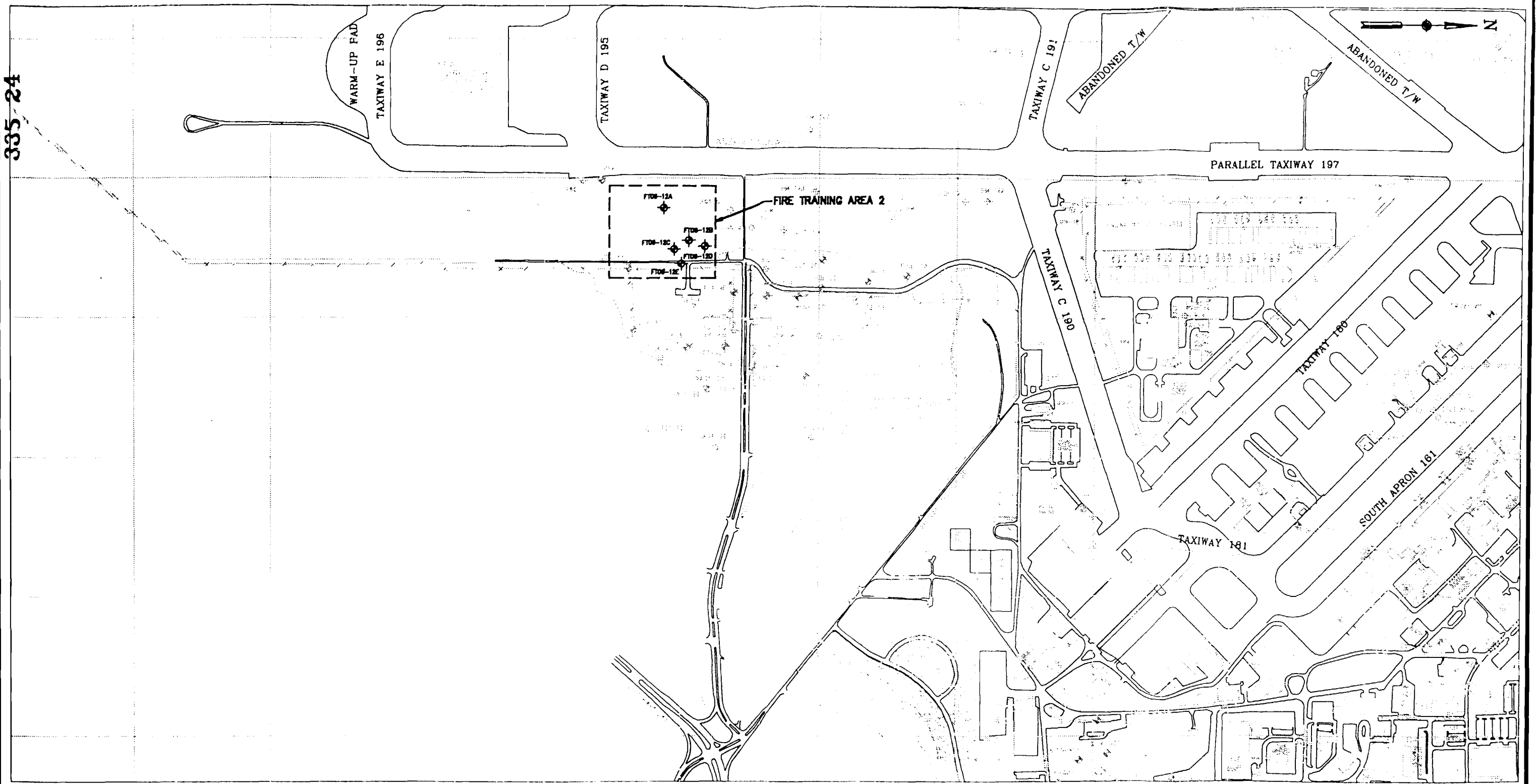
SWMU 19 consists of the FTA-2, which was used by the fire department for training exercises to simulate an aircraft fire. The FTA-2 consists of an oval area that originally included two

berms. The outer berm was constructed of a clayey soil. It was approximately 2 feet high, about 260 feet in diameter, and enclosed an area of approximately 1.2 acres. The inner berm was also 2 feet high and was also constructed of a clayey soil. The approximate diameter of the inner berm was 120 feet, and the total area was 0.25 acre (Dames & Moore, 1995). The location of the FTA-2 is shown on Figure 1-1.

The nature, extent, direction of movement, volume, and composition of environmental contaminants have been previously described by Radian Corporation and documented in their remedial investigation/feasibility study (RI/FS) report dated April 1989. Environmental investigations completed at the SWMU included installation of five ground-water monitoring wells and five separate soil borings by Radian Corporation. The results of soil samples indicated that volatile and semi-volatile petroleum hydrocarbons were the major constituents of concern in soil. Total petroleum hydrocarbon (TPH) concentrations in soil ranged from below detection limit to 5,790 ppm at the 19-foot sand layer. Benzene, toluene, ethylbenzene, and xylene(s) (BTEX) concentrations ranged from below detection limit to 47 ppm. Semi-volatiles in soil ranged from below detection limit to 17 ppm. In addition, trichloroethene (TCE) was detected in ground water in the upper zone of the aquifer, primarily downgradient of the FTA-2 (Radian, 1989). Dames & Moore conducted remediation activities at the SWMU consisting of bioremediation of the top 3 feet of soil (Dames & Moore, 1995). The near-surface soils from the FTA-2 were excavated and treated by bioremediation on what was called a "biocell." Following treatment, BTEX constituents were below the detection limit, and total petroleum hydrocarbons (TPH) were less than 100 parts per million (ppm) using EPA method 8000, which is specific for fuel constituents. The detection limits were not reported. A 32-inch thick low permeability compacted clay liner was placed on the bottom of the excavation at the FTA-2, and the bioremediated soil was returned to the excavation. The final elevation of the FTA-2 was contoured to facilitate run-off of rainwater, and the site was seeded with grass to prevent erosion.

According to the contractor that collected the referenced data, the sand layer is not saturated at boring location 12H (where the maximum TPH was detected). In their RI/FS Stage 2, Draft

335-24



0 700 1400
SCALE IN FEET

NAVAL AIR STATION
FORT WORTH JOINT RESERVE BASE
FORT WORTH, TEXAS

RISK ASSESSMENT TECHNICAL REPORT
FIRE TRAINING AREA 2

SITE LOCATION MAP

PREPARED BY:	DSS	FIGURE NUMBER: 1-1	FILE DATE:	30.OCT.95
CHECKED BY:	JRF		PLOT DATE:	30.OCT.95
PROJECT NO.	11-3517-3209		FILE NAME:	SITE-LOC.DWG

Final Technical Report, Radian states that "Ground water occurs in the upper zone materials underlying Site 12 at depths ranging from 15 feet at 12A to 30 feet at 12B and 12C. The ground water exists under unconfined (water table) condition in the upper zone materials. However, observation during drilling of several boreholes (12G, 12H, and 12J) indicates that the upper zone is locally dry (Radian, 1989)." A review of Radian's boring logs for boreholes 12I and 12K shows that water was not encountered at either location. Boring 12I was terminated at 24 feet in limestone and 12K was terminated at 25 feet in the sand layer. This information suggests that the sand layer is not part of a potential ground-water pathway.

2.0 BASELINE RISK ASSESSMENT

The approach taken to assess risk at the site is in accordance with the Texas Natural Resources Conservation Commission (TNRCC) RRS 3, and the U.S. Environmental Protection Agency's (USEPA) Risk Assessment Guidance for Superfund (RAGS), (USEPA, 1989a). The approach consists of the following steps:

1. Identification of constituents of potential concern (COPCs)

2. Evaluation of potential for cross-media migration

3. Exposure assessment

   - Identification of potential exposure pathways
   - Estimation of exposure point concentrations
   - Estimation of long-term daily intake values

4. Toxicity assessment

   - Identification of critical toxicity values

5. Risk characterization

   - Estimation of risk taking into account the site-specific exposure assessment and chemical-specific toxicity assessment

6. Development and comparison of RRS 3 media-specific cleanup levels to site-specific analytical data

7. Discussion of assumptions and uncertainty

Following the risk assessment, the proposed media-specific cleanup levels are presented for both surface soil and ground water.

2.1 IDENTIFICATION OF CONSTITUENTS OF POTENTIAL CONCERN

This section presents a brief review of analytical results of previous investigations. It is LAW's understanding that a comprehensive basewide background study to characterize concentrations

of naturally occurring constituents at Carswell Field is planned for fiscal year 1996. Because background concentrations are not available at this time, COPCs are considered to be those constituents which were detected by laboratory analyses. In characterizing the site, COPCs were compared to the Media-Specific Concentrations (MSCs) for nonresidential land use established under RRS 2. The MSCs for soil consist of the Ground-Water Protection Standard (GWP-Ind) for industrial use of soil, and the Soil/Air and Ingestion Standard for industrial use (SAI-Ind). The GWP-Ind is the concentration of a contaminant in soil that is assumed to be protective of ground water considering cross-media contamination from soil. Constituents in ground water are not discussed in this report because (as discussed below) soils at the FTA-2 are unlikely to impact ground water under current conditions, and ground water is under remediation downgradient of the site. The SAI-Ind is the concentration of a contaminant in soil that is protective of human health for exposure by ingestion of soils and inhalation of volatiles and particulates.

2.1.1 Surface Soils

In 1994, soils from 0 to 3 feet were subjected to bioremediation by Dames & Moore. The biocell verification sampling conducted by Dames & Moore shows that BTEX isomers were below the detection limits (Dames & Moore, 1994). However, the bioremediated soils were not tested for metals or semi-volatile organic compounds. Therefore, historical data were evaluated to determine if concentrations of these constituents were above the TNRCC soil criteria for RRS 2. Radian Corporation collected samples from soil borings in and around the FTA-2 during their investigation. There was one sample that was representative of surface soils. Soil boring 12H from within the FTA-2 included the interval from 0 to 4 feet (Radian, 1989). Monitoring well and boring locations are shown in Figure 2-1. The metals arsenic, beryllium, cadmium, chromium, lead, and selenium exceeded their MSCs, as shown in Table 2-1.

TABLE 2-1

COMPARISON OF DETECTED SURFACE SOIL CONCENTRATIONS TO TYPE 2 MEDIUM SPECIFIC CONCENTRATIONS (mg/kg)
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Parameter	Maximum Detected Concentration (a) (mg/kg)	GWP-Ind (mg/kg)	SAI-Ind (mg/kg)
INORGANICS:			
Aluminum	13,000	NA	NA
Arsenic	***30***	5	3.27
Barium	86	200	137,000
Beryllium	***0.7***	0.4	1.33
Calcium	41,000	NA	NA
Cadmium	***0.6***	0.5	1,020
Cobalt	4.6	610	123,000
Chromium	***14***	10	5,110
Copper	3.4	130	75,800
Iron	12,000	NA	NA
Lead	***16***	1.5	1,000
Magnesium	1,700	NA	NA
Manganese	250	1,400	286,000
Nickel	10	10	20,400
Potassium	1,100	NA	NA
Selenium	***50***	5	10,200
Silicon	350	NA	NA
Sodium	74	NA	NA
Vanadium	30	72	14,300
Zinc	18	3,100	613,000
SEMI-VOLATILES:			
bis(2-Ethylhexyl)phthalate	0.53	2.04	409
Di-n-octyl phthalate	0.15	204	40,900
Dibenzofuran	0.17	0.409	8,176
2-Methylnaphthalene	8.7	41	81,760
4-Methylphenol	4.2	410	51,100
Naphthalene	3.9	409	7,720
Phenol	0.5	6,130	NA

GWP-Ind – Groundwater Protection Standard for Industrial Use.
SAI-Ind – Soil/Air and Ingestion Standard for Industrial Use.
Bold indicates the concentration exceeds the Type 2 Risk Reduction Standard for Soil.
NA – Not available.
(a) Sample 12H-1 (0 – 4 feet), collected February 23, 1988, by Radian Corporation.

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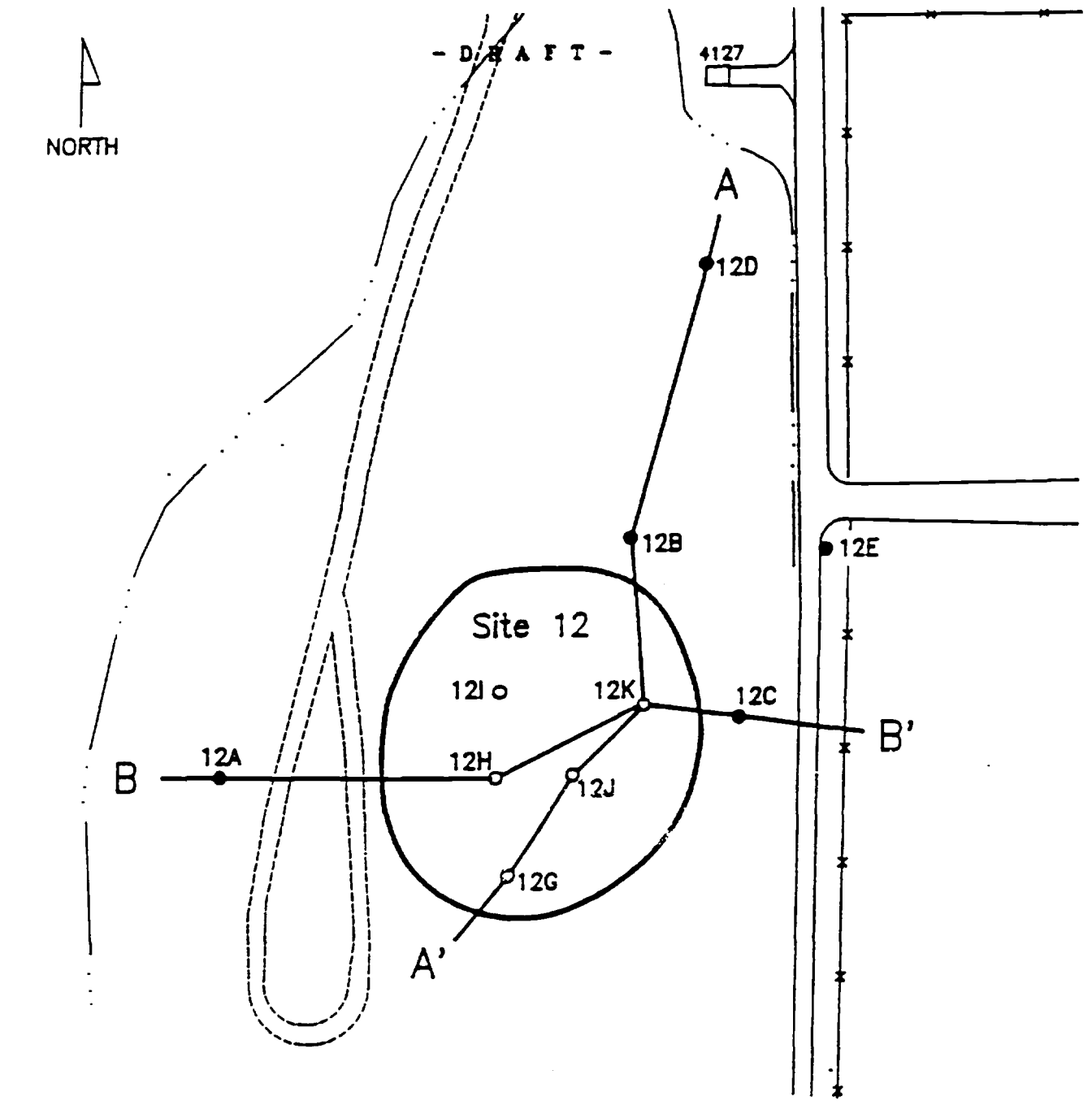


● Monitor Well

○ Borehole

A —— A' Cross-Section Location

0 100 200
FEET

UNITED STATES AIR FORCE
NAVAL AIR STATION FORT WORTH
JOINT RESERVE BASE, CARSWELL FIELD

LOCATIONS OF MONITOR WELLS AND BOREHOLES AT FTA-2

FROM RADIAN, APRIL 1989

PREPARED/DATE:	JRF 30 OCT 95	FIGURE NUMBER:	2-1	FILE DATE:	30 OCT 95
CHECKED/DATE:	EFS 30 OCT 95			PLOT DATE:	30 OCT 95
PROJECT NO.:	11-3517-3209			FILE NAME:	11-3517-3209.01

2.1.2 Subsurface Soils

Subsurface soils from within the FTA-2 are not discussed in this report because:

- Currently, there is no plausible exposure pathway for contact with subsurface soil.
- Under RRS 3, deed restrictions may be established to prevent the disturbance of soil.
- The control measures in place (i.e., low permeability compacted clay liner) are expected to eliminate the potential for cross-media contamination of ground water.

Soil boring samples from outside the FTA-2 were collected by Radian during the Stage I investigation (Radian, 1986). The maximum detections in soils from monitoring well locations 12A, 12B, and 12C of metals and volatile organic compounds (VOCs) are discussed in this report. Lead and selenium were the only metals that exceeded the GWP-Ind. Lead was detected at 10.6 milligram per kilogram (mg/kg) (GWP-Ind = 1.5 mg/kg), and selenium at 12.2 mg/kg (GWP-Ind = 5.0 mg/kg), as shown in Table 2-2. The elevated levels were detected in boring 12B at a depth of 9 to 10 feet below ground surface (bgs). Purgeable halocarbons were not detected in any samples collected outside the FTA-2 area. Purgeable aromatics (BTEX) were tested for, but only ethylbenzene and toluene were detected (in boring 12B), and the concentrations were below the GWP-Ind.

2.2 POTENTIAL FOR CROSS-MEDIA MIGRATION

Potential exposure of human or environmental receptors to a constituent is determined, in part, by the potential for migration and persistence of the constituent in the environmental medium of interest. This section reviews the potential for soils at the site to impact surface water, air, and ground water due to cross-media contamination.

TABLE 2-2

COMPARISON OF DETECTED SUBSURFACE SOIL CONCENTRATIONS
TO TYPE 2 MEDIUM SPECIFIC CONCENTRATIONS (mg/kg)
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Parameter	Maximum Detected Concentration* (mg/kg)	GWP-Ind (mg/kg)	SAI-Ind (mg/kg)
INORGANICS:			
Barium	34	200	137,000
Cadmium	0.45	0.5	1,020
Chromium	5	10	5,110
Lead	***10.6***	1.5	1,000
Selenium	***12.2***	5	10,200
Silver	0.81	51.1	10,200
VOLATILES:			
Ethylbenzene	2.9	70	17,000
Toluene	1.4	100	3,630

GWP-Ind – Groundwater Protection Standard for Industrial Use.
SAI-Ind – Soil/Air and Ingestion Standard for Industrial Use.
Bold indicates the concentration exceeds the Type 2 Risk Reduction Standard for Soil.
NA – Not available.
* Soil boring locations 12A, 12B, and 12C from outside FTA-2 area.

PREPARED/DATE: EFC/10-27-95
CHECKED/DATE: WJM/10-27-95

The evaluation considered the following potential pathways for cross-media migration for constituents in soil:

- Release to the atmosphere as fugitive dust
- Transport as suspended sediment with surface run-off
- Transport as leachate with run-off
- Migration from soil to ground water, as leachate

The potential for impact to humans by the air pathway under current conditions is considered insignificant, because release by volatilization or release of fugitive dust is considered unlikely. Release of volatiles is unlikely because the bioremediation of surface soils reduced the levels of BTEX below the detection limits. Release of dust is unlikely because the site is covered with grass. Although a release could occur if excavation were to take place, soil disturbance is unlikely unless there is additional remediation of the FTA-2. Potential exposures due to this pathway can be effectively eliminated by use of deed restrictions. Therefore, cross-media contamination by the air pathway does not present a concern to human health.

The potential for transport as suspended sediment with surface run-off is minimal because surface soils at the site are covered with grass and graded to drain away from and above the FTA-2 area. The concentrations of constituents that remain after treatment are unlikely to contain levels of constituents that would be a concern to human health.

Ground water could be a potential receiving medium if constituents were to be leached from the soil in the unsaturated zone. However, a low permeability clay liner is in place beneath the bioremediated soils which should provide a barrier to the downward movement of rainwater and effectively prevent percolation through the underlying soils. If there is little or no infiltration, then generation of leachate can be considered insignificant. Therefore, impact to ground water is not a concern.

2.3 EXPOSURE ASSESSMENT

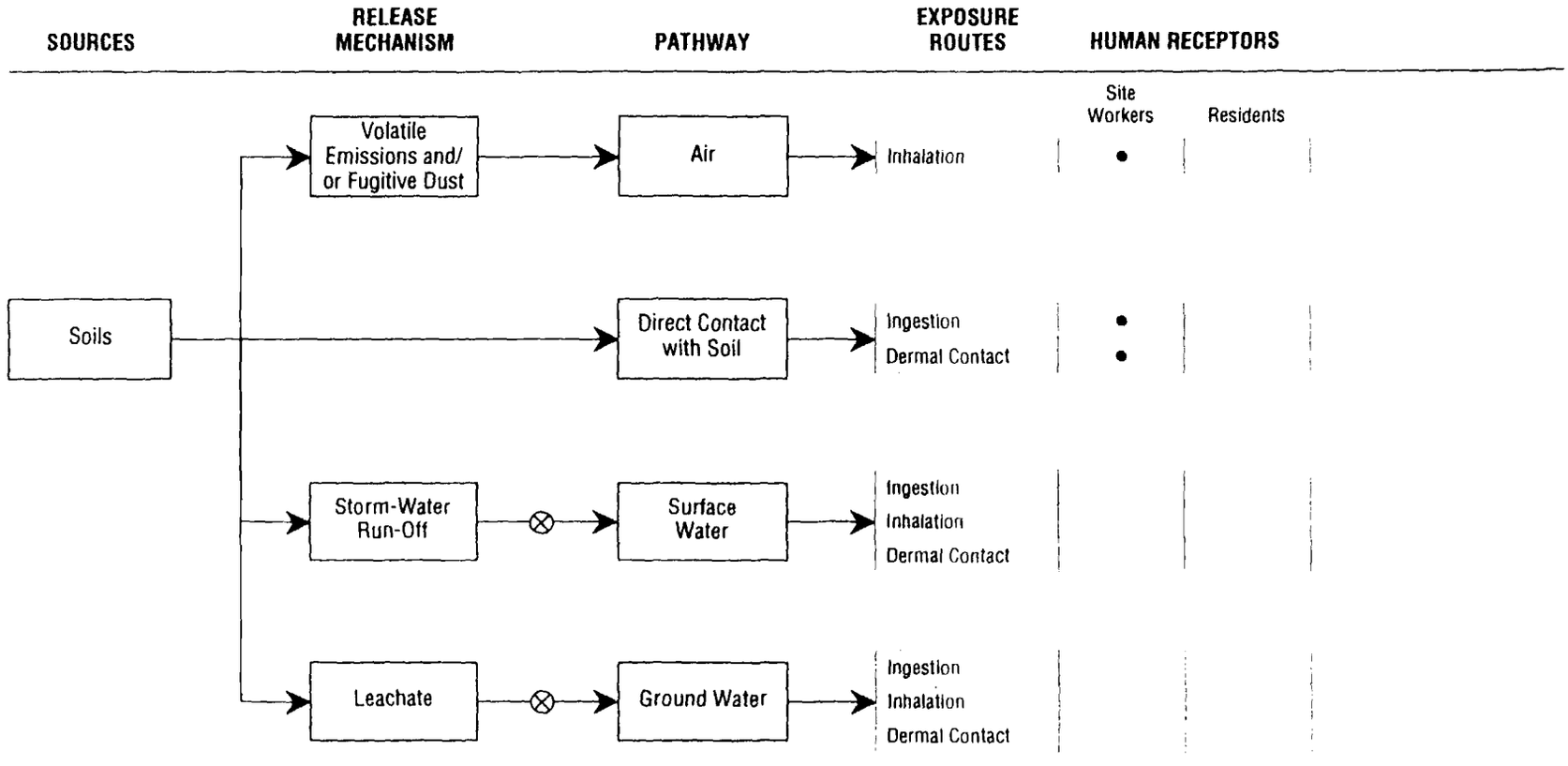
In order to evaluate the exposure pathways that may be present at or adjacent to the subject area, an exposure assessment was conducted. The primary purpose of an exposure assessment is to identify the potential for exposure to human or environmental receptors, and the routes by which receptors could be exposed. The routes of exposure are evaluated by developing a conceptual site model that includes plausible scenarios for potential exposure. The conceptual site model was developed based on a review of available information on the environmental setting at and adjacent to the FTA-2. The conceptual site model, depicted in Figure 2-2, shows the exposure pathways that are potentially complete at the site under current and potential future conditions.

2.3.1 Exposure Setting

The FTA-2 is located in the southern part of NAS Fort Worth just west of the radar facility. The site is currently an oval mound covered with grass. Land use in the surrounding area is industrial, commercial, and residential. Air Force Plant 4 is an industrial facility northwest of the FTA-2. Commercial property extends to the south, and residential development exists within one-quarter to one-half mile to the southeast and northeast of the FTA-2. The shallow ground water beneath the FTA-2 is not currently used as a drinking water source.

For the potential exposure scenario to be viable, there must be a complete exposure pathway. The components of a complete pathway are:

- A source of hazard
- A release from the source
- A transport mechanism from (or through) the contaminated media to the exposure point
- A receptor at the exposure point



⊗ Incomplete Release Mechanism

● Potential Complete Pathway, Current Conditions

UNITED STATES AIR FORCE
NAVAL AIR STATION FORT WORTH
JOINT RESERVE BASE, CARSWELL FIELD

CONCEPTUAL SITE MODEL

FIRE TRAINING AREA NO. 2

PREPARED/DATE	WJM 25 OCT 95	FIGURE NUMBER	FILE DATE	23 OCT 95
CHECKED/DATE	LAS 27 OCT 95	2-2	PLOT DATE	23 OCT 95
PROJECT No	11-3517-3209		FILE NAME	3517-3209.01

335 34

If any component is missing, the pathway is incomplete and no exposure can occur. A description of the source has been provided in the discussion of COPCs (Section 2.1), and potential release and transport mechanisms are discussed in Section 2.2.

2.3.2 Receptors

The presence of receptors at the subject area depends on the current and potential future land use of the site and the surrounding area. Land use at the site under current and potential future use is considered nonresidential. The facility is currently used as a training airfield by reserve units of the Air Force and the Navy.

Under nonresidential use, potential human receptors would only be those who would be in the vicinity of the subject area as part of their normal job duties. A plausible scenario for exposure to surface soil at the FTA-2 would be exposure of a groundskeeper during mowing of the grass that covers the site.

2.3.3 Estimation of Exposure Concentrations and Exposure Intake Values

The next step in the exposure assessment is to quantify the magnitude, frequency, and duration of exposure for the population and pathway selected for quantitative evaluation. Because of the limited data set available for this site, the maximum detected concentrations were used as the exposure point concentrations. Intake variables and exposure point concentrations were selected so that the combination of all variables results in an estimate of the reasonable maximum exposure (RME) for each pathway. The RME is the maximum exposure that is reasonably expected to occur at a site.

Pathway-specific exposure intakes have been quantified by defining a series of variables that describe the exposed population, such as contact rate, exposure frequency and duration, and body weight. The specific calculation procedures and variables used to determine pathway-specific intakes for dermal contact with and ingestion of soil are described below. These

exposure variables have been multiplied by the exposure point concentrations to yield estimates of the chemical-specific intakes for these pathways.

2.3.3.1 Dermal Intake of Soil - The equation for determining chemical intakes from dermal contact with soil is shown in Table 2-3. Intakes calculated for groundskeepers assume an exposed surface area equal to 3,070 square centimeters (cm^2) which represents the surface area of the forearms, hands, and head of an adult (USEPA, 1989b). Groundskeepers were assumed to weigh 70 kilograms and be exposed to soil for 1 hour a day for 39 days per year (i.e., 1 day per week in a 9-month growing season) (LAW, 1995). The averaging time was assumed to be 25 years for noncarcinogens (9,125 days) and 70 years (25,550 days) for carcinogens (USEPA, 1991a). Chemical-specific absorption factors are not available for the COPCs. Therefore, a surrogate value of 6 percent was used for semi-volatiles, and 1 percent was used for metals. These surrogate values are those that have been published for tetrachlorobiphenyl and cadmium, respectively (USEPA, 1992a).

2.3.3.2 Ingestion Intake for Soil - The intake calculation for incidental ingestion of soil is shown in Table 2-4. It was assumed that all of the ingested soil was from the FTA-2 (fraction ingested = 1), and that the ingestion rate is 100 milligrams per day (mg/day). The factors for body weight, exposure duration, and exposure frequency are the same as for the dermal exposure scenario.

2.4 TOXICITY ASSESSMENT

The USEPA has developed toxicity values which reflect the magnitude of the adverse noncarcinogenic and carcinogenic effects from exposure to specific chemicals. Toxicity values for the chemicals of potential concern at this site are presented in the following sections. Reference toxicity values such as the Reference Dose (RfD) or Reference Concentration (RfC) and the Slope Factor (SF) are based primarily on human and animal studies with supportive evidence from pharmacokinetics, mutagenicity, and chemical structure studies.

TABLE 2-3

INTAKE FACTORS
DERMAL CONTACT WITH SOILS BY GROUNDSKEEPERS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

$$\text{DERMAL INTAKE (mg/kg-day)} = \frac{CS \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

Where:			
	CS	=	Concentration in Soil (mg/kg)
	SA	=	Surface Area of Exposed Skin (cm^2/day)
	AF	=	Soil to Skin Adherance Factor (mg/cm^2)
	ABS	=	Absorption Factor (unitless)
	EF	=	Exposure Frequency (days/year)
	ED	=	Exposure Duration (years)
	BW	=	Body Weight (kg)
	AT	=	Averaging Time (days)
	CF	=	Conversion Factor (1E-06 kg/mg)

Exposure Variable		Occupational Receptor Groundskeeper
SA	(Adult)	3,070 (a)
AF		1.0
ABS		CHEMICAL SPECIFIC (b)
EF	(Adult)	39 (c)
ED	(Adult)	25
BW	(Adult)	70
AT	(Noncarcinogens - Adult)	9,125
AT	(Carcinogens - Adult)	25,550
CF		1E-06

PATHWAY-SPECIFIC INTAKES:

Dermal Intake:

			SEMI-VOLATILES:	METALS:
Groundskeeper Adult (Noncarcinogens)	=	CS x	2.81E-07	4.69E-08
Groundskeeper Adult (Carcinogens)	=	CS x	1.00E-07	1.67E-08

(a) Surface area measurement for forearms, hands, and head of an adult.
(b) Interim Guidance for Dermal Exposure Assessment: Principles and Applications (USEPA, 1992).
The value for semi-volatiles is based on tetrachlorobiphenyls (0.06) and the value for metals is based on cadmium (0.01).
(c) One day per week for nine months (excluding winter).

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TABLE 2-4

INTAKE FACTORS
INCIDENTAL INGESTION OF SOILS BY GROUNDSKEEPERS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

$$\text{INGESTION INTAKE (mg/kg-day)} = \frac{CS \times IR \times EF \times ED \times CF \times FI}{BW \times AT}$$

Where:	CS	=	Concentration in Soils (mg/kg)
	FI	=	Fraction Ingested from Contaminant Source (unitless)
	IR	=	Ingestion Rate (mg/day)
	EF	=	Exposure Frequency (days/year)
	ED	=	Exposure Duration (years)
	BW	=	Body Weight (kg)
	AT	=	Averaging Time (days)
	CF	=	Conversion Factor (1E-06 kg/mg)

Exposure Variable		Occupational Receptor Groundskeeper
FI		1
IR	(Adult)	100
EF	(Adult)	39 (a)
ED	(Adult)	25
BW	(Adult)	70
AT	(Noncarcinogens - Adult)	9,125
AT	(Carcinogens)	25,550
CF		1E-06

PATHWAY-SPECIFIC INTAKES:

Ingestion of Soil:

Groundskeeper Adult (Noncarcinogens)	= CS *	1.53E-07
Groundskeeper Adult (Carcinogens)	= CS *	5.45E-08

(a) One day per week for nine months (excluding winter).

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2.4.1 Noncarcinogenic Effects

Chemicals that give rise to toxic endpoints other than cancer and gene mutations are often referred to as "systemic toxicants" because of their effects on the function of various organ systems. Chemicals considered to be systemic toxicants can also exhibit systemic carcinogenic effects. For many noncarcinogenic effects, protective mechanisms (i.e., exposure or dose thresholds) are believed to exist that must be overcome before an adverse effect is manifested. This characteristic distinguishes systemic toxicants from carcinogens and mutagens which are often treated as acting without a distinct threshold. As a result, a range of exposure exists from zero to some finite value that can be tolerated with essentially no chance of the organism expressing adverse effects. In developing toxicity values for evaluating noncarcinogenic effects, the standard approach is to identify the upper boundary of this tolerance range or threshold and to establish the toxicity values based on this threshold.

The toxicity value most often used in evaluating noncarcinogenic effects is the RfD. Various types of RfDs are available depending on the exposure route of concern (e.g., oral or inhalation, RfD_o and RfD_i respectively), the critical effect of the chemical (e.g., developmental or other), and the length of exposure being evaluated (e.g., chronic or subchronic).

The chronic RfD is defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposures, i.e., 7 years to a lifetime (70 years). Although site construction workers are not assumed to be exposed over a long time, chronic RfDs were used for the risk calculations because subchronic values were not available. Use of chronic RfDs to evaluate short-term exposures (e.g., one year) is a conservative assumption which will overestimate potential risk at the site. The chronic RfDs for the chemicals of concern at the site were primarily derived from the USEPA's Integrated Risk Information System data base (IRIS, 1995) and the Health Effects Assessment Summary Tables (HEAST, 1994).

2.4.2 Carcinogenic Effects

Carcinogens are generally thought to have nonthreshold effects. In other words, USEPA assumes that a small number of molecular events can cause changes in a single cell that can lead to uncontrolled cellular growth. This hypothesis for carcinogenesis is referred to as "nonthreshold" because there is believed to be essentially no level of exposure to such a chemical that does not pose a finite probability of generating a carcinogenic response.

To evaluate carcinogenic effects, USEPA uses a two-part evaluation in which the chemical is first assigned a weight-of-evidence classification, and then a toxicity value, the slope factor (SF), is calculated. The weight-of-evidence classification is based on an evaluation of the available data to determine the likelihood that the chemical is a human carcinogen. Chemicals with the strongest evidence of human carcinogenicity are denoted Class A, B1, or B2, while chemicals with less supporting evidence are classified as C or D. The SF quantitatively defines the relationship between the dose and the response. The SF is generally expressed as a plausible upper-bound estimate of the probability of response occurring per unit of chemical. The carcinogenic SF factors for the chemicals of concern at the site were derived from IRIS (1995) or HEAST (1994).

2.4.3 Toxicity Assessment for Dermal Exposure

RfDs and SFs have not been derived specifically for dermal absorption. Therefore, in accordance with USEPA guidance, risks associated with dermal exposures were evaluated with Oral RfDs or Oral SFs.

2.5 RISK CHARACTERIZATION

The risk characterization integrates the results of the exposure and toxicity assessments into quantitative and qualitative expressions of risk for potentially complete pathways of exposure at the site. To characterize potential noncarcinogenic effects, comparisons are made between the

estimated chemical intakes and the RfDs for those chemicals; to characterize potential carcinogenic effects, estimated chemical intakes are multiplied by the chemical-specific SFs to yield chemical-specific information regarding potential risk.

2.5.1 Noncarcinogenic Risk Characterization

Noncarcinogenic risks are characterized by comparing the estimated chemical intakes to the appropriate RfD value. When the estimated chronic daily intake of a site-related chemical exceeds the appropriate RfD, there may be a concern for potential noncancer effects from exposure to that chemical. The ratio of the chronic daily intake to the chronic RfD is referred to as the "hazard quotient." It is important to note that the hazard quotient does not represent a statistical probability. Rather, a hazard quotient greater than 1.0 indicates that the "threshold" for acceptable exposure to that chemical has been exceeded. The chemical-specific hazard quotient values for exposure to surface soil by the dermal and ingestion routes are presented in Tables 2-5 and 2-6, respectively. All of the hazard quotient values for exposure to surface soil are well below the threshold value of 1.

The USEPA assumes additivity of effects in evaluating noncarcinogenic effects from a mixture of chemicals. The chemical-specific hazard quotients are summed to yield an overall pathway-specific hazard index; pathway-specific hazard indices are then summed to yield a total hazard index for the relevant population.

The total hazard index for dermal contact with soil is 0.007, and for ingestion of soil, 0.02. The total hazard index for the soil pathway is 0.027, which is well below the threshold level.

2.5.2 Carcinogenic Risk Characterization

Risks from potential carcinogens are estimated as probabilities of excess cancers as a result of exposure to chemicals from the site. The SF correlates estimated total chronic daily intake to incremental cancer risk. Chemical-specific cancer risks are estimated by multiplying the SF by

TABLE 2-5

CALCULATIONS OF RISK, MAXIMUM CONCENTRATIONS
POTENTIAL FUTURE OCCUPATIONAL EXPOSURE
DERMAL CONTACT WITH SURFACE SOILS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Parameter	Maximum Exposure Point Concentration (mg/kg) (a)	Intake Factor (kg/kg-d) Noncarc. (Adult)	Intake Factor (kg/kg-d) Carcinogen (Lifetime)	Chronic Intake (mg/kg-d) (b) Noncarc. (Adult)	Chronic Intake (mg/kg-d) (b) Carcinogen (Lifetime)	Toxicity Values Oral RfD (mg/kg-d)	Toxicity Values Slope Factor (kg-d/mg)	Adult Hazard Quotient (c) (unitless)	Excess Cancer Risk (d) (unitless)
SEMI-VOLATILES:									
bis(2-Ethylhexyl)phthalate	0.53	2.81E-07	1.00E-07	1.49E-07	5.30E-08	2.00E-02	1.40E-02	7.45E-06	7.42E-10
Di-n-octyl phthalate	0.15	2.81E-07	1.00E-07	4.21E-08	1.50E-08	2.00E-02	NA	2.11E-06	NA
Dibenzofuran	0.17	2.81E-07	1.00E-07	4.78E-08	1.70E-08	4.00E-03	NA	1.19E-05	NA
2-Methylnaphthalene	8.7	2.81E-07	1.00E-07	2.44E-06	8.70E-07	NA	NA	NA	NA
4-Methylphenol	4.2	2.81E-07	1.00E-07	1.18E-06	4.20E-07	5.00E-03	NA	2.36E-04	NA
Naphthalene	3.9	2.81E-07	1.00E-07	1.10E-06	3.90E-07	4.00E-02	NA	2.74E-05	NA
Phenol	0.5	2.81E-07	1.00E-07	1.40E-07	5.00E-08	6.00E-01	NA	2.34E-07	NA
INORGANICS:									
Aluminum	13000	4.69E-08	1.67E-08	6.10E-04	2.17E-04	1.00E+00	NA	6.10E-04	NA
Arsenic	30	4.69E-08	1.67E-08	1.41E-06	5.01E-07	3.00E-04	1.50E+00	4.69E-03	7.52E-07
Barium	86	4.69E-08	1.67E-08	4.03E-06	1.44E-06	7.00E-02	NA	5.76E-05	NA
Beryllium	0.7	4.69E-08	1.67E-08	3.28E-08	1.17E-08	5.00E-03	4.30E+00	6.57E-06	5.03E-08
Calcium	41000	4.69E-08	1.67E-08	1.92E-03	6.85E-04	NA	NA	NA	NA
Cadmium	0.6	4.69E-08	1.67E-08	2.81E-08	1.00E-08	1.00E-03	NA	2.81E-05	NA
Cobalt	4.6	4.69E-08	1.67E-08	2.16E-07	7.68E-08	6.00E-02	NA	3.60E-06	NA
Chromium	14	4.69E-08	1.67E-08	6.57E-07	2.34E-07	5.00E-03	NA	1.31E-04	NA
Copper	3.4	4.69E-08	1.67E-08	1.59E-07	5.68E-08	3.71E-02	NA	4.30E-06	NA
Iron	12000	4.69E-08	1.67E-08	5.63E-04	2.00E-04	NA	NA	NA	NA
Lead	16	4.69E-08	1.67E-08	7.50E-07	2.67E-07	NA	NA	NA	NA
Magnesium	1700	4.69E-08	1.67E-08	7.97E-05	2.84E-05	NA	NA	NA	NA
Manganese	250	4.69E-08	1.67E-08	1.17E-05	4.17E-06	1.40E-01	NA	8.37E-05	NA
Nickel	10	4.69E-08	1.67E-08	4.69E-07	1.67E-07	2.00E-02	NA	2.35E-05	NA
Potassium	1100	4.69E-08	1.67E-08	5.16E-05	1.84E-05	NA	NA	NA	NA
Selenium	50	4.69E-08	1.67E-08	2.34E-06	8.35E-07	5.00E-03	NA	4.69E-04	NA
Silicon	350	4.69E-08	1.67E-08	1.64E-05	5.84E-06	NA	NA	NA	NA
Sodium	74	4.69E-08	1.67E-08	3.47E-06	1.24E-06	NA	NA	NA	NA
Vanadium	30	4.69E-08	1.67E-08	1.41E-06	5.01E-07	7.00E-03	NA	2.01E-04	NA
Zinc	18	4.69E-08	1.67E-08	8.44E-07	3.01E-07	3.00E-01	NA	2.81E-06	NA
							TOTAL:	0.007	8E-07

(a) Exposure Point Concentrations consist of the maximum detected concentration.
(b) Chronic Intake = Exposure Point Concentration x Intake Factor
(c) Hazard Quotient (Noncarcinogens) = Chronic Intake / Oral RfD
(d) Excess Cancer Risk (Carcinogens) = Slope Factor x Chronic Intake

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TABLE 2-6

CALCULATIONS OF RISK, MAXIMUM CONCENTRATIONS
POTENTIAL FUTURE OCCUPATIONAL EXPOSURE
INCIDENTAL INGESTION OF SURFACE SOILS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Parameter	Maximum Exposure Point Concentration (mg/kg) (a)	Intake Factor (kg/kg-d)		Chronic Intake (mg/kg-d) (b)		Toxicity Values		Adult Hazard Quotient (c) (unitless)	Excess Cancer Risk (d) (unitless)
		Noncarc. (Adult)	Carcinogen (Lifetime)	Noncarc. (Adult)	Carcinogen (Lifetime)	Oral RfD (mg/kg-d)	Slope Factor (kg-d/mg)		
SEMI-VOLATILES:									
bis(2-Ethylhexyl)phthalate	0.53	1.53E-07	5.45E-08	8.11E-08	2.89E-08	2.00E-02	1.40E-02	4.05E-06	4.04E-10
Di-n-octyl phthalate	0.15	1.53E-07	5.45E-08	2.30E-08	8.17E-09	2.00E-02	NA	1.15E-06	NA
Dibenzofuran	0.17	1.53E-07	5.45E-08	2.60E-08	9.27E-09	4.00E-03	NA	6.50E-06	NA
2-Methylnaphthalene	8.7	1.53E-07	5.45E-08	1.33E-06	4.74E-07	NA	NA	NA	NA
4-Methylphenol	4.2	1.53E-07	5.45E-08	6.43E-07	2.29E-07	5.00E-03	NA	1.29E-04	NA
Naphthalene	3.9	1.53E-07	5.45E-08	5.97E-07	2.13E-07	4.00E-02	NA	1.49E-05	NA
Phenol	0.5	1.53E-07	5.45E-08	7.65E-08	2.73E-08	6.00E-01	NA	1.28E-07	NA
INORGANICS:									
Aluminum	13000	1.53E-07	5.45E-08	1.99E-03	7.09E-04	1.00E+00	NA	1.99E-03	NA
Arsenic	30	1.53E-07	5.45E-08	4.59E-06	1.64E-06	3.00E-04	1.50E+00	1.53E-02	2.45E-06
Barium	86	1.53E-07	5.45E-08	1.32E-05	4.69E-06	7.00E-02	NA	1.88E-04	NA
Beryllium	0.7	1.53E-07	5.45E-08	1.07E-07	3.81E-08	5.00E-03	4.30E+00	2.14E-05	1.64E-07
Calcium	41000	1.53E-07	5.45E-08	6.27E-03	2.23E-03	NA	NA	NA	NA
Cadmium	0.6	1.53E-07	5.45E-08	9.18E-08	3.27E-08	1.00E-03	NA	9.18E-05	NA
Cobalt	4.6	1.53E-07	5.45E-08	7.04E-07	2.51E-07	6.00E-02	NA	1.17E-05	NA
Chromium	14	1.53E-07	5.45E-08	2.14E-06	7.63E-07	5.00E-03	NA	4.28E-04	NA
Copper	3.4	1.53E-07	5.45E-08	5.20E-07	1.85E-07	3.71E-02	NA	1.40E-05	NA
Iron	12000	1.53E-07	5.45E-08	1.84E-03	6.54E-04	NA	NA	NA	NA
Lead	16	1.53E-07	5.45E-08	2.45E-06	8.72E-07	NA	NA	NA	NA
Magnesium	1700	1.53E-07	5.45E-08	2.60E-04	9.27E-05	NA	NA	NA	NA
Manganese	250	1.53E-07	5.45E-08	3.83E-05	1.36E-05	1.40E-01	NA	2.73E-04	NA
Nickel	10	1.53E-07	5.45E-08	1.53E-06	5.45E-07	2.00E-02	NA	7.65E-05	NA
Potassium	1100	1.53E-07	5.45E-08	1.68E-04	6.00E-05	NA	NA	NA	NA
Selenium	50	1.53E-07	5.45E-08	7.65E-06	2.73E-06	5.00E-03	NA	1.53E-03	NA
Silicon	350	1.53E-07	5.45E-08	5.36E-05	1.91E-05	NA	NA	NA	NA
Sodium	74	1.53E-07	5.45E-08	1.13E-05	4.03E-06	NA	NA	NA	NA
Vanadium	30	1.53E-07	5.45E-08	4.59E-06	1.64E-06	7.00E-03	NA	6.56E-04	NA
Zinc	18	1.53E-07	5.45E-08	2.75E-06	9.81E-07	3.00E-01	NA	9.18E-06	NA
							TOTAL:	0.02	3E-06

NA Not available or applicable
(a) Exposure Point Concentrations consist of the maximum detected concentration.
(b) Chronic Intake = Exposure Point Concentration x Intake Factor
(c) Hazard Quotient (Noncarcinogens) = Chronic Intake / Oral RfD
(d) Excess Cancer Risk (Carcinogens) = Slope Factor x Chronic Intake

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the chronic daily intake estimates. The results of the carcinogenic risk characterization are expressed as upper-bound estimates of the potential carcinogenic risk for each exposure point. To assess the overall potential for cancer effects posed by the mixture of chemicals present at a site, USEPA guidance assumes additivity. Therefore, cancer risks are estimated for each chemical, then chemical-specific risks are summed to yield an estimate of the overall pathway-specific cancer risk. The TNRCC Risk Reduction Standards define the target risk range as concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 1×10^{-4} and 1×10^{-6} (TNRCC, 1993).

The chemical-specific risks for exposures to soil by dermal contact and ingestion are shown in Tables 2-5 and 2-6, respectively. The excess cancer risk for exposure to soil by the dermal route is below the target risk range, at a level of 8×10^{-7}. The estimated risk for the ingestion route is 3×10^{-6}, which is within the target risk range of 1×10^{-4} to 1×10^{-6}. The total cancer risk for the soil pathway is rounded off to 3×10^{-6}.

2.6 ASSUMPTIONS AND UNCERTAINTIES

While evaluating this risk assessment, several assumptions and uncertainties need to be noted which may have impact upon the total risk.

- The maximum detected concentrations were used for the risk calculations due to the limited data set. This will tend to overestimate potential risks.
- The comparison of surface soil analytical results for semi-volatiles and metals was based on a single soil sample because no other data were available. The use of a single datum to represent surface soils may underestimate or overestimate the concentrations of constituents at the site.
- Subchronic RfDs were not available for the chemicals of potential concern; therefore, chronic RfDs were used for the risk calculations. This is a conservative assumption which will overestimate potential risk at the site.

- RfDs and SFs were not available for several constituents. Thus, the noncarcinogenic and carcinogenic risks calculated for the pathways of interest at the site may be underestimated.

- Chemical-specific dermal absorption information was not available for the constituents of potential concern, so oral RfDs and SFs were used. This may overestimate or underestimate the potential risk at the site.

- An assumption was made that exposures would occur at a constant rate over the estimated duration of exposure. Site-specific exposure parameters may vary from those used to estimate exposures for receptors.

- In evaluating risks from future exposures to site media, the assumption was made that future constituent concentrations will remain the same as current concentrations. Dilution, decay, degradation, and attenuation of constituents occur naturally over time, and site contaminants would thus present a reduced risk in future scenarios.

This baseline risk assessment should not be viewed as an absolute quantitative measure of the risk to public health presented by site-specific contaminants. The assumptions and inherent uncertainties in the risk assessment process do not allow this level of confidence. However, this risk assessment does provide a reasonable indication of the potential for risk due to exposure to site-specific chemicals.

3.0 MEDIA CLEANUP LEVELS

This section discusses the procedure used to calculate media cleanup levels according to RRS 3 and provides a comparison of the calculated MSC level values to site constituent concentrations.

3.1 CALCULATION OF MEDIA CLEANUP LEVELS

The site-specific media cleanup levels were calculated in accordance with the guidelines given in the TNRCC Risk Reduction Standards and the USEPA Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), (USEPA, 1991b).

The equations used to calculate the risk-based carcinogenic and noncarcinogenic cleanup levels for soil are shown on the bottom of Table 3-1. The equations are comprised of one component for the dermal exposure route, and one component for the ingestion route. The cumulative excess target lifetime cancer risk (TR) to exposed populations for all the known or suspected carcinogens cannot exceed 1 in 10,000 (10^{-4}). Individual TR values range between an excess upperbound lifetime risk of 1 in 10,000 (10^{-4}) and 1 in 1,000,000 (10^{-6}). The cumulative excess lifetime cancer risk (TR) used in Table 3-1 is 1 in 100,000 (10^{-5}) For systemic toxicants, the target hazard index (THI) for a single constituent is 1. The cumulative hazard index, i.e., the sum of the THIs for single or multiple systematic toxicants which affect the same organ or act by the same method of toxicity, cannot exceed 1. Due to these cumulative limits, the individual TR and THI values were reduced for some constituents, as shown at the bottom of Table 3-1.

3.2 COMPARISON OF SITE CONSTITUENT CONCENTRATIONS TO CALCULATED MEDIA CLEANUP LEVELS FOR RRS 3

The maximum detected concentrations of constituents in surface soil at the FTA-2 were all below the calculated media cleanup levels of RRS 3, as shown in Table 3-2.

TABLE 3-1

CURRENT EXPOSURE
TYPE 3 MEDIA CLEANUP LEVELS FOR SOIL
USING SITE-SPECIFIC ASSUMPTIONS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Parameter	Chronic Reference Dose Oral (mg/kg/day)	Cancer Slope Factor Oral (mg/kg/day)-1	Target Organ	Source	Type 3 Standard (mg/kg) Construction Worker Carcinogenic	Noncarcinogenic
INORGANICS:						
Aluminum	1.00E+00	NA	Nervous System	ECAO	NA	9204018
Arsenic	3.00E-04	1.50E+00	Skin	IRIS	172	8367
Barium	7.00E-02	NA	Blood	IRIS	NA	488092
Beryllium	5.00E-03	4.30E+00	No Adverse Effects	IRIS	60	46020
Calcium	NA	NA			NA	NA
Cadmium	1.00E-03	NA	Kidney	IRIS	NA	13945
Cobalt	6.00E-02	NA	Lung	ECAO	NA	1673458
Chromium	5.00E-03	NA	No Adverse Effects	IRIS	NA	46020
Copper	3.71E-02	NA	Gastrointestinal	HEAST	NA	1034755
Iron	NA	NA			NA	NA
Lead	NA	NA			NA	NA
Magnesium	NA	NA			NA	NA
Manganese	1.40E-01	NA	Nervous System	IRIS	NA	1288562
Nickel	2.00E-02	NA	Body Weight	IRIS	NA	278910
Potassium	NA	NA			NA	NA
Selenium	5.00E-03	NA	Blood	IRIS	NA	34864
Silicon	NA	NA			NA	NA
Sodium	NA	NA			NA	NA
Vanadium	7.00E-03	NA	No Adverse Effects	HEAST	NA	64428
Zinc	3.00E-01	NA	Blood	IRIS	NA	2091822
SEMI-VOLATILES:						
bis(2-Ethylhexyl)phthalate	2.00E-02	1.40E-02	Liver	IRIS	6671	101079
Di-n-octyl phthalate	2.00E-02	NA	Kidney, Liver	IRIS	NA	101079
Dibenzofuran	4.00E-03	NA	Blood	ECAO	NA	10108
2-Methylnaphthalene	NA	NA			NA	NA
4-Methylphenol	5.00E-03	NA	Nervous System, Body Weight	IRIS	NA	16678
Naphthalene	4.00E-02	NA	Body Weight	Withdrawn from IRIS	NA	202158
Phenol	6.00E-01	NA	Fetal Development	IRIS	NA	6064737

TABLE 3-1

CURRENT EXPOSURE
TYPE 3 MEDIA CLEANUP LEVELS FOR SOIL
USING SITE-SPECIFIC ASSUMPTIONS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Equation (Noncarcinogens):

$$C = \frac{THI \times BW \times AT}{EF \times ED \times CF} \times \left[\frac{RfD}{IR \times FI} + \frac{RfD}{SA \times AF \times ABS} \right]$$

Equation (Carcinogens):

$$C = \frac{TR \times BW \times AT}{EF \times ED \times CF} \times \left[\frac{1}{IR \times FI \times CSF} + \frac{1}{SA \times AF \times ABS \times CSF} \right]$$

Where:

THI = Target Hazard Index =	1 for skin, lung, gastrointestinal, and fetal development
	0.5 for liver, body weight, and kidney
	0.33 for central nervous system and no adverse effects
	0.25 for blood
BW = Body Weight =	70 kg
AT = Averaging Time =	9,125 days for Noncarcinogens; 25,550 days for Carcinogens
EF = Exposure Frequency =	39 day/year
ED = Exposure Duration =	25 years
CF = Conversion Factor =	1E-06 kilograms/milligram
IR = Ingestion Rate =	100 milligrams/day
FI = Fraction Ingested =	1 unitless
SA = Surface Area of Exposed Skin =	3,070 square centimeters / day
AF = Soil to Skin Adherence Factor =	1 milligrams / square centimeter
ABS = Absorption Factor =	0.01 for metals; 0.06 for semi-volatiles
RfD = Oral Reference Dose =	Chemical Specific
TR = Target Risk =	3.3E-06 for Carcinogens
CSF = Oral Cancer Slope Factor =	Chemical Specific

Source: IRIS - Integrated Risk Information System, USEPA (IRIS, 1995).
HEAST - Health Effects Assessment Summary Table FY1994, USEPA (HEAST, 1994).
ECAO - Environmental Criteria and Assessment Office, USEPA (ECAO, 1995).

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TABLE 3-2

COMPARISON OF DETECTED SURFACE SOIL CONCENTRATIONS TO TYPE 3 MEDIA CLEANUP LEVELS (mg/kg)
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Parameter	Maximum Detected Concentrations (mg/kg)	Type 3 Risk Reduction Standard Values (mg/kg) Noncarcinogenic Effect	Carcinogenic Effect
SEMI-VOLATILES:			
bis(2-Ethylhexyl)phthalate	0.53	100,000	6,671
Di-n-octyl phthalate	0.15	100,000	NA
Dibenzofuran	0.17	10,000	NA
2-Methylnaphthalene	8.7	NA	NA
4-Methylphenol	4.2	17,000	NA
Naphthalene	3.9	200,000	NA
Phenol	0.5	6,100,000	NA
INORGANICS:			
Aluminum	13,000	9,200,000	NA
Arsenic	30	8,400	172
Barium	86	490,000	NA
Beryllium	0.7	46,000	60
Calcium	41,000	NA	NA
Cadmium	0.6	14,000	NA
Cobalt	4.6	1,700,000	NA
Chromium	14	46,000	NA
Copper	3.4	1,000,000	NA
Iron	12,000	NA	NA
Lead	16	NA	NA
Magnesium	1,700	NA	NA
Manganese	250	1,300,000	NA
Nickel	10	280,000	NA
Potassium	1,100	NA	NA
Selenium	50	35,000	NA
Silicon	350	NA	NA
Sodium	74	NA	NA
Vanadium	30	64,000	NA
Zinc	18	2,100,000	NA

NA - Not available

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4.0 CONCLUSIONS AND RECOMMENDATIONS

This document shows that closure under RRS 3 (with no additional removal) is appropriate for the subject area, for the following reasons:

- Cross-media contamination from soil to air or soil to surface water is unlikely because there has been remediation of surface soils, and because soils are covered by grass.
- Concentrations of constituents in surface soil at the FTA-2 do not exceed the calculated media cleanup levels using site-specific exposure scenarios.
- Constituents of concern in subsurface soils at the FTA-2 are not a concern provided that deed restrictions are established to prevent soil excavation.

Based on the information provided in this report, LAW recommends closure of the FTA-2.

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TAB

2

Applicable Portions of the Draft RI/FS Report Radian Corporation

4.2.6 Fire Department Training Area 2 (Site 12)

Work performed at Fire Department Training Area 2 (FDTA 2) consisted of the drilling of boreholes installation of upper zone monitor wells, and collection and analysis of soil and ground-water samples. The results of the hydrogeologic and chemical data are discussed in the following sections. A baseline risk assessment is discussed in Section 4.2.6.4. Figure 4.2.6-1 illustrates the locations of the monitor wells and boreholes at Site 12.

4.2.6.1 Site Description

Topography

Site 12 is located in the southern part of Carswell AFB just west of the radar facility. The site is an oval-shaped gravel surface containing rectangular metal containers. A low berm surrounds the basically flat area. Surface drainage is generally to the north to an unnamed tributary of Farmers Branch.

Geology

Geologic data developed for Site 12 resulted from soil sampling during drilling operations and observations of water levels during and after monitor well installation.

The geology of Site 12 is based on an evaluation of drilling logs from five Stage 1 and Stage 2 upper zone monitor wells and five Stage 2 soil borings. Figures 4.2.6-2 and 4.2.6-3 are cross-sections that illustrate the hydrogeologic conditions at Site 12. Upper zone materials consist of surficial deposits of clayey silt with variable amounts of fine sand and gravel, underlain by sand and gravel deposits. The thickness of the upper zone ranges from 18 feet at the southwest portion of the site to 40 feet north and east of the site. Surficial clay and silt deposits are 10 to 17 feet thick and the

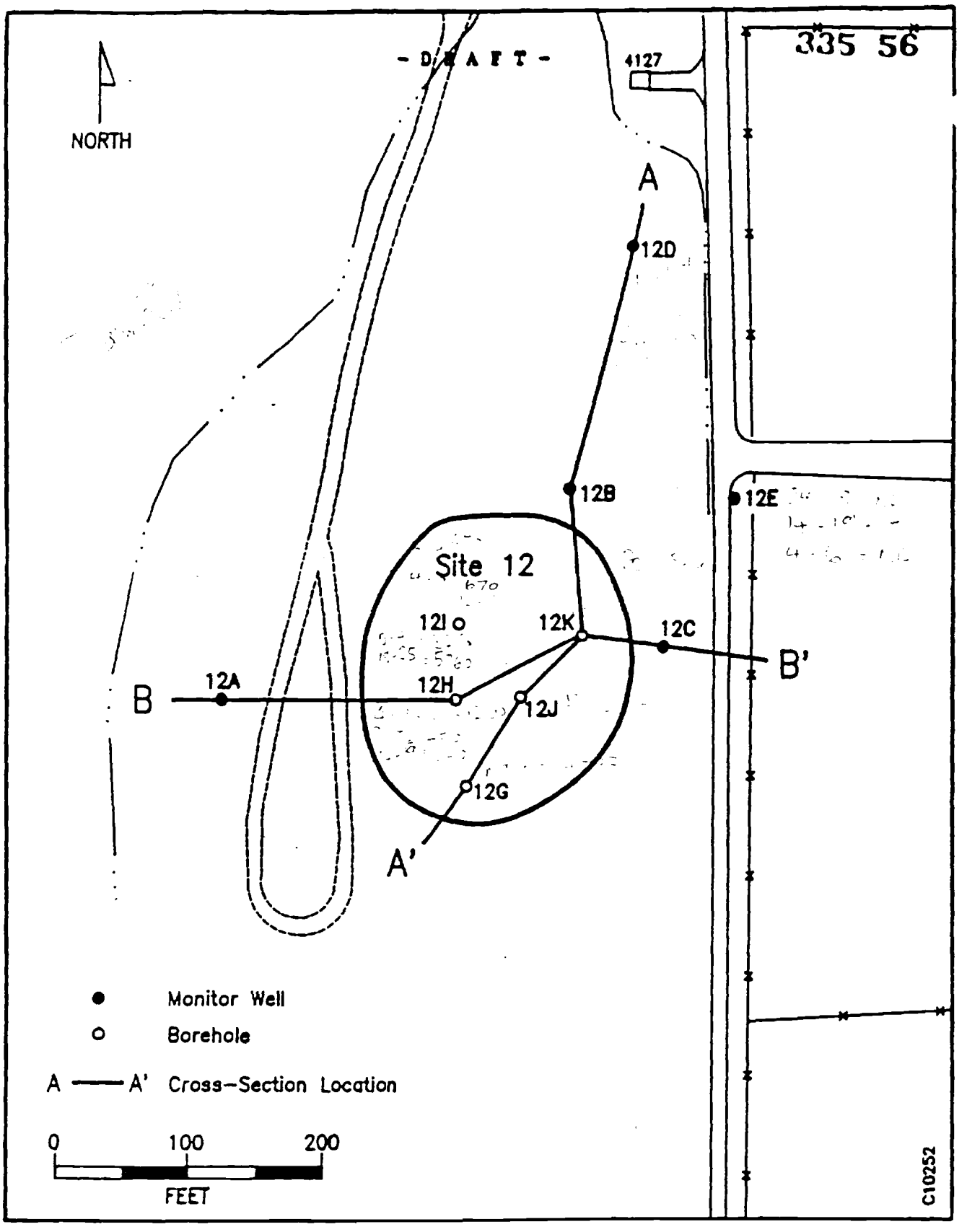

Figure 4.2.6-1. Locations of Monitor Wells and Boreholes at Site 12, Carswell AFB, Texas

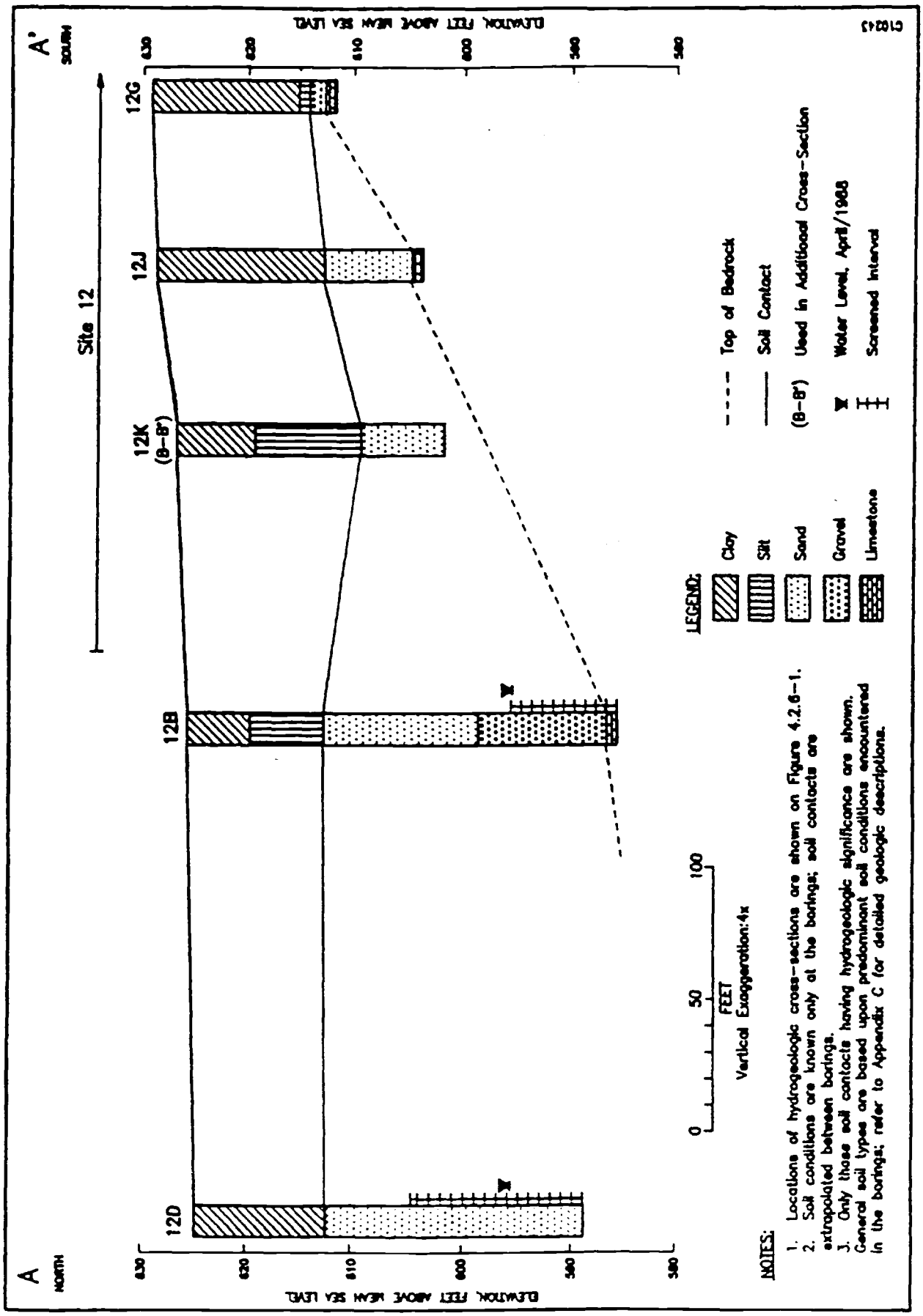

Figure 4.2.6-2. Hydrogeologic Cross-Section A-A' at Site 12, Carswell AFB, Texas

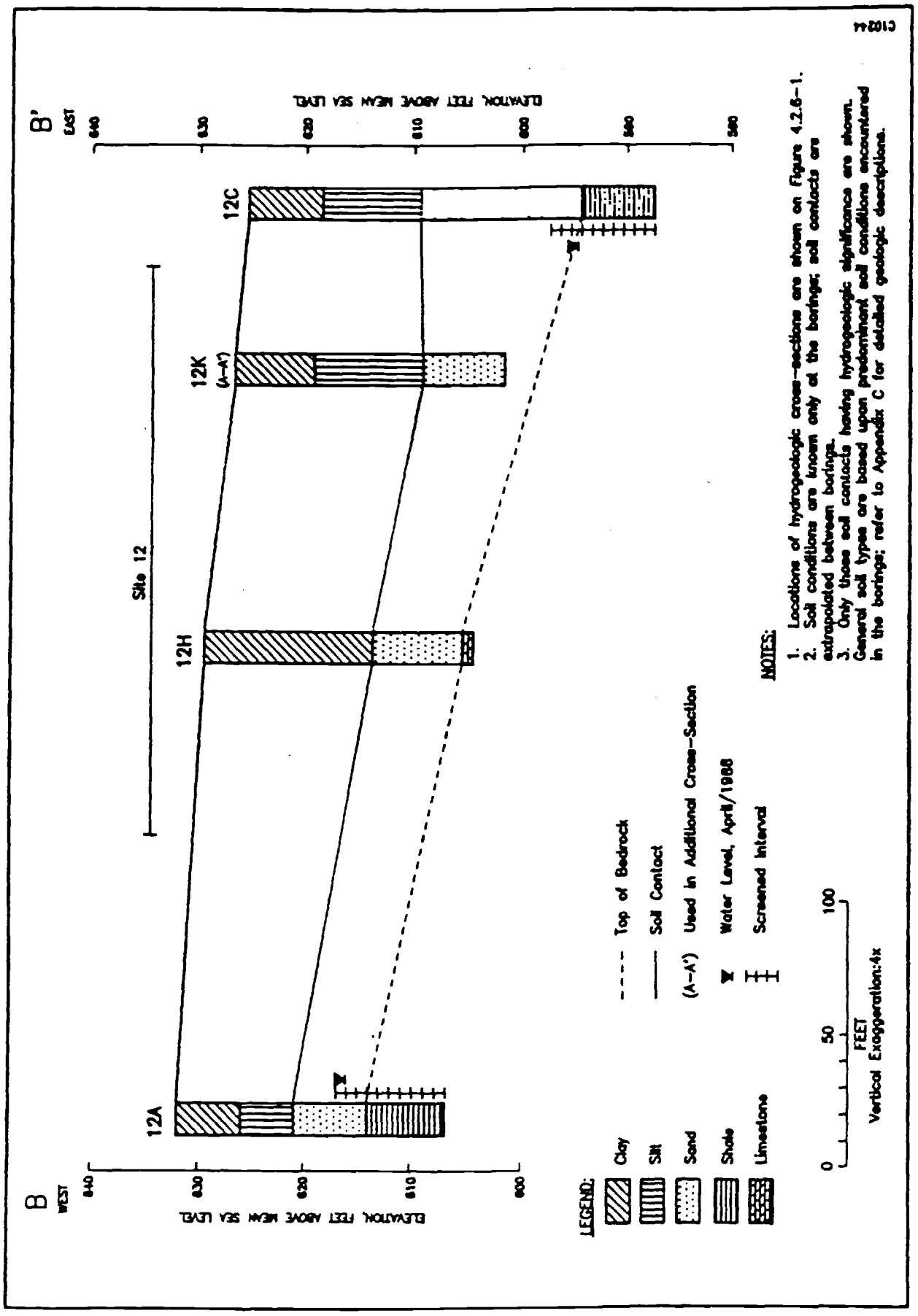

Figure 4.2.6-3. Hydrogeologic Cross-Section B-B' at Site 12, Carswell AFB, TX

sand and gravel deposits are 2 to 27 feet thick. The thickness of sand and gravel deposits decrease abruptly toward the south (e.g. 12G) as the bedrock elevation rises. It was observed that in most borings in the vicinity of the Flightline that the grain size of the sand and gravel increases with depth.

Shale and limestone of the Goodland Formation underlie the upper zone materials at all locations. The top of the Goodland occurs at a maximum depth of 40 feet to the northeast of the site (at 12E) and at its shallowest depth of 18 feet in the southernmost part of the site (at 12G). Limestone of the Goodland Formation crops out just southeast of the site near Landfill 4 in a stream that flows to Farmers Branch. The bedrock/upper zone contact slopes steeply to the northeast under the site. Figure 4.2.6-4 illustrates the relationship between the upper zone materials and the underlying limestone and shale.

Hydrogeology

Ground water occurs in the upper zone materials underlying Site 12 at depths ranging from 15 feet at 12A to 30 feet at 12B and 12C. The ground water exists under unconfined (water table) conditions in the upper zone materials. However, observations during drilling of several boreholes (12G, 12H, 12J) indicate that the upper zone is locally dry. In addition, other locations (12A, 12C) reveal that only a very thin zone of saturation exists in the upper zone or uppermost portion of bedrock. The saturated thickness of the upper zone increases to the north and east of the site (e.g., 12D, 12E). Figure 4.2.6-5 illustrates the potentiometric surface of the water table as determined in March 1988. Comparison of the potentiometric surface map for the upper zone ground water and the contour map of the base of the upper zone strongly suggests that the occurrence and direction of movement of ground water in the upper zone is directly related to the configuration of the bedrock surface. The direction of ground-water flow is to the northeast.

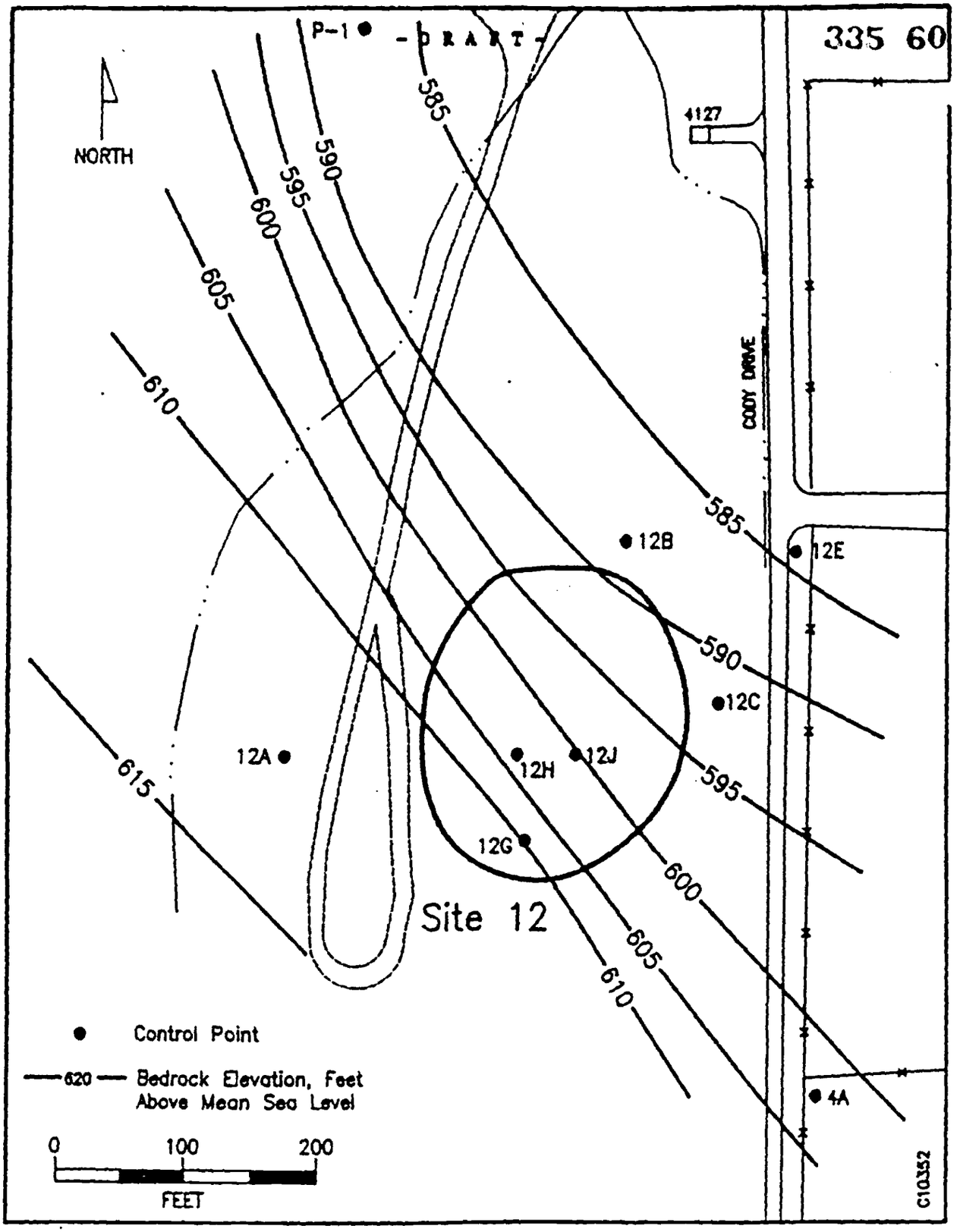

Figure 4.2.6-4. Contour Map of the Top of Bedrock, Site 12 (FDTA 2), Carswell AFB, Texas

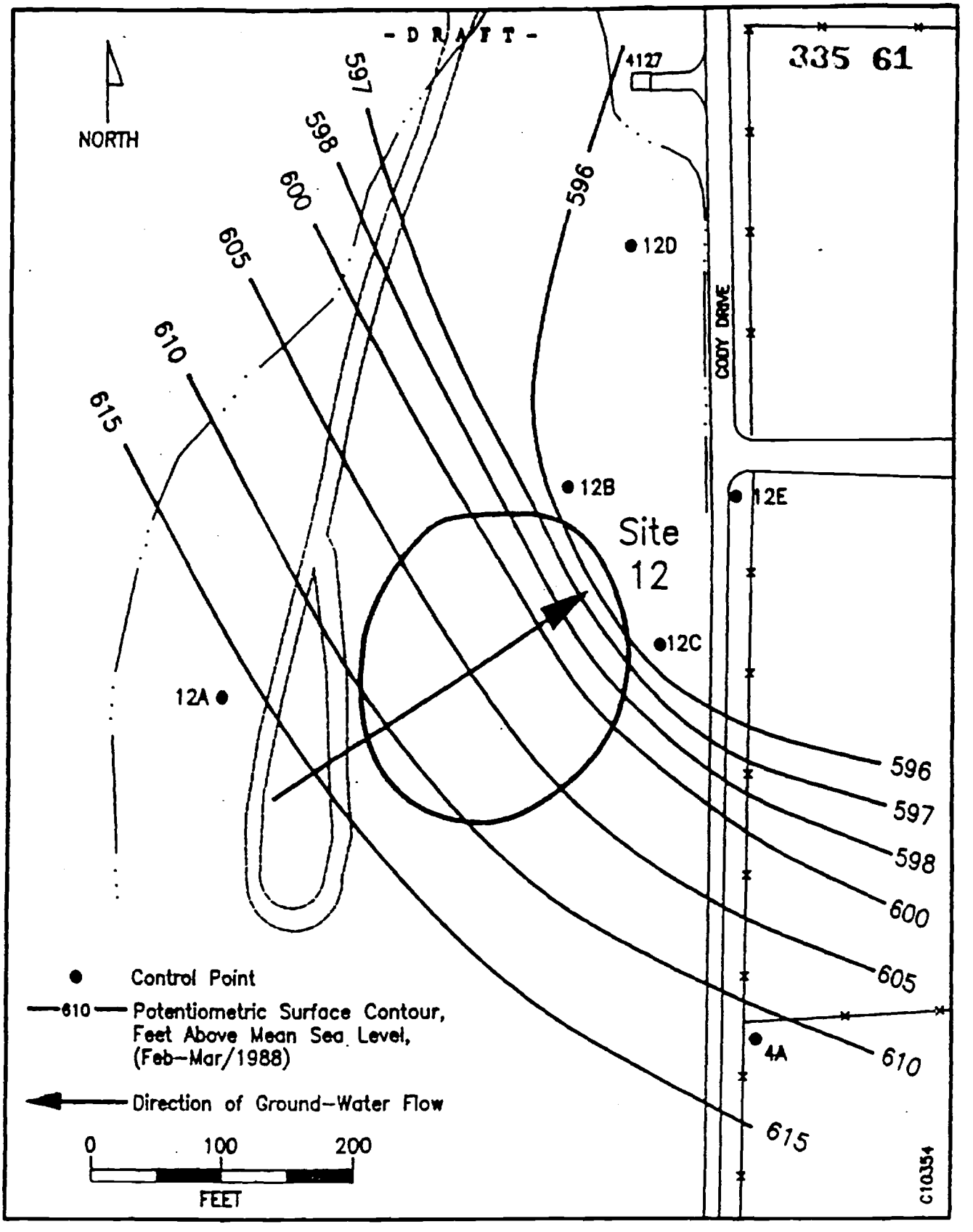

Figure 4.2.6-5. Potentiometric Surface Map of the Upper zone, Site 12 (FDTA 2), Carswell AFB, Texas

4.2.6.2 Chemical Analytical Results

Soil Chemistry

At Site 12, two Stage 2 monitor wells were installed downgradient of the site and five soil borings were drilled within the bermed area during February 1988. Split-spoon samples collected during the monitor well installation and the soil borings were retained and visually examined for any evidence of contamination. Based on the depth and location of samples, as well as the presence of water, samples of soil were selected for analysis of moisture content, heavy metals, petroleum hydrocarbons, volatile organic compounds, and semivolatile organic compounds. The samples were selected for analysis such that the vertical and horizontal distribution of contamination could be evaluated. Results of the analyses are provided in Table 4.2.6-1 (inorganic parameters) and Table 4.2.6-2 (organic parameters).

Heavy Metals--Soil samples from boreholes 12D-12K were submitted for heavy metal analysis. As many as six samples were analyzed from each soil boring. Although there are no generally accepted standards or regulations governing heavy metal content in soil, the analytical results were compared to published average metal concentrations in U.S. soils (Table 4.1-3). Selenium was found at elevated levels in 12H, 12I, and 12J, at depths less than 12 feet. Lead was detected above mean values at boring 12J at a depth of 4 to 8 feet. Other metals parameters from Site 12 were at or less than mean U.S. soil concentrations.

Petroleum Hydrocarbons--Petroleum hydrocarbons were encountered at all boreholes except for 12D and 12G. Boring 12H had five samples analyzed from various depths. These samples showed an apparent trend of decreasing petroleum hydrocarbon concentrations with depth until sand was encountered at 19 feet, where the highest values (5,760 mg/kg) were detected. Furthermore, all samples from boring 12H were noted to have petroleum hydrocarbon odors

TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

	Primary Results							
	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12D		12D		12E		12E	
	12D-4		12D-6		12E-2		12E-4	
	19-Feb-88		19-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	(15 - 20)		(25 - 30)		(4 - 6)		(14 - 19)	
Soil Moisture X MOISTURE								
Dry Weight Determination	3.0		14.0		27.0		16.0	
Metal Screen (ICP) MG/KG								
Ag Silver	1.1	(0.88)	ND	(0.89)	ND	(0.88)	1.5	(0.87)
Al Aluminum	820.0E	(20.0)	740.0E	(20.0)	8600.0	(20.0)	510.0	(19.0)
As Arsenic	ND	(29.0)	ND	(30.0)	ND	(29.0)	ND	(29.0)
B Boron	ND	(59.0)	ND	(59.0)	ND	(59.0)	ND	(58.0)
Ba Barium	4.9E	(0.88)	5.8E	(0.89)	43.0	(0.88)	2.6	(0.87)
Be Beryllium	0.1	(0.098)	0.1	(0.099)	0.5	(0.098)	0.1	(0.096)
Ca Calcium	650.0	(5.9)	44000.0	(5.9)	51000.0	(5.9)	340.0	(5.8)
Cd Cadmium	ND	(0.29)	0.3	(0.30)	ND	(0.29)	0.5	(0.29)
Co Cobalt	ND	(0.98)	ND	(0.99)	3.8	(0.98)	1.9	(0.96)
Cr Chromium	2.2	(0.88)	3.0	(0.89)	9.6	(0.88)	2.4	(0.87)
Cu Copper	1.9	(0.98)	1.3	(0.99)	3.0	(0.98)	ND	(0.96)
Fe Iron	2700.0	(2.9)	2600.0	(3.0)	8800.0	(2.9)	3200.0	(2.9)
K Potassium	80.0	(29.0)	80.0	(30.0)	1200.0	(29.0)	45.0	(29.0)
Mg Magnesium	120.0E	(9.8)	350.0E	(9.9)	1700.0	(9.8)	74.0	(9.6)
Mn Manganese	21.0E	(0.29)	41.0E	(0.30)	76.0	(0.29)	21.0	(0.29)
Mo Molybdenum	ND	(4.9)	ND	(5.0)	ND	(4.9)	ND	(4.8)
Na Sodium	70.0E	(7.8)	140.0E	(7.9)	40.0	(7.8)	39.0	(7.7)
Ni Nickel	2.0	(2.0)	ND	(2.0)	9.0	(2.0)	4.0	(1.9)
Pb Lead	ND	(4.9)	ND	(5.0)	13.0	(4.9)	6.0	(4.8)
Sb Antimony	ND	(5.9)	ND	(5.9)	7.0	(5.9)	ND	(5.8)
Se Selenium	ND	(29.0)	NDE	(30.0)	ND	(29.0)	ND	(29.0)
Si Silicon	350.0E	(29.0)	440.0	(30.0)	310.0	(29.0)	280.0	(29.0)
Tl Thallium	ND	(8.8)	ND	(8.9)	9.0	(8.8)	ND	(8.7)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

		Primary Results							
		Monitor Well							
		Sample ID							
		Date Sampled							
		Beg. Depth - End Depth							
		12D		12D		12E		12E	
		12D-4		12D-6		12E-2		12E-4	
		19-Feb-88		19-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER		(15 - 20)		(25 - 30)		(4 - 6)		(14 - 19)	
V	Vanadium	4.0	(2.0)	7.0	(2.0)	22.0E	(2.0)	6.0E	(1.9)
Zn	Zinc	3.3E	(0.59)	3.2E	(0.59)	17.0	(0.59)	3.7	(0.58)

E: The reported value is estimated due to the presence of an interferant.
ND: Not detected at specified detection limit
( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

	Primary Results					
	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12E		12G		12H	
	12E-6		12G-4		12H-1	
	23-Feb-88		20-Feb-88		23-Feb-88	
PARAMETER	(24 - 29)		(14 - 17)		(0 - 4)	
Soil Moisture % MOISTURE						
Dry Weight Determination	26.0		28.0		29.0	
Metal Screen (ICP) MG/KG						
Ag Silver	1.4	(0.88)	1.3	(0.89)	ND	(0.88)
Al Aluminum	2000.0	(20.0)	7100.0	(79.0)	13000.0	(20.0)
As Arsenic	ND	(29.0)	ND	(30.0)	30.0	(29.0)
B Boron	ND	(59.0)	ND	(59.0)	ND	(59.0)
Ba Barium	8.6	(0.88)	33.0	(0.89)	86.0	(0.88)
Be Beryllium	0.2	(0.098)	0.3	(0.099)	0.7	(0.098)
Ca Calcium	5600.0	(5.9)	120000.0	(24.0)	41000.0	(5.9)
Cd Cadmium	ND	(0.29)	0.7	(0.30)	0.6	(0.29)
Co Cobalt	2.3	(0.98)	1.6	(0.99)	4.6	(0.98)
Cr Chromium	6.4	(0.88)	8.7	(0.89)	14.0	(0.88)
Cu Copper	2.0	(0.98)	1.6	(0.99)	3.4	(0.98)
Fe Iron	7800.0	(2.9)	7700.0	(3.0)	12000.0	(2.9)
K Potassium	270.0	(29.0)	690.0	(30.0)	1100.0	(29.0)
Mg Magnesium	420.0	(9.8)	1400.0	(9.9)	1700.0	(9.8)
Mn Manganese	60.0	(0.29)	47.0	(0.30)	250.0	(0.29)
Mo Molybdenum	ND	(4.9)	ND	(5.0)	ND	(4.9)
Na Sodium	43.0	(7.8)	93.0	(7.9)	74.0	(7.8)
Ni Nickel	6.0	(2.0)	6.0	(2.0)	10.0	(2.0)
Pb Lead	11.0	(4.9)	9.0	(5.0)	16.0	(4.9)
Sb Antimony	ND	(5.9)	19.0	(5.9)	ND	(5.9)
Se Selenium	ND	(29.0)	ND	(30.0)	50.0	(29.0)
Si Silicon	330.0	(29.0)	320.0	(30.0)	350.0	(29.0)
Tl Thallium	ND	(8.8)	12.0	(8.9)	ND	(8.8)

E: The reported value is estimated due to the presence of an interferent.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

		Primary Results					
		Monitor Well					
		Sample ID					
		Date Sampled					
		Beg. Depth - End Depth					
		12E		12G		12H	
		12E-6		12G-4		12H-1	
		23-Feb-88		20-Feb-88		23-Feb-88	
PARAMETER		(24 - 29)		(14 - 17)		(0 - 4)	
V	Vanadium	15.0E	(2.0)	27.0E	(2.0)	30.0E	(2.0)
Zn	Zinc	9.8	(0.59)	12.0	(0.59)	18.0	(0.59)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

	Primary Results							
Monitor Well	12H		12H		12H		12H	
Sample ID	12H-2		12H-2		12H-3		12H-4	
Date Sampled	23-Feb-88		23-Feb-88		23-Feb-88		23-Feb-88	
Beg. Depth - End Depth	(4 - 9)		(4 - 9)		(9 - 14)		(14 - 19)	
PARAMETER								
Soil Moisture % MOISTURE								
Dry Weight Determination	27.0		27.0		25.0		27.0	
Metal Screen (ICP) MG/KG								
Ag Silver	2.3	(0.89)	1.4	(0.87)	2.0	(0.87)	2.7	(0.87)
Al Aluminum	10000.0	(40.0)	7800.0	(39.0)	5400.0	(78.0)	5900.0	(19.0)
As Arsenic	ND	(30.0)	ND	(29.0)	ND	(29.0)	ND	(29.0)
B Boron	ND	(59.0)	ND	(58.0)	ND	(58.0)	ND	(58.0)
Ba Barium	170.0	(0.89)	97.0	(0.87)	37.0	(0.87)	37.0	(0.87)
Be Beryllium	0.5	(0.099)	0.5	(0.097)	0.3	(0.097)	0.5	(0.097)
Ca Calcium	120000.0	(12.0)	91000.0	(12.0)	160000.0	(23.0)	61000.0	(5.8)
Cd Cadmium	ND	(0.30)	ND	(0.29)	ND	(0.29)	ND	(0.29)
Co Cobalt	3.0	(0.99)	4.4	(0.97)	3.2	(0.97)	4.5	(0.97)
Cr Chromium	12.0	(0.89)	9.9	(0.87)	9.5	(0.87)	9.1	(0.87)
Cu Copper	1.2	(0.99)	1.5	(0.97)	2.9	(0.97)	5.2	(0.97)
Fe Iron	9000.0	(3.0)	8200.0	(2.9)	8400.0	(2.9)	9900.0	(2.9)
K Potassium	1000.0	(30.0)	930.0	(29.0)	640.0	(29.0)	730.0	(29.0)
Mg Magnesium	1800.0	(9.9)	1600.0	(9.7)	1400.0	(9.7)	1200.0	(9.7)
Mn Manganese	190.0	(0.30)	130.0	(0.29)	180.0	(0.29)	280.0	(0.29)
Mo Molybdenum	ND	(5.0)	ND	(4.9)	ND	(4.9)	ND	(4.9)
Na Sodium	88.0	(7.9)	91.0	(7.8)	87.0	(7.8)	71.0	(7.8)
Ni Nickel	9.0	(2.0)	9.0	(1.9)	8.0	(1.9)	9.0	(1.9)
Pb Lead	11.0	(5.0)	10.0	(4.9)	11.0	(4.9)	14.0	(4.9)
Sb Antimony	14.0	(5.9)	10.0	(5.8)	40.0	(23.0)	9.0	(5.8)
Se Selenium	30.0	(30.0)	ND	(29.0)	ND	(29.0)	ND	(29.0)
Si Silicon	280.0	(30.0)	230.0	(29.0)	290.0	(29.0)	290.0	(29.0)
Tl Thallium	ND	(8.9)	9.0	(8.7)	10.0	(8.7)	16.0	(8.7)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER		Monitor Well Sample ID Date Sampled Beg. Depth - End Depth							
		12M 12M-2 23-Feb-88 (4 - 9)		12M 12M-2 23-Feb-88 (4 - 9)		12M 12M-3 23-Feb-88 (9 - 14)		12M 12M-4 23-Feb-88 (14 - 19)	
V	Vanadium	28.0E	(2.0)	23.0E	(1.9)	29.0E	(1.9)	24.0E	(1.9)
Zn	Zinc	15.0	(0.59)	15.0	(0.58)	12.0	(0.58)	16.0	(0.58)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

	Primary Results					
	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12E		12I		12I	
	12E-5		12I-2		12I-3	
	23-Feb-88		23-Feb-88		24-Feb-88	
PARAMETER	(19 - 25)		(4 - 9)		(9 - 14)	
Soil Moisture % MOISTURE						
Dry Weight Determination	16.0		16.0		15.0	
Metal Screen (ICP) MG/KG						
Ag Silver	3.9	(0.88)	ND	(0.88)	ND	(0.87)
Al Aluminum	380.0	(20.0)	13000.0	(78.0)	9500.0	(78.0)
As Arsenic	ND	(29.0)	ND	(29.0)	ND	(29.0)
B Boron	ND	(59.0)	ND	(59.0)	ND	(58.0)
Ba Barium	3.4	(0.88)	54.0E	(0.88)	42.0E	(0.87)
Be Beryllium	ND	(0.098)	0.5	(0.098)	0.4	(0.097)
Ca Calcium	520.0	(5.9)	130000.0E	(24.0)	110000.0E	(23.0)
Cd Cadmium	0.8	(0.29)	0.7	(0.29)	ND	(0.29)
Co Cobalt	1.6	(0.98)	2.6	(0.98)	2.8	(0.97)
Cr Chromium	3.6	(0.88)	13.0	(0.88)	11.0	(0.87)
Cu Copper	ND	(0.98)	2.1	(0.98)	3.6	(0.97)
Fe Iron	3900.0	(2.9)	10000.0	(2.9)	8800.0	(2.9)
K Potassium	90.0	(29.0)	1200.0	(29.0)	1100.0	(29.0)
Mg Magnesium	66.0	(9.8)	2200.0E	(9.8)	1800.0E	(9.7)
Mn Manganese	40.0	(0.29)	170.0	(0.29)	200.0	(0.29)
Mo Molybdenum	ND	(4.9)	ND	(4.9)	ND	(4.9)
Na Sodium	44.0	(7.8)	22.0	(7.8)	ND	(7.8)
Ni Nickel	ND	(2.0)	9.0	(2.0)	7.0	(1.9)
Pb Lead	6.0	(4.9)	14.0	(4.9)	7.0	(4.9)
Sb Antimony	ND	(5.9)	28.0	(5.9)	22.0	(5.8)
Se Selenium	ND	(29.0)	42.0	(29.0)	ND	(29.0)
Si Silicon	250.0	(29.0)	330.0	(29.0)	320.0	(29.0)
Tl Thallium	ND	(8.8)	ND	(8.8)	11.0	(8.7)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

		Primary Results					
		Monitor Well					
		Sample ID					
		Date Sampled					
		Beg. Depth - End Depth					
		12H		12I		12I	
		12H-5		12I-2		12I-3	
		23-Feb-88		23-Feb-88		24-Feb-88	
PARAMETER		(19 - 23)		(4 - 9)		(9 - 14)	
V	Vanadium	8.0E	(2.0)	32.0	(2.0)	22.0	(1.9)
Zn	Zinc	2.6	(0.59)	18.0E	(0.59)	15.0E	(0.58)

E: The reported value is estimated due to the presence of an interferant.
ND: Not detected at specified detection limit
(): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

	Primary Results					
	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12I		12J		12J	
	12I-3		12J-2		12J-2	
PARAMETER	24-Feb-88		24-Feb-88		24-Feb-88	
	(19 - 24)		(4 - 9)		(4 - 9)	
Soil Moisture % MOISTURE						
Dry Weight Determination	4.0		15.0		14.0	
Metal Screen (ICP) MG/KG						
Ag Silver	ND	(0.87)	2.0	(0.90)	1.2	(0.86)
Al Aluminum	590.0	(19.0)	14000.0	(80.0)	21000.0	(76.0)
As Arsenic	ND	(29.0)	ND	(30.0)	ND	(29.0)
B Boron	ND	(58.0)	ND	(60.0)	ND	(57.0)
Ba Barium	15.0E	(0.87)	48.0E	(0.90)	91.0E	(0.86)
Be Beryllium	0.1	(0.097)	0.7	(0.10)	0.8	(0.095)
Ca Calcium	5600.0E	(5.8)	120000.0E	(24.0)	81000.0E	(23.0)
Cd Cadmium	0.5	(0.29)	0.6	(0.30)	0.5	(0.29)
Co Cobalt	1.2	(0.97)	2.0	(1.0)	4.8	(0.95)
Cr Chromium	4.2	(0.87)	16.0	(0.90)	19.0	(0.86)
Cu Copper	1.3	(0.97)	5.0	(1.0)	4.8	(0.95)
Fe Iron	5500.0	(2.9)	11000.0	(3.0)	13000.0	(2.9)
K Potassium	ND	(29.0)	1400.0	(30.0)	1900.0	(29.0)
Mg Magnesium	110.0E	(9.7)	2300.0E	(10.0)	2700.0E	(9.5)
Mn Manganese	170.0	(0.29)	140.0	(0.30)	240.0	(0.29)
Mo Molybdenum	ND	(4.9)	ND	(5.0)	ND	(4.8)
Na Sodium	ND	(7.8)	ND	(8.0)	ND	(7.6)
Ni Nickel	3.0	(1.9)	10.0	(2.0)	12.0	(1.9)
Pb Lead	7.0	(4.9)	13.0	(5.0)	20.0	(4.8)
Sb Antimony	ND	(5.8)	31.0	(6.0)	20.0	(5.7)
Se Selenium	ND	(29.0)	50.0	(30.0)	70.0	(29.0)
Si Silicon	260.0	(29.0)	290.0	(30.0)	250.0	(29.0)
Tl Thallium	9.0	(8.7)	ND	(9.0)	ND	(8.6)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

		Primary Results					
		Monitor Well					
		Sample ID					
		Date Sampled					
		Beg. Depth - End Depth					
		12I		12J		12J	
		12I-5		12J-2		12J-2	
		24-Feb-88		24-Feb-88		24-Feb-88	
PARAMETER		(19 - 24)		(4 - 9)		(4 - 9)	
V	Vanadium	11.0	(1.9)	42.0	(2.0)	38.0	(1.9)
Zn	Zinc	3.4E	(0.38)	18.0E	(0.40)	24.0E	(0.37)

E: The reported value is estimated due to the presence of an interferant.
ND: Not detected at specified detection limit
( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

	Primary Results					
	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12J		12J		12K	
	12J-3		12J-5		12K-5	
	24-Feb-88		24-Feb-88		28-Feb-88	
PARAMETER	(9 - 14)		(19 - 22)		(20 - 25)	
Soil Moisture % MOISTURE						
Dry Weight Determination	17.0		4.0		16.8	
Metal Screen (ICP) MG/KG						
Ag Silver	1.4	(0.83)	1.7	(0.82)	1.9	(0.89)
Al Aluminum	10000.0	(74.0)	900.0	(18.0)	5300.0	(20.0)
As Arsenic	ND	(28.0)	ND	(27.0)	ND	(30.0)
B Boron	ND	(56.0)	ND	(55.0)	ND	(59.0)
Ba Barium	38.0E	(0.83)	7.0E	(0.82)	49.0	(0.89)
Be Beryllium	0.5	(0.093)	0.090	(0.091)	0.4	(0.099)
Ca Calcium	110000.0E	(22.0)	980.0E	(5.5)	27000.0	(5.9)
Cd Cadmium	0.5	(0.28)	0.3	(0.27)	ND	(0.30)
Co Cobalt	5.2	(0.93)	1.7	(0.91)	4.6	(0.99)
Cr Chromium	13.0	(0.83)	4.0	(0.82)	9.9	(0.89)
Cu Copper	4.8	(0.93)	2.0	(0.91)	5.1	(0.99)
Fe Iron	10000.0	(2.8)	3400.0	(2.7)	11000.0	(3.0)
K Potassium	1300.0	(28.0)	130.0	(27.0)	670.0	(30.0)
Mg Magnesium	2000.0E	(9.3)	150.0E	(9.1)	930.0	(9.9)
Mn Manganese	150.0	(0.28)	100.0	(0.27)	230.0	(0.30)
Mo Molybdenum	ND	(4.6)	ND	(4.5)	ND	(5.0)
Na Sodium	65.0	(7.4)	ND	(7.3)	68.0	(7.9)
Ni Nickel	8.0	(1.9)	4.0	(1.8)	9.0	(2.0)
Pb Lead	12.0	(4.6)	12.0	(4.5)	11.0	(5.0)
Sb Antimony	30.0	(5.6)	10.0	(5.5)	6.0	(5.9)
Se Selenium	30.0	(28.0)	ND	(27.0)	ND	(30.0)
Si Silicon	230.0	(28.0)	270.0	(27.0)	330.0	(30.0)
Tl Thallium	ND	(8.3)	ND	(8.2)	10.0	(8.9)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-1 RESULTS OF INORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

		Primary Results					
		Monitor Well					
		Sample ID					
		Date Sampled					
		Beg. Depth - End Depth					
		12J		12J		12K	
		12J-3		12J-5		12K-5	
		24-Feb-88		24-Feb-88		20-Feb-88	
PARAMETER		(9 - 14)		(19 - 23)		(20 - 25)	
V	Vanadium	26.0	(1.9)	9.0	(1.8)	25.0E	(2.0)
Zn	Zinc	17.0E	(0.56)	4.7E	(0.55)	17.0	(0.59)

E: The reported value is estimated due to the presence of an interferant.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12D		12D		12E		12E	
	12D-4		12D-6		12E-2		12E-4	
	19-Feb-88		19-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	15 - 20		25 - 30		4 - 6		14 - 19	
Petroleum Hydrocarbons MG/KG								
Petroleum Hydrocarbons	ND	(5.0)	ND	(2.0)	ND	(5.0)	14.0	
Volatile Organic Compounds MG/KG								
1,1,1-trichloroethane	ND	(0.0040)	ND	(0.0045)	ND	(0.0044)	ND	(0.0039)
1,1,2,2-tetrachloroethane	ND	(0.0073)	ND	(0.0081)	ND	(0.0080)	ND	(0.0071)
1,1,2-trichloroethane	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
1,2-dichloroethane	ND	(0.0030)	ND	(0.0033)	ND	(0.0032)	ND	(0.0029)
1,2-dichloropropane	ND	(0.0064)	ND	(0.0071)	ND	(0.0070)	ND	(0.0062)
2-butanone	ND	(0.027)	ND	(0.030)	ND	(0.029)	ND	(0.026)
2-chloroethylvinyl ether	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
2-hexanone	ND	(0.038)	ND	(0.042)	ND	(0.042)	ND	(0.037)
4-methyl-2-pentanone	ND	(0.049)	ND	(0.054)	ND	(0.053)	ND	(0.047)
Benzene	ND	(0.0047)	ND	(0.0052)	ND	(0.0051)	ND	(0.0045)
Ethylbenzene	ND	(0.0076)	ND	(0.0085)	ND	(0.0084)	ND	(0.0074)
Toluene	ND	(0.0064)	0.029	(0.0071)	0.018	(0.0070)	0.0019J	(0.0062)
Trichloroethene	ND	(0.0020)	ND	(0.0022)	ND	(0.0022)	ND	(0.0020)
acetone	0.011B	(0.0080)	0.014B	(0.0089)	0.012B	(0.0087)	0.015B	(0.0077)
bromodichloromethane	ND	(0.0023)	ND	(0.0026)	ND	(0.0026)	ND	(0.0023)
bromoform	ND	(0.0050)	ND	(0.0055)	ND	(0.0055)	ND	(0.0048)
bromomethane	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
carbon disulfide	ND	(0.0018)	ND	(0.0020)	ND	(0.0020)	ND	(0.0018)
carbon tetrachloride	ND	(0.0030)	ND	(0.0033)	ND	(0.0032)	ND	(0.0029)
chlorobenzene	ND	(0.0064)	ND	(0.0071)	ND	(0.0070)	ND	(0.0062)
chloroethane	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12D		12D		12E		12E	
	12D-4		12D-6		12E-2		12E-4	
	19-Feb-88		19-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	15 - 20		25 - 30		4 - 6		14 - 19	
chloroform	ND	(0.0017)	ND	(0.0019)	ND	(0.0019)	ND	(0.0016)
chloromethane	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
cis-1,3-Dichloropropene	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
dibromochloromethane	ND	(0.0033)	ND	(0.0037)	ND	(0.0036)	ND	(0.0032)
methylene chloride	ND	(0.0030)	ND	(0.0033)	ND	(0.0032)	ND	(0.0029)
styrene	ND	(0.0032)	ND	(0.0035)	ND	(0.0035)	ND	(0.0031)
tetrachloroethene	ND	(0.0043)	ND	(0.0048)	ND	(0.0048)	ND	(0.0042)
total xylenes	ND	(0.0049)	ND	(0.0054)	ND	(0.0053)	ND	(0.0047)
trans-1,2-Dichloroethene	ND	(0.0017)	ND	(0.0019)	ND	(0.0019)	ND	(0.0016)
trans-1,3-Dichloropropene	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
trichlorofluoromethane	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
vinyl acetate	ND	(0.0073)	ND	(0.0081)	ND	(0.0080)	ND	(0.0071)
vinyl chloride	ND	(0.0053)	ND	(0.0059)	ND	(0.0058)	ND	(0.0052)
Semivolatile Organic Compounds MG/KG								
1,2,4-trichlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
1,2-dichlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
1,3-dichlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
1,4-dichlorobenzene	ND	(0.30)	ND	(0.34)	ND	(0.40)	ND	(0.35)
2,4,5-trichlorophenol	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)
2,4,6-trichlorophenol	ND	(0.18)	ND	(0.21)	ND	(0.25)	ND	(0.21)
2,4-dichlorophenol	ND	(0.18)	ND	(0.21)	ND	(0.25)	ND	(0.21)
2,4-dimethylphenol	ND	(0.18)	ND	(0.21)	ND	(0.25)	ND	(0.21)
2,4-dinitrophenol	ND	(2.9)	ND	(3.2)	ND	(3.8)	ND	(3.3)
2,4-dinitrotoluene	ND	(0.39)	ND	(0.44)	ND	(0.52)	ND	(0.45)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12D		12D		12E		12E	
	12D-4		12D-6		12E-2		12E-4	
	19-Feb-88		19-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	15 - 20		25 - 30		4 - 6		14 - 19	
2,6-dinitrotoluene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
2-chloronaphthalene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
2-chlorophenol	ND	(0.23)	ND	(0.25)	ND	(0.30)	ND	(0.26)
2-methylnaphthalene	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)
2-methylphenol	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)
2-nitroaniline	ND	(3.4)	ND	(3.9)	ND	(4.6)	ND	(4.0)
2-nitrophenol	ND	(0.25)	ND	(0.28)	ND	(0.33)	ND	(0.29)
3,3'-dichlorobenzidine	ND	(1.1)	ND	(1.3)	ND	(1.5)	ND	(1.3)
3-nitroaniline	ND	(3.4)	ND	(3.9)	ND	(4.6)	ND	(4.0)
4,6-dinitro-2-methylphenol	ND	(1.6)	ND	(1.9)	ND	(2.2)	ND	(1.9)
4-bromophenyl-phenylether	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
4-chloro-3-methylphenol	ND	(0.21)	ND	(0.23)	ND	(0.27)	ND	(0.24)
4-chloroaniline	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)
4-chlorophenyl-phenylether	ND	(0.29)	ND	(0.32)	ND	(0.38)	ND	(0.33)
4-methylphenol	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)
4-nitroaniline	ND	(3.4)	ND	(3.9)	ND	(4.6)	ND	(4.0)
4-nitrophenol	ND	(0.16)	ND	(0.19)	ND	(0.22)	ND	(0.19)
acenaphthene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
acenaphthylene	ND	(0.24)	ND	(0.27)	ND	(0.32)	ND	(0.28)
aniline	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)
anthracene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
benzidine	ND	(3.0)	ND	(3.4)	ND	(4.0)	ND	(3.5)
benzo(a)anthracene	ND	(0.53)	ND	(0.60)	ND	(0.71)	ND	(0.62)
benzo(a)pyrene	ND	(0.17)	ND	(0.19)	ND	(0.23)	ND	(0.20)
benzo(b)fluoranthene	ND	(0.33)	ND	(0.37)	ND	(0.44)	ND	(0.38)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12D		12D		12E		12E	
	12D-4		12D-6		12E-2		12E-4	
	19-Feb-88		19-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	15 - 20		25 - 30		4 - 6		14 - 19	
benzo(k)fluoranthene	ND	(0.17)	ND	(0.19)	ND	(0.23)	ND	(0.20)
benzoic acid	ND	(3.4)	ND	(3.9)	ND	(4.6)	ND	(4.0)
benzyl alcohol	ND	(3.4)	ND	(3.9)	ND	(4.6)	ND	(4.0)
bis(2-chloroethoxy)methane	ND	(0.36)	ND	(0.41)	ND	(0.48)	ND	(0.42)
bis(2-chloroethyl) ether	ND	(0.39)	ND	(0.44)	ND	(0.52)	ND	(0.45)
bis(2-chloroisopropyl)ether	ND	(0.39)	ND	(0.44)	ND	(0.52)	ND	(0.45)
bis(2-ethylhexyl)phthalate	ND	(0.17)	0.15BJ	(0.19)	0.11J	(0.23)	0.16J	(0.20)
butylbenzylphthalate	ND	(0.17)	ND	(0.19)	ND	(0.23)	ND	(0.20)
chrysene	ND	(0.17)	ND	(0.19)	ND	(0.23)	ND	(0.20)
di-n-butylphthalate	0.21	(0.17)	0.096J	(0.19)	0.15BJ	(0.23)	0.25B	(0.20)
di-n-octyl phthalate	ND	(0.17)	ND	(0.19)	0.10J	(0.23)	ND	(0.20)
dibenzo(a,h)anthracene	ND	(0.17)	ND	(0.19)	ND	(0.23)	ND	(0.20)
dibenzofuran	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)
diethylphthalate	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
dimethyl phthalate	ND	(0.11)	ND	(0.12)	ND	(0.15)	ND	(0.13)
fluoranthene	ND	(0.15)	ND	(0.17)	ND	(0.20)	ND	(0.17)
fluorene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
hexachlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
hexachlorobutadiene	ND	(0.062)	ND	(0.069)	ND	(0.082)	ND	(0.071)
hexachlorocyclopentadiene	ND	(0.41)	ND	(0.46)	ND	(0.55)	ND	(0.48)
hexachloroethane	ND	(0.11)	ND	(0.12)	ND	(0.15)	ND	(0.13)
indeno(1,2,3-cd)pyrene	ND	(0.25)	ND	(0.29)	ND	(0.34)	ND	(0.29)
isophorone	ND	(0.15)	ND	(0.17)	ND	(0.20)	ND	(0.17)
n-nitroso-di-n-propylamine	ND	(0.82)	ND	(0.93)	ND	(1.1)	ND	(0.95)
n-nitrosodimethylamine	ND	(0.68)	ND	(0.77)	ND	(0.91)	ND	(0.79)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12D'		12D		12E		12E	
	12D-4		12D-6		12E-2		12E-4	
	19-Feb-88		19-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	15 - 20		25 - 30		4 - 6		14 - 19	
n-nitrosodiphenylamine	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
naphthalene	ND	(0.11)	ND	(0.12)	ND	(0.15)	ND	(0.13)
nitrobenzene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)
pentachlorophenol	ND	(0.25)	ND	(0.28)	ND	(0.33)	ND	(0.29)
phenanthrene	ND	(0.37)	ND	(0.42)	ND	(0.49)	ND	(0.43)
phenol	ND	(0.10)	ND	(0.12)	ND	(0.14)	ND	(0.12)
pyrene	ND	(0.13)	ND	(0.15)	ND	(0.17)	ND	(0.15)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12E		12G		12H	
	12E-6		12G-4		12H-1	
	23-Feb-88		20-Feb-88		23-Feb-88	
PARAMETER	24 - 29		14 - 17		0 - 4	
Petroleum Hydrocarbons MG/KG						
Petroleum Hydrocarbons	ND	(5.0)	ND	(5.0)	3230.0	
Volatile Organic Compounds MG/KG						
1,1,1-trichloroethane	ND	(0.0040)	ND	(0.0044)	ND	(0.95)
1,1,2,2-tetrachloroethane	ND	(0.0072)	ND	(0.0079)	ND	(1.7)
1,1,2-trichloroethane	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
1,2-dichloroethane	ND	(0.0029)	ND	(0.0032)	ND	(0.70)
1,2-dichloropropane	ND	(0.0063)	ND	(0.0069)	ND	(1.5)
2-butanone	ND	(0.026)	ND	(0.029)	3.6BJ	(6.3)
2-chloroethylvinyl ether	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
2-hexanone	ND	(0.038)	ND	(0.041)	ND	(9.0)
4-methyl-2-pentanone	ND	(0.048)	ND	(0.053)	ND	(12.0)
Benzene	ND	(0.0046)	ND	(0.0051)	0.37J	(1.1)
Ethylbenzene	ND	(0.0076)	ND	(0.0083)	4.1	(1.8)
Toluene	0.0042J	(0.0063)	0.019	(0.0069)	11.0	(1.5)
Trichloroethene	ND	(0.0020)	ND	(0.0022)	ND	(0.48)
acetone	0.029B	(0.0079)	0.015B	(0.0086)	0.74BJ	(1.9)
bromodichloromethane	ND	(0.0023)	ND	(0.0025)	ND	(0.55)
bromoform	ND	(0.0049)	ND	(0.0054)	ND	(1.2)
bromomethane	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
carbon disulfide	ND	(0.0018)	ND	(0.0020)	ND	(0.43)
carbon tetrachloride	ND	(0.0029)	ND	(0.0032)	ND	(0.70)
chlorobenzene	ND	(0.0063)	ND	(0.0069)	ND	(1.5)
chloroethane	ND	(0.0053)	ND	(0.0058)	ND	(1.3)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12E		12G		12H	
	12E-6		12G-4		12H-1	
	23-Feb-88		20-Feb-88		23-Feb-88	
PARAMETER	24 - 29		14 - 17		0 - 4	
chloroform	ND	(0.0017)	ND	(0.0018)	ND	(0.40)
chloromethane	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
cis-1,3-Dichloropropene	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
dibromochloromethane	ND	(0.0033)	ND	(0.0036)	ND	(0.78)
methylene chloride	ND	(0.0029)	ND	(0.0032)	ND	(0.70)
styrene	ND	(0.0032)	ND	(0.0035)	ND	(0.75)
tetrachloroethene	ND	(0.0043)	ND	(0.0047)	ND	(1.0)
total xylenes	ND	(0.0048)	ND	(0.0053)	32.0	(1.2)
trans-1,2-Dichloroethene	ND	(0.0017)	ND	(0.0018)	ND	(0.40)
trans-1,3-Dichloropropene	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
trichlorofluoromethane	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
vinyl acetate	ND	(0.0072)	ND	(0.0079)	ND	(1.7)
vinyl chloride	ND	(0.0053)	ND	(0.0058)	ND	(1.3)
Semivolatile Organic Compounds MG/KG						
1,2,4-trichlorobenzene	ND	(0.17)	ND	(0.18)	ND	(0.22)
1,2-dichlorobenzene	ND	(0.17)	ND	(0.18)	ND	(0.22)
1,3-dichlorobenzene	ND	(0.17)	ND	(0.18)	ND	(0.22)
1,4-dichlorobenzene	ND	(0.39)	ND	(0.41)	ND	(0.51)
2,4,5-trichlorophenol	ND	(0.89)	ND	(0.92)	ND	(1.2)
2,4,6-trichlorophenol	ND	(0.24)	ND	(0.25)	ND	(0.32)
2,4-dichlorophenol	ND	(0.24)	ND	(0.25)	ND	(0.32)
2,4-dimethylphenol	ND	(0.24)	ND	(0.25)	ND	(0.32)
2,4-dinitrophenol	ND	(3.8)	ND	(3.9)	ND	(4.9)
2,4-dinitrotoluene	ND	(0.51)	ND	(0.53)	ND	(0.67)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12E		12G		12H	
	12E-6		12G-4		12H-1	
	23-Feb-88		20-Feb-88		23-Feb-88	
PARAMETER	24 - 29		14 - 17		0 - 4	
2,6-dinitrotoluene	ND	(0.17)	ND	(0.18)	ND	(0.22)
2-chloronaphthalene	ND	(0.17)	ND	(0.18)	ND	(0.22)
2-chlorophenol	ND	(0.30)	ND	(0.30)	ND	(0.39)
2-methylnaphthalene	ND	(0.89)	ND	(0.92)	8.7	(1.2)
2-methylphenol	ND	(0.89)	ND	(0.92)	ND	(1.2)
2-nitroaniline	ND	(4.5)	ND	(4.6)	ND	(5.8)
2-nitrophenol	ND	(0.32)	ND	(0.33)	ND	(0.42)
3,3'-dichlorobenzidine	ND	(1.5)	ND	(1.5)	ND	(1.9)
3-nitroaniline	ND	(4.5)	ND	(4.6)	ND	(5.8)
4,6-dinitro-2-methylphenol	ND	(2.1)	ND	(2.2)	ND	(2.8)
4-bromophenyl-phenylether	ND	(0.17)	ND	(0.18)	ND	(0.22)
4-chloro-3-methylphenol	ND	(0.27)	ND	(0.28)	ND	(0.35)
4-chloroaniline	ND	(0.89)	ND	(0.92)	ND	(1.2)
4-chlorophenyl-phenylether	ND	(0.38)	ND	(0.39)	ND	(0.49)
4-methylphenol	ND	(0.89)	ND	(0.92)	4.2	(1.2)
4-nitroaniline	ND	(4.5)	ND	(4.6)	ND	(5.8)
4-nitrophenol	ND	(0.21)	ND	(0.22)	ND	(0.28)
acenaphthene	ND	(0.17)	ND	(0.18)	ND	(0.22)
acenaphthylene	ND	(0.31)	ND	(0.32)	ND	(0.41)
aniline	ND	(0.89)	ND	(0.92)	ND	(1.2)
anthracene	ND	(0.17)	ND	(0.18)	ND	(0.22)
benzidine	ND	(3.9)	ND	(4.1)	ND	(5.1)
benzo(a)anthracene	ND	(0.70)	ND	(0.72)	ND	(0.91)
benzo(a)pyrene	ND	(0.22)	ND	(0.23)	ND	(0.29)
benzo(b)fluoranthene	ND	(0.43)	ND	(0.44)	ND	(0.56)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12E		12G		12H	
	12E-6		12G-4		12H-1	
	23-Feb-88		20-Feb-88		23-Feb-88	
PARAMETER	24 - 29		14 - 17		0 - 4	
benzo(k)fluoranthene	ND	(0.22)	ND	(0.23)	ND	(0.29)
benzoic acid	ND	(4.5)	ND	(4.6)	ND	(5.8)
benzyl alcohol	ND	(4.5)	ND	(4.6)	ND	(5.8)
bis(2-chloroethoxy)methane	ND	(0.47)	ND	(0.49)	ND	(0.62)
bis(2-chloroethyl) ether	ND	(0.51)	ND	(0.53)	ND	(0.67)
bis(2-chloroisopropyl)ether	ND	(0.51)	ND	(0.53)	ND	(0.67)
bis(2-ethylhexyl)phthalate	0.094J	(0.22)	0.19J	(0.23)	0.53	(0.29)
butylbenzylphthalate	ND	(0.22)	ND	(0.23)	ND	(0.29)
chrysene	ND	(0.22)	ND	(0.23)	ND	(0.29)
di-n-butylphthalate	0.24B	(0.22)	0.31B	(0.23)	0.62B	(0.29)
di-n-octyl phthalate	0.092J	(0.22)	0.18J	(0.23)	0.15J	(0.29)
dibenzo(a,h)anthracene	ND	(0.22)	ND	(0.23)	ND	(0.29)
dibenzofuran	ND	(0.89)	ND	(0.92)	0.17J	(1.2)
diethylphthalate	ND	(0.17)	ND	(0.18)	ND	(0.22)
dimethyl phthalate	ND	(0.14)	ND	(0.15)	ND	(0.19)
fluoranthene	ND	(0.20)	ND	(0.20)	ND	(0.26)
fluorene	ND	(0.17)	ND	(0.18)	ND	(0.22)
hexachlorobenzene	ND	(0.17)	ND	(0.18)	ND	(0.22)
hexachlorobutadiene	ND	(0.080)	ND	(0.083)	ND	(0.11)
hexachlorocyclopentadiene	ND	(0.54)	ND	(0.55)	ND	(0.70)
hexachloroethane	ND	(0.14)	ND	(0.15)	ND	(0.19)
indeno(1,2,3-cd)pyrene	ND	(0.33)	ND	(0.34)	ND	(0.43)
isophorone	ND	(0.20)	ND	(0.20)	ND	(0.26)
n-nitroso-di-n-propylamine	ND	(1.1)	ND	(1.1)	ND	(1.4)
n-nitrosodimethylamine	ND	(0.89)	ND	(0.92)	ND	(1.2)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12E		12C		12H	
	12E-6		12C-4		12H-1	
	23-Feb-88		20-Feb-88		23-Feb-88	
PARAMETER	24 - 29		14 - 17		0 - 4	
n-nitrosodiphenylamine	ND	(0.17)	ND	(0.18)	ND	(0.22)
naphthalene	ND	(0.14)	ND	(0.15)	3.9	(0.19)
nitrobenzene	ND	(0.17)	ND	(0.18)	ND	(0.22)
pentachlorophenol	ND	(0.32)	ND	(0.33)	ND	(0.42)
phenanthrene	ND	(0.48)	ND	(0.50)	ND	(0.63)
phenol	ND	(0.13)	ND	(0.14)	0.50	(0.18)
pyrene	ND	(0.17)	ND	(0.18)	ND	(0.22)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12M		12M		12M		12M	
	12M-2		12M-2		12M-3		12M-4	
	23-Feb-88		23-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	4 - 9		4 - 9		9 - 14		14 - 19	
Petroleum Hydrocarbons MG/KG								
Petroleum Hydrocarbons	2110.0		1200.0		450.0		340.0	
Volatile Organic Compounds MG/KG								
1,1,1-trichloroethane	ND	(0.95)	ND	(0.55)	ND	(0.56)	ND	(0.56)
1,1,2,2-tetrachloroethane	ND	(1.7)	ND	(1.0)	ND	(1.0)	ND	(1.0)
1,1,2-trichloroethane	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
1,2-dichloroethane	ND	(0.70)	ND	(0.41)	ND	(0.41)	ND	(0.41)
1,2-dichloropropane	ND	(1.5)	ND	(0.87)	ND	(0.88)	ND	(0.88)
2-butanone	4.3BJ	(6.3)	5.1B	(3.6)	8.0B	(3.7)	5.7B	(3.7)
2-chloroethylvinyl ether	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
2-hexanone	ND	(9.0)	ND	(5.2)	ND	(5.3)	ND	(5.3)
4-methyl-2-pentanone	ND	(12.0)	ND	(6.7)	ND	(6.8)	ND	(6.8)
Benzene	ND	(1.1)	ND	(0.64)	ND	(0.65)	ND	(0.65)
Ethylbenzene	4.8	(1.8)	3.6	(1.0)	1.1J	(1.1)	0.89J	(1.1)
Toluene	8.8	(1.5)	7.5	(0.87)	1.9	(0.88)	0.24J	(0.88)
Trichloroethene	ND	(0.48)	ND	(0.28)	ND	(0.28)	ND	(0.28)
acetone	4.0B	(1.9)	2.6B	(1.1)	2.5B	(1.1)	11.0B	(1.1)
bromodichloromethane	ND	(0.55)	ND	(0.32)	ND	(0.32)	ND	(0.32)
bromoform	ND	(1.2)	ND	(0.68)	ND	(0.69)	ND	(0.69)
bromomethane	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
carbon disulfide	ND	(0.43)	ND	(0.25)	ND	(0.25)	ND	(0.25)
carbon tetrachloride	ND	(0.70)	ND	(0.41)	ND	(0.41)	ND	(0.41)
chlorobenzene	ND	(1.5)	ND	(0.87)	ND	(0.88)	ND	(0.88)
chloroethane	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
PARAMETER	12H 12H-2 23-Feb-88 4 - 9		12H 12H-2 23-Feb-88 4 - 9		12H 12H-3 23-Feb-88 9 - 14		12H 12H-4 23-Feb-88 14 - 19	
chloroform	ND	(0.40)	ND	(0.23)	ND	(0.24)	ND	(0.24)
chloromethane	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
cis-1,3-Dichloropropene	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
dibromochloromethane	ND	(0.78)	ND	(0.45)	ND	(0.46)	ND	(0.46)
methylene chloride	ND	(0.70)	ND	(0.41)	ND	(0.41)	ND	(0.41)
styrene	ND	(0.75)	ND	(0.44)	ND	(0.44)	ND	(0.44)
tetrachloroethene	ND	(1.0)	ND	(0.59)	ND	(0.60)	ND	(0.60)
total xylenes	31.0	(1.2)	23.0	(0.67)	6.4	(0.68)	4.0	(0.68)
trans-1,2-Dichloroethene	ND	(0.40)	ND	(0.23)	ND	(0.24)	ND	(0.24)
trans-1,3-Dichloropropene	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
trichlorofluoromethane	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
vinyl acetate	ND	(1.7)	ND	(1.0)	ND	(1.0)	ND	(1.0)
vinyl chloride	ND	(1.3)	ND	(0.73)	ND	(0.74)	ND	(0.74)
Semivolatile Organic Compounds MG/KG								
1,2,4-trichlorobenzene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
1,2-dichlorobenzene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
1,3-dichlorobenzene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
1,4-dichlorobenzene	ND	(0.40)	ND	(0.40)	ND	(0.39)	ND	(0.40)
2,4,5-trichlorophenol	ND	(0.92)	ND	(0.91)	ND	(0.89)	ND	(0.92)
2,4,6-trichlorophenol	ND	(0.25)	ND	(0.25)	ND	(0.24)	ND	(0.25)
2,4-dichlorophenol	ND	(0.25)	ND	(0.25)	ND	(0.24)	ND	(0.25)
2,4-dimethylphenol	ND	(0.25)	ND	(0.25)	ND	(0.24)	ND	(0.25)
2,4-dinitrophenol	ND	(3.8)	ND	(3.8)	ND	(3.7)	ND	(3.9)
2,4-dinitrotoluene	ND	(0.52)	ND	(0.52)	ND	(0.51)	ND	(0.52)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
PARAMETER	12H 12H-2 23-Feb-88 4 - 9		12H 12H-2 23-Feb-88 4 - 9		12H 12H-3 23-Feb-88 9 - 14		12H 12H-4 23-Feb-88 14 - 19	
2,6-dinitrotoluene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
2-chloronaphthalene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
2-chlorophenol	ND	(0.30)	ND	(0.30)	ND	(0.29)	ND	(0.30)
2-methylnaphthalene	4.8	(0.92)	4.8	(0.91)	0.66J	(0.89)	0.95	(0.92)
2-methylphenol	ND	(0.92)	ND	(0.91)	ND	(0.89)	ND	(0.92)
2-nitroaniline	ND	(4.6)	ND	(4.6)	ND	(4.4)	ND	(4.6)
2-nitrophenol	ND	(0.33)	ND	(0.33)	ND	(0.32)	ND	(0.33)
3,3'-dichlorobenzidine	ND	(1.5)	ND	(1.5)	ND	(1.5)	ND	(1.5)
3-nitroaniline	ND	(4.6)	ND	(4.6)	ND	(4.4)	ND	(4.6)
4,6-dinitro-2-methylphenol	ND	(2.2)	ND	(2.2)	ND	(2.1)	ND	(2.2)
4-bromophenyl-phenylether	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.18)
4-chloro-3-methylphenol	ND	(0.27)	ND	(0.27)	ND	(0.27)	ND	(0.28)
4-chloroaniline	ND	(0.92)	ND	(0.91)	ND	(0.89)	ND	(0.92)
4-chlorophenyl-phenylether	ND	(0.38)	ND	(0.38)	ND	(0.37)	ND	(0.39)
4-methylphenol	0.54J	(0.92)	0.76J	(0.91)	ND	(0.89)	ND	(0.92)
4-nitroaniline	ND	(4.6)	ND	(4.6)	ND	(4.4)	ND	(4.6)
4-nitrophenol	ND	(0.22)	ND	(0.22)	ND	(0.21)	ND	(0.22)
acenaphthene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
acenaphthylene	ND	(0.32)	ND	(0.32)	ND	(0.31)	ND	(0.32)
aniline	ND	(0.92)	ND	(0.91)	ND	(0.89)	ND	(0.92)
anthracene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
benzidine	ND	(4.0)	ND	(4.0)	ND	(3.9)	ND	(4.0)
benzo(a)anthracene	ND	(0.71)	ND	(0.71)	ND	(0.69)	ND	(0.72)
benzo(a)pyrene	ND	(0.23)	ND	(0.23)	ND	(0.22)	ND	(0.23)
benzo(b)fluoranthene	ND	(0.44)	ND	(0.44)	ND	(0.43)	ND	(0.44)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12H		12H		12H		12H	
	12H-2		12H-2		12H-3		12H-4	
	23-Feb-88		23-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	4 - 9		4 - 9		9 - 14		14 - 19	
benzo(k)fluoranthene	ND	(0.23)	ND	(0.23)	ND	(0.22)	ND	(0.23)
benzoic acid	ND	(4.6)	ND	(4.6)	ND	(4.4)	ND	(4.6)
benzyl alcohol	ND	(4.6)	ND	(4.6)	ND	(4.4)	ND	(4.6)
bis(2-chloroethoxy)methane	ND	(0.48)	ND	(0.48)	ND	(0.47)	ND	(0.49)
bis(2-chloroethyl) ether	ND	(0.52)	ND	(0.52)	ND	(0.51)	ND	(0.52)
bis(2-chloroisopropyl)ether	ND	(0.52)	ND	(0.52)	ND	(0.51)	ND	(0.52)
bis(2-ethylhexyl)phthalate	0.28	(0.23)	0.33	(0.23)	1.1B	(0.22)	1.4B	(0.23)
butylbenzylphthalate	ND	(0.23)	ND	(0.23)	ND	(0.22)	ND	(0.23)
chrysene	ND	(0.23)	ND	(0.23)	ND	(0.22)	ND	(0.23)
di-n-butylphthalate	0.28B	(0.23)	0.61B	(0.23)	ND	(0.22)	ND	(0.23)
di-n-octyl phthalate	0.10J	(0.23)	0.22J	(0.23)	0.14BJ	(0.22)	ND	(0.23)
dibenzo(a,h)anthracene	ND	(0.23)	ND	(0.23)	ND	(0.22)	ND	(0.23)
dibenzofuran	ND	(0.92)	ND	(0.91)	ND	(0.89)	ND	(0.92)
diethylphthalate	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
dimethyl phthalate	ND	(0.15)	ND	(0.15)	ND	(0.14)	ND	(0.15)
fluoranthene	ND	(0.20)	ND	(0.20)	ND	(0.20)	ND	(0.20)
fluorene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
hexachlorobenzene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
hexachlorobutadiene	ND	(0.082)	ND	(0.082)	ND	(0.080)	ND	(0.083)
hexachlorocyclopentadiene	ND	(0.55)	ND	(0.55)	ND	(0.53)	ND	(0.55)
hexachloroethane	ND	(0.15)	ND	(0.15)	ND	(0.14)	ND	(0.15)
indeno(1,2,3-cd)pyrene	ND	(0.34)	ND	(0.34)	ND	(0.33)	ND	(0.34)
isophorone	ND	(0.20)	ND	(0.20)	ND	(0.20)	ND	(0.20)
n-nitroso-di-n-propylamine	ND	(1.1)	ND	(1.1)	ND	(1.1)	ND	(1.1)
n-nitrosodimethylamine	ND	(0.92)	ND	(0.91)	ND	(0.89)	ND	(0.92)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well							
	Sample ID							
	Date Sampled							
	Beg. Depth - End Depth							
	12H		12H		12H		12H	
	12H-2		12H-2		12H-3		12H-4	
	23-Feb-88		23-Feb-88		23-Feb-88		23-Feb-88	
PARAMETER	4 - 9		4 - 9		9 - 14		14 - 19	
n-nitrosodiphenylamine	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
naphthalene	2.1	(0.15)	2.7	(0.15)	0.31	(0.14)	0.37	(0.15)
nitrobenzene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)
pentachlorophenol	ND	(0.33)	ND	(0.33)	ND	(0.32)	ND	(0.33)
phenanthrene	ND	(0.49)	ND	(0.49)	ND	(0.48)	ND	(0.50)
phenol	0.33	(0.14)	0.36	(0.14)	ND	(0.13)	ND	(0.14)
pyrene	ND	(0.17)	ND	(0.17)	ND	(0.17)	ND	(0.17)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FUTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	Monitor Well Sample ID Date Sampled Beg. Depth - End Depth 12H 12H-5 23-Feb-88 19 - 25		12I 12I-2 23-Feb-88 4 - 9		12I 12I-3 24-Feb-88 9 - 14	
Petroleum Hydrocarbons MG/KG						
Petroleum Hydrocarbons	5760.0		670.0^		450.0	
Volatile Organic Compounds MG/KG						
1,1,1-trichloroethane	ND	(2.4)	ND	(0.55)	ND	(0.55)
1,1,2,2-tetrachloroethane	1.3J	(4.3)	ND	(1.8)	ND	(0.99)
1,1,2-trichloroethane	ND	(3.1)	ND	(0.73)	ND	(0.72)
1,2-dichloroethane	ND	(1.8)	ND	(0.41)	ND	(0.40)
1,2-dichloropropane	ND	(3.8)	ND	(0.87)	ND	(0.86)
2-butanone	ND	(16.0)	5.0B	(3.6)	6.0B	(3.6)
2-chloroethylvinyl ether	ND	(3.1)	ND	(0.73)	ND	(0.72)
2-hexanone	ND	(23.0)	ND	(5.2)	ND	(5.2)
4-methyl-2-pentanone	ND	(29.0)	ND	(6.7)	ND	(6.6)
Benzene	ND	(2.8)	ND	(0.64)	0.54J	(0.63)
Ethylbenzene	5.0	(4.5)	1.3	(1.0)	5.6	(1.0)
Toluene	3.7J	(3.8)	1.7	(0.87)	2.2	(0.86)
Trichloroethene	ND	(1.2)	ND	(0.28)	ND	(0.27)
acetone	0.87BJ	(4.7)	8.2B	(1.1)	5.4B	(1.1)
bromodichloromethane	ND	(1.4)	ND	(0.32)	ND	(0.32)
bromoform	ND	(2.9)	ND	(0.68)	ND	(0.68)
bromomethane	ND	(3.1)	ND	(0.73)	ND	(0.72)
carbon disulfide	ND	(1.1)	ND	(0.25)	ND	(0.24)
carbon tetrachloride	ND	(1.8)	ND	(0.41)	ND	(0.40)
chlorobenzene	ND	(3.8)	ND	(0.87)	ND	(0.86)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

^: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12H		12I		12I	
	12H-5		12I-2		12I-3	
	23-Feb-88		23-Feb-88		24-Feb-88	
PARAMETER	19 - 25		4 - 9		9 - 14	
chloroethane	ND	(3.1)	ND	(0.73)	ND	(0.72)
chloroform	ND	(1.0)	ND	(0.23)	ND	(0.23)
chloromethane	ND	(3.1)	ND	(0.73)	ND	(0.72)
cis-1,3-Dichloropropene	ND	(3.1)	ND	(0.73)	ND	(0.72)
dibromochloromethane	ND	(1.9)	ND	(0.45)	ND	(0.45)
methylene chloride	ND	(1.8)	ND	(0.41)	ND	(0.40)
styrene	ND	(1.9)	ND	(0.44)	ND	(0.43)
tetrachloroethene	ND	(2.6)	ND	(0.59)	ND	(0.59)
total xylenes	32.0	(2.9)	8.6	(0.67)	35.0	(0.66)
trans-1,2-Dichloroethene	ND	(1.0)	ND	(0.23)	ND	(0.23)
trans-1,3-Dichloropropene	ND	(3.1)	ND	(0.73)	ND	(0.72)
trichlorofluoromethane	ND	(3.1)	ND	(0.73)	ND	(0.72)
vinyl acetate	ND	(4.3)	ND	(1.0)	ND	(0.99)
vinyl chloride	ND	(3.1)	ND	(0.73)	ND	(0.72)
Semivolatile Organic Compounds MG/KG						
1,2,4-trichlorobenzene	ND	(1.4)	ND	(0.15)	ND	(0.15)
1,2-dichlorobenzene	ND	(1.4)	ND	(0.15)	ND	(0.15)
1,3-dichlorobenzene	ND	(1.4)	ND	(0.15)	ND	(0.15)
1,4-dichlorobenzene	ND	(3.3)	ND	(0.35)	ND	(0.35)
2,4,5-trichlorophenol	ND	(7.6)	ND	(0.80)	ND	(0.79)
2,4,6-trichlorophenol	ND	(2.0)	ND	(0.22)	ND	(0.21)
2,4-dichlorophenol	ND	(2.0)	ND	(0.22)	ND	(0.21)
2,4-dimethylphenol	ND	(2.0)	ND	(0.22)	ND	(0.21)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

* Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12H		12I		12I	
	12H-5		12I-2		12I-3	
	23-Feb-88		23-Feb-88		24-Feb-88	
PARAMETER	19 - 25		4 - 9		9 - 14	
2,4-dinitrophenol	ND	(32.0)	ND	(3.4)	ND	(3.3)
2,4-dinitrotoluene	ND	(4.3)	ND	(0.45)	ND	(0.45)
2,6-dinitrotoluene	ND	(1.4)	ND	(0.15)	ND	(0.15)
2-chloronaphthalene	ND	(1.4)	ND	(0.15)	ND	(0.15)
2-chlorophenol	ND	(2.5)	ND	(0.26)	ND	(0.26)
2-methylnaphthalene	11.8	(7.6)	2.0	(0.80)	2.0	(0.79)
2-methylphenol	ND	(7.6)	ND	(0.80)	ND	(0.79)
2-nitroaniline	ND	(38.0)	ND	(4.0)	ND	(3.9)
2-nitrophenol	ND	(2.7)	ND	(0.29)	ND	(0.28)
3,3'-dichlorobenzidine	ND	(12.0)	ND	(1.3)	ND	(1.3)
3-nitroaniline	ND	(38.0)	ND	(4.0)	ND	(3.9)
4,6-dinitro-2-methylphenol	ND	(18.0)	ND	(1.9)	ND	(1.9)
4-bromophenyl-phenylether	ND	(1.4)	ND	(0.15)	ND	(0.15)
4-chloro-3-methylphenol	ND	(2.3)	ND	(0.24)	ND	(0.24)
4-chloroaniline	ND	(7.6)	ND	(0.80)	ND	(0.79)
4-chlorophenyl-phenylether	ND	(3.2)	ND	(0.34)	ND	(0.33)
4-methylphenol	ND	(7.6)	1.4	(0.80)	0.26J	(0.79)
4-nitroaniline	ND	(38.0)	ND	(4.0)	ND	(3.9)
4-nitrophenol	ND	(1.8)	ND	(0.19)	ND	(0.19)
acenaphthene	ND	(1.4)	ND	(0.15)	ND	(0.15)
acenaphthylene	ND	(2.6)	ND	(0.28)	ND	(0.27)
aniline	ND	(7.6)	ND	(0.80)	ND	(0.79)
anthracene	ND	(1.4)	ND	(0.15)	ND	(0.15)
benzidine	ND	(33.0)	ND	(3.5)	ND	(3.5)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (QC test codes)

*: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12H		12I		12I	
	12H-5		12I-2		12I-3	
	23-Feb-88		23-Feb-88		24-Feb-88	
PARAMETER	19 - 25		4 - 9		9 - 14	
benzo(a)anthracene	ND	(5.9)	ND	(0.62)	ND	(0.61)
benzo(a)pyrene	ND	(1.9)	ND	(0.20)	ND	(0.20)
benzo(b)fluoranthene	ND	(3.6)	ND	(0.38)	ND	(0.38)
benzo(k)fluoranthene	ND	(1.9)	ND	(0.20)	ND	(0.20)
benzoic acid	ND	(38.8)	ND	(4.0)	ND	(3.9)
benzyl alcohol	ND	(38.8)	ND	(4.0)	ND	(3.9)
bis(2-chloroethoxy)methane	ND	(4.8)	ND	(0.42)	ND	(0.42)
bis(2-chloroethyl) ether	ND	(4.3)	ND	(0.45)	ND	(0.45)
bis(2-chloroisopropyl)ether	ND	(4.3)	ND	(0.45)	ND	(0.45)
bis(2-ethylhexyl)phthalate	12.0B	(1.9)	1.4B	(0.20)	0.58B	(0.20)
butylbenzylphthalate	ND	(1.9)	ND	(0.20)	ND	(0.20)
chrysene	ND	(1.9)	ND	(0.20)	ND	(0.20)
di-n-butylphthalate	ND	(1.9)	ND	(0.20)	ND	(0.20)
di-n-octyl phthalate	ND	(1.9)	0.21	(0.20)	0.47	(0.20)
dibenzo(a,h)anthracene	ND	(1.9)	ND	(0.20)	ND	(0.20)
dibenzofuran	ND	(7.6)	ND	(0.80)	ND	(0.79)
diethylphthalate	ND	(1.4)	ND	(0.15)	ND	(0.15)
dimethyl phthalate	ND	(1.2)	ND	(0.13)	ND	(0.13)
fluoranthene	ND	(1.7)	ND	(0.18)	ND	(0.17)
fluorene	ND	(1.4)	ND	(0.15)	ND	(0.15)
hexachlorobenzene	ND	(1.4)	ND	(0.15)	ND	(0.15)
hexachlorobutadiene	ND	(0.68)	ND	(0.072)	ND	(0.071)
hexachlorocyclopentadiene	ND	(4.5)	ND	(0.48)	ND	(0.47)
hexachloroethane	ND	(1.2)	ND	(0.13)	ND	(0.13)

B: Detected in Reagent Blank; background subtraction not performed

BJ: Analyte detected in blank. Estimated value below detection limit.

J: Estimated value (GC test codes)

*: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

rimary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12H		12I		12I	
	12H-5		12I-2		12I-3	
	23-Feb-88		23-Feb-88		24-Feb-88	
LRAMETER	19 - 25		4 - 9		9 - 14	
ıdeno(1,2,3-cd)pyrene	ND	(2.8)	ND	(0.30)	ND	(0.29)
ıophorone	ND	(1.7)	ND	(0.18)	ND	(0.17)
nitroso-di-n-propylamine	ND	(9.1)	ND	(0.96)	ND	(0.94)
nitrosodimethylamine	ND	(7.6)	ND	(0.80)	ND	(0.79)
nitrosodiphenylamine	ND	(1.4)	ND	(0.15)	ND	(0.15)
ıphthalene	4.7	(1.2)	0.95	(0.13)	0.94	(0.13)
trobenzene	ND	(1.4)	ND	(0.15)	ND	(0.15)
ntachlorophenol	ND	(2.7)	ND	(0.29)	ND	(0.28)
enanthrene	ND	(4.1)	ND	(0.43)	ND	(0.42)
enol	ND	(1.1)	ND	(0.12)	ND	(0.12)
rene	ND	(1.4)	ND	(0.15)	ND	(0.15)

Detected in Reagent Blank; background subtraction not performed

: Analyte detected in blank. Estimated value below detection limit.

Estimated value (GC test codes)

Indicates duplicate analysis is not within control limits.

: Not detected at specified detection limit

): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	Monitor Well Sample ID Date Sampled Beg. Depth - End Depth 12I 12I-5 24-Feb-88 19 - 24		12J 12J-2 24-Feb-88 4 - 9		12J 12J-2 24-Feb-88 4 - 9	
Petroleum Hydrocarbons MG/KG						
Petroleum Hydrocarbons	1258.0		ND	(5.0)	ND	(5.0)
Volatile Organic Compounds MG/KG						
1,1,1-trichloroethane	ND	(0.0039)	ND	(0.0045)	ND	(0.0044)
1,1,2,2-tetrachloroethane	ND	(0.0070)	ND	(0.0081)	ND	(0.0080)
1,1,2-trichloroethane	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
1,2-dichloroethane	ND	(0.0029)	ND	(0.0033)	ND	(0.0032)
1,2-dichloropropane	ND	(0.0061)	ND	(0.0071)	ND	(0.0070)
2-butanone	ND	(0.026)	ND	(0.030)	ND	(0.029)
2-chloroethylvinyl ether	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
2-hexanone	ND	(0.037)	ND	(0.042)	ND	(0.042)
4-methyl-2-pentanone	ND	(0.047)	0.023J	(0.054)	ND	(0.053)
Benzene	ND	(0.0045)	ND	(0.0052)	ND	(0.0051)
Ethylbenzene	ND	(0.0073)	ND	(0.0085)	ND	(0.0084)
Toluene	0.016	(0.0061)	0.0062J	(0.0071)	0.013	(0.0070)
Trichloroethene	ND	(0.0019)	ND	(0.0022)	ND	(0.0022)
acetone	0.057B	(0.0077)	ND	(0.0089)	0.035B	(0.0087)
bromodichloromethane	ND	(0.0022)	ND	(0.0026)	ND	(0.0026)
bromoform	ND	(0.0048)	ND	(0.0055)	ND	(0.0055)
bromomethane	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
carbon disulfide	ND	(0.0017)	ND	(0.0020)	ND	(0.0020)
carbon tetrachloride	ND	(0.0029)	ND	(0.0033)	ND	(0.0032)
chlorobenzene	ND	(0.0061)	ND	(0.0071)	ND	(0.0070)
chloroethane	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
chloroform	ND	(0.0016)	ND	(0.0019)	ND	(0.0019)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (QC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12I		12J		12J	
	12I-5		12J-2		12J-2	
	24-Feb-88		24-Feb-88		24-Feb-88	
PARAMETER	19 - 24		4 - 9		4 - 9	
chloromethane	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
cis-1,3-Dichloropropene	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
dibromochloromethane	ND	(0.0032)	ND	(0.0037)	ND	(0.0036)
methylene chloride	0.0050	(0.0029)	0.12	(0.0033)	0.018	(0.0032)
styrene	ND	(0.0031)	ND	(0.0035)	ND	(0.0035)
tetrachloroethene	ND	(0.0042)	ND	(0.0048)	ND	(0.0048)
total xylenes	0.0063	(0.0047)	ND	(0.0054)	ND	(0.0053)
trans-1,2-Dichloroethene	ND	(0.0016)	ND	(0.0019)	ND	(0.0019)
trans-1,3-Dichloropropene	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
trichlorofluoromethane	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
vinyl acetate	ND	(0.0070)	ND	(0.0081)	ND	(0.0080)
vinyl chloride	ND	(0.0051)	ND	(0.0059)	ND	(0.0058)
Semivolatile Organic Compounds MG/KG						
1,2,4-trichlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.15)
1,2-dichlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.15)
1,3-dichlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.15)
1,4-dichlorobenzene	ND	(0.30)	ND	(0.35)	ND	(0.34)
2,4,5-trichlorophenol	ND	(0.69)	ND	(0.79)	ND	(0.77)
2,4,6-trichlorophenol	ND	(0.19)	ND	(0.21)	ND	(0.21)
2,4-dichlorophenol	ND	(0.19)	ND	(0.21)	ND	(0.21)
2,4-dimethylphenol	ND	(0.19)	ND	(0.21)	ND	(0.21)
2,4-dinitrophenol	ND	(2.9)	ND	(3.3)	ND	(3.2)
2,4-dinitrotoluene	ND	(0.39)	ND	(0.45)	ND	(0.44)
2,6-dinitrotoluene	ND	(0.13)	ND	(0.15)	ND	(0.15)
2-chloronaphthalene	ND	(0.13)	ND	(0.15)	ND	(0.15)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ) Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12I		12J		12J	
	12I-5		12J-2		12J-2	
	24-Feb-88		24-Feb-88		24-Feb-88	
PARAMETER	19 - 24		4 - 9		4 - 9	
2-chlorophenol	ND	(0.23)	ND	(0.26)	ND	(0.25)
2-methylnaphthalene	0.84	(0.69)	ND	(0.79)	ND	(0.77)
2-methylphenol	ND	(0.69)	ND	(0.79)	ND	(0.77)
2-nitroaniline	ND	(3.4)	ND	(3.9)	ND	(3.9)
2-nitrophenol	ND	(0.25)	ND	(0.28)	ND	(0.28)
3,3'-dichlorobenzidine	ND	(1.1)	ND	(1.3)	ND	(1.3)
3-nitroaniline	ND	(3.4)	ND	(3.9)	ND	(3.9)
4,6-dinitro-2-methylphenol	ND	(1.6)	ND	(1.9)	ND	(1.8)
4-bromophenyl-phenylether	ND	(0.13)	ND	(0.15)	ND	(0.15)
4-chloro-3-methylphenol	ND	(0.21)	ND	(0.24)	ND	(0.23)
4-chloroaniline	ND	(0.69)	ND	(0.79)	ND	(0.77)
4-chlorophenyl-phenylether	ND	(0.29)	ND	(0.33)	ND	(0.32)
4-methylphenol	0.16J	(0.69)	ND	(0.79)	ND	(0.77)
4-nitroaniline	ND	(3.4)	ND	(3.9)	ND	(3.9)
4-nitrophenol	ND	(0.16)	ND	(0.19)	ND	(0.18)
acenaphthene	ND	(0.13)	ND	(0.15)	ND	(0.15)
acenaphthylene	ND	(0.24)	ND	(0.27)	ND	(0.27)
aniline	ND	(0.69)	ND	(0.79)	ND	(0.77)
anthracene	ND	(0.13)	ND	(0.15)	ND	(0.15)
benzidine	ND	(3.0)	ND	(3.5)	ND	(3.4)
benzo(a)anthracene	ND	(0.54)	ND	(0.61)	ND	(0.60)
benzo(a)pyrene	ND	(0.17)	ND	(0.20)	ND	(0.19)
benzo(b)fluoranthene	ND	(0.33)	ND	(0.38)	ND	(0.37)
benzo(k)fluoranthene	ND	(0.17)	ND	(0.20)	ND	(0.19)
benzoic acid	ND	(3.4)	ND	(3.9)	ND	(3.9)
benzyl alcohol	ND	(3.4)	ND	(3.9)	ND	(3.9)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ) Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	Monitor Well / Sample ID / Date Sampled / Beg. Depth - End Depth: 12I, 12I-5, 24-Feb-88, 19 - 24		12J, 12J-2, 24-Feb-88, 4 - 9		12J, 12J-2, 24-Feb-88, 4 - 9	
bis(2-chloroethoxy)methane	ND	(0.36)	ND	(0.42)	ND	(0.41)
bis(2-chloroethyl) ether	ND	(0.39)	ND	(0.45)	ND	(0.44)
bis(2-chloroisopropyl)ether	ND	(0.39)	ND	(0.45)	ND	(0.44)
bis(2-ethylhexyl)phthalate	0.86B	(0.17)	ND	(0.20)	ND	(0.19)
butylbenzylphthalate	ND	(0.17)	ND	(0.20)	ND	(0.19)
chrysene	ND	(0.17)	ND	(0.20)	ND	(0.19)
di-n-butylphthalate	ND	(0.17)	ND	(0.20)	ND	(0.19)
di-n-octyl phthalate	0.095J	(0.17)	ND	(0.20)	ND	(0.19)
dibenzo(a,h)anthracene	ND	(0.17)	ND	(0.20)	ND	(0.19)
dibenzofuran	ND	(0.69)	ND	(0.79)	ND	(0.77)
diethylphthalate	ND	(0.13)	ND	(0.15)	ND	(0.15)
dimethyl phthalate	ND	(0.11)	ND	(0.13)	ND	(0.12)
fluoranthene	ND	(0.15)	ND	(0.17)	ND	(0.17)
fluorene	ND	(0.13)	ND	(0.15)	ND	(0.15)
hexachlorobenzene	ND	(0.13)	ND	(0.15)	ND	(0.15)
hexachlorobutadiene	ND	(0.062)	ND	(0.071)	ND	(0.069)
hexachlorocyclopentadiene	ND	(0.41)	ND	(0.47)	ND	(0.46)
hexachloroethane	ND	(0.11)	ND	(0.13)	ND	(0.12)
indeno(1,2,3-cd)pyrene	ND	(0.25)	ND	(0.29)	ND	(0.28)
isophorone	ND	(0.15)	ND	(0.17)	ND	(0.17)
n-nitroso-di-n-propylamine	ND	(0.82)	ND	(0.94)	ND	(0.92)
n-nitrosodimethylamine	ND	(0.69)	ND	(0.79)	ND	(0.77)
n-nitrosodiphenylamine	ND	(0.13)	ND	(0.15)	ND	(0.15)
naphthalene	0.28	(0.11)	ND	(0.13)	ND	(0.12)
nitrobenzene	ND	(0.13)	ND	(0.15)	ND	(0.15)
pentachlorophenol	ND	(0.25)	ND	(0.28)	ND	(0.28)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (QC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12I		12J		12J	
	12I-5		12J-2		12J-2	
	24-Feb-88		24-Feb-88		24-Feb-88	
	19 - 24		4 - 9		4 - 9	
PARAMETER						
phenanthrene	ND	(0.37)	ND	(0.42)	ND	(0.42)
phenol	ND	(0.10)	ND	(0.12)	ND	(0.12)
pyrene	ND	(0.13)	ND	(0.15)	ND	(0.15)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	Monitor Well Sample ID Date Sampled Beg. Depth - End Depth 12J 12J-3 24-Feb-88 9 - 14		12J 12J-5 24-Feb-88 19 - 23		12K 12K-5 20-Feb-88 20 - 25	
Petroleum Hydrocarbons MG/KG						
Petroleum Hydrocarbons	ND	(6.0)	17.0		14.0	
Volatile Organic Compounds MG/KG						
1,1,1-trichloroethane	ND	(0.0045)	ND	(0.0039)	ND	(0.0040)
1,1,2,2-tetrachloroethane	ND	(0.0081)	ND	(0.0070)	ND	(0.0072)
1,1,2-trichloroethane	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
1,2-dichloroethane	ND	(0.0033)	ND	(0.0029)	ND	(0.0029)
1,2-dichloropropane	ND	(0.0071)	ND	(0.0061)	ND	(0.0063)
2-butanone	ND	(0.030)	ND	(0.026)	0.034	(0.026)
2-chloroethylvinyl ether	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
2-hexanone	ND	(0.042)	ND	(0.037)	ND	(0.038)
4-methyl-2-pentanone	ND	(0.054)	ND	(0.047)	ND	(0.048)
Benzene	ND	(0.0052)	ND	(0.0045)	ND	(0.0046)
Ethylbenzene	ND	(0.0085)	ND	(0.0073)	ND	(0.0076)
Toluene	ND	(0.0071)	0.0064	(0.0061)	0.0011J	(0.0063)
Trichloroethene	ND	(0.0022)	ND	(0.0019)	ND	(0.0020)
Acetone	0.016B	(0.0089)	0.014B	(0.0077)	0.013B	(0.0079)
Bromodichloromethane	ND	(0.0026)	ND	(0.0022)	ND	(0.0023)
Bromoform	ND	(0.0055)	ND	(0.0048)	ND	(0.0049)
Bromomethane	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
Carbon disulfide	ND	(0.0020)	ND	(0.0017)	ND	(0.0018)
Carbon tetrachloride	ND	(0.0033)	ND	(0.0029)	ND	(0.0029)
Chlorobenzene	ND	(0.0071)	ND	(0.0061)	ND	(0.0063)
Chloroethane	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
Chloroform	ND	(0.0019)	ND	(0.0016)	ND	(0.0017)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

(): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12J		12J		12K	
	12J-3		12J-5		12K-5	
	24-Feb-88		24-Feb-88		20-Feb-88	
	9 - 14		19 - 23		20 - 25	
chloromethane	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
cis-1,3-Dichloropropene	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
dibromochloromethane	ND	(0.0037)	ND	(0.0032)	ND	(0.0033)
methylene chloride	0.0039	(0.0033)	0.0062	(0.0029)	ND	(0.0029)
styrene	ND	(0.0035)	ND	(0.0031)	ND	(0.0032)
tetrachloroethene	ND	(0.0048)	ND	(0.0042)	ND	(0.0043)
total xylenes	ND	(0.0054)	ND	(0.0047)	ND	(0.0048)
trans-1,2-Dichloroethene	ND	(0.0019)	ND	(0.0016)	ND	(0.0017)
trans-1,3-Dichloropropene	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
trichlorofluoromethane	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
vinyl acetate	ND	(0.0081)	ND	(0.0070)	ND	(0.0072)
vinyl chloride	ND	(0.0059)	ND	(0.0051)	ND	(0.0053)
Semivolatile Organic Compounds MG/KG						
1,2,4-trichlorobenzene	ND	(0.15)	ND	(0.13)	ND	(0.15)
1,2-dichlorobenzene	ND	(0.15)	ND	(0.13)	ND	(0.15)
1,3-dichlorobenzene	ND	(0.15)	ND	(0.13)	ND	(0.15)
1,4-dichlorobenzene	ND	(0.35)	ND	(0.30)	ND	(0.35)
2,4,5-trichlorophenol	ND	(0.80)	ND	(0.69)	ND	(0.79)
2,4,6-trichlorophenol	ND	(0.22)	ND	(0.19)	ND	(0.21)
2,4-dichlorophenol	ND	(0.22)	ND	(0.19)	ND	(0.21)
2,4-dimethylphenol	ND	(0.22)	ND	(0.19)	ND	(0.21)
2,4-dinitrophenol	ND	(3.4)	ND	(2.9)	ND	(3.3)
2,4-dinitrotoluene	ND	(0.46)	ND	(0.39)	ND	(0.45)
2,6-dinitrotoluene	ND	(0.15)	ND	(0.13)	ND	(0.15)
2-chloronaphthalene	ND	(0.15)	ND	(0.13)	ND	(0.15)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12J		12J		12K	
	12J-3		12J-5		12K-5	
	24-Feb-88		24-Feb-88		20-Feb-88	
PARAMETER	9 - 14		19 - 23		20 - 25	
2-chlorophenol	ND	(0.26)	ND	(0.23)	ND	(0.24)
2-methylnaphthalene	ND	(0.80)	ND	(0.69)	ND	(0.79)
2-methylphenol	ND	(0.80)	ND	(0.69)	ND	(0.79)
2-nitroaniline	ND	(4.0)	ND	(3.5)	ND	(3.9)
2-nitrophenol	ND	(0.29)	ND	(0.25)	ND	(0.28)
3,3'-dichlorobenzidine	ND	(1.3)	ND	(1.1)	ND	(1.3)
3-nitroaniline	ND	(4.0)	ND	(3.5)	ND	(3.9)
4,6-dinitro-2-methylphenol	ND	(1.9)	ND	(1.7)	ND	(1.9)
4-bromophenyl-phenylether	ND	(0.15)	ND	(0.13)	ND	(0.15)
4-chloro-3-methylphenol	ND	(0.24)	ND	(0.21)	ND	(0.24)
4-chloroaniline	ND	(0.80)	ND	(0.69)	ND	(0.79)
4-chlorophenyl-phenylether	ND	(0.34)	ND	(0.29)	ND	(0.33)
4-methylphenol	ND	(0.80)	ND	(0.69)	ND	(0.79)
4-nitroaniline	ND	(4.0)	ND	(3.5)	ND	(3.9)
4-nitrophenol	ND	(0.19)	ND	(0.17)	ND	(0.19)
acenaphthene	ND	(0.15)	ND	(0.13)	ND	(0.15)
acenaphthylene	ND	(0.28)	ND	(0.24)	ND	(0.28)
aniline	ND	(0.80)	ND	(0.69)	ND	(0.79)
anthracene	ND	(0.15)	ND	(0.13)	ND	(0.15)
benzidine	ND	(3.5)	ND	(3.0)	ND	(3.5)
benzo(a)anthracene	ND	(0.62)	ND	(0.54)	ND	(0.61)
benzo(a)pyrene	ND	(0.20)	ND	(0.17)	ND	(0.20)
benzo(b)fluoranthene	ND	(0.38)	ND	(0.33)	ND	(0.38)
benzo(k)fluoranthene	ND	(0.20)	ND	(0.17)	ND	(0.20)
benzoic acid	ND	(4.0)	ND	(3.5)	ND	(3.9)
benzyl alcohol	ND	(4.0)	ND	(3.5)	ND	(3.9)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (QC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12J		12J		12K	
	12J-3		12J-5		12K-5	
	24-Feb-88		24-Feb-88		20-Feb-88	
PARAMETER	9 - 14		19 - 23		20 - 25	
bis(2-chloroethoxy)methane	ND	(0.42)	ND	(0.37)	ND	(0.42)
bis(2-chloroethyl) ether	ND	(0.46)	ND	(0.39)	ND	(0.45)
bis(2-chloroisopropyl)ether	ND	(0.46)	ND	(0.39)	ND	(0.45)
bis(2-ethylhexyl)phthalate	ND	(0.20)	0.32B	(0.17)	0.12J	(0.20)
butylbenzylphthalate	ND	(0.20)	ND	(0.17)	ND	(0.20)
chrysene	ND	(0.20)	ND	(0.17)	ND	(0.20)
di-n-butylphthalate	ND	(0.20)	ND	(0.17)	ND	(0.20)
di-n-octyl phthalate	ND	(0.20)	ND	(0.17)	ND	(0.20)
dibenzo(a,h)anthracene	ND	(0.20)	ND	(0.17)	ND	(0.20)
dibenzofuran	ND	(0.80)	ND	(0.69)	ND	(0.79)
diethylphthalate	ND	(0.15)	ND	(0.13)	ND	(0.15)
dimethyl phthalate	ND	(0.13)	ND	(0.11)	ND	(0.13)
fluoranthene	ND	(0.18)	ND	(0.15)	ND	(0.17)
fluorene	ND	(0.15)	ND	(0.13)	ND	(0.15)
hexachlorobenzene	ND	(0.15)	ND	(0.13)	ND	(0.15)
hexachlorobutadiene	ND	(0.072)	ND	(0.062)	ND	(0.071)
hexachlorocyclopentadiene	ND	(0.48)	ND	(0.41)	ND	(0.47)
hexachloroethane	ND	(0.13)	ND	(0.11)	ND	(0.13)
indeno(1,2,3-cd)pyrene	ND	(0.30)	ND	(0.26)	ND	(0.29)
isophorone	ND	(0.18)	ND	(0.15)	ND	(0.17)
n-nitroso-di-n-propylamine	ND	(0.96)	ND	(0.83)	ND	(0.94)
n-nitrosodimethylamine	ND	(0.80)	ND	(0.69)	ND	(0.79)
n-nitrosodiphenylamine	ND	(0.15)	ND	(0.13)	ND	(0.15)
naphthalene	ND	(0.13)	ND	(0.11)	ND	(0.13)
nitrobenzene	ND	(0.15)	ND	(0.13)	ND	(0.15)
pentachlorophenol	ND	(0.29)	ND	(0.25)	ND	(0.28)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-2 RESULTS OF ORGANIC ANALYSES FOR SOIL SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

	Monitor Well					
	Sample ID					
	Date Sampled					
	Beg. Depth - End Depth					
	12J		12J		12K	
	12J-3		12J-5		12K-5	
	24-Feb-88		24-Feb-88		20-Feb-88	
PARAMETER	9 - 14		19 - 23		20 - 25	
phenanthrene	ND	(0.43)	ND	(0.37)	ND	(0.42)
phenol	ND	(0.12)	ND	(0.10)	ND	(0.12)
pyrene	ND	(0.15)	ND	(0.13)	ND	(0.15)

B: Detected in Reagent Blank; background subtraction not performed

J: Estimated value (GC test codes)

ND: Not detected at specified detection limit

( ): Detection limit

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while drilling. Borehole 12I had the next highest readings, again displaying the trend of decreasing hydrocarbon values until the sand zone was encountered at 19 to 22 feet, where the highest value (1,250 mg/kg) was recorded. Borings 12E, 12J, and 12K showed a similar pattern with little or no detection of petroleum hydrocarbons until the sand was encountered.

Volatile Organic Compounds--Soil analysis at Site 12 did not display good correlation with ground-water analyses for purgeable halocarbons. TCE was not detected in any of the soil samples. 1,1,2,2-tetrachloroethane was estimated from GC test codes at 1.3 mg/kg at 12H in the sand layer 19-21 feet below land surface. Maximum concentrations from borehole 12H included 0.37 mg/kg for benzene (in the first two feet of soil), 37 mg/kg for total xylenes (in the first two feet of soil), and 5 mg/kg for ethylbenzene (in the sand layer 19 to 21 feet below land surface). Xylenes concentrations at borehole 12I were 35 mg/kg (9 to 12 feet).

Semivolatile Organic Compounds--Semivolatile organic compounds encountered in soil from 12H were as follows: 2-methylnaphthalene (11 mg/kg), 4-methylphenol (4.2 mg/kg), phenol (0.5 mg/kg), naphthalene (4.7 mg/kg). Samples from borehole 12I had similar compounds, but occurring at lower concentrations. These compounds were not detected in other boreholes. The trend in concentration for napthalene and 2-methylnapthalene was high concentrations at the surface, decreasing concentrations with depth, and then maximum concentrations in the sand zone at 19 feet below land surface. Phenol and methylphenol concentrations were highest at the surface, but were not detected at depth.

Water Quality

All Stage 1 wells (12A-C) and Stage 2 wells (12D-E) were sampled for chemical analysis during 2 rounds. Results of the two sampling rounds are provided in Table 4.2.6-3 (inorganic parameters) and Table 4.2.6-4 (organic parameters). Field chemistry analyses are reported in Table 4.2.6-5. Samples were analyzed for water quality indicators, heavy metals, petroleum hydro-

carbons, purgeable halocarbons, purgeable aromatics, and extractable priority pollutants (12A and 12C). These data are discussed in the following paragraphs.

Water Quality Indicators--Total dissolved solids (TDS) ranged from 380 to 590 mg/L at Site 12, with the lowest value observed in the upgradient well, 12A. The trend in water quality indicators from the first to second sampling rounds was one of a steady increase in most concentrations of fluoride, chloride, nitrate, and sulfate. Well 12A did not exhibit this increasing trend but, rather, remained fairly stable between samples rounds.

Heavy Metals--Concentrations of several metals were above federal regulatory limits for drinking water (Table 4.1-1). Arsenic (wells 12B, 12C, and 12D), lead (12B, 12C, 12D, and 12E), cadmium (12D), and chromium (12B, 12C, 12D, and 12E) exceeded MCLs in the first sampling round. In the second sampling round, arsenic (12A, 12C, and 12D), lead (12A, 12C, 12D, and 12E), cadmium (12C), and chromium (12A, 12C, 12D, and 12E) concentrations exceeded MCLs. MCLGs were exceeded by iron and manganese in every ground-water sample from Site 12. Cadmium exceeded MCLGs, but not MCLs, in the first sampling round at 12B and 12E. The two southernmost wells, 12A and 12C, showed increased metals concentrations while 12C, 12D, and 12E all declined in ground-water metals concentrations.

Petroleum Hydrocarbons--The only detection of petroleum hydrocarbons was in the ground water monitor well 12C (0.60 mg/L) in Round 1.

Purgeable Halocarbons--Purgeable halocarbons were present in all ground-water samples except the first round sample from the upgradient well, 12A. TCE concentrations were highest at 12B (110 μg/L) and 12D (55 μg/L) and tetrachloroethene also occurred at 12B (49 μg/L). Concentrations in both of

TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FOTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well / Sample ID / Date Sampled: 12A 02-154 25-Feb-88		12A 04-04 04-Apr-88		12B 03-24 03-Mar-88		12B 03-25 03-Mar-88	
Total Dissolved Solids MG/L										
Total Dissolved Solids			380.0	(1.0)	430.0	(1.0)	450.0	(1.0)	510.0	(1.0)
Fluoride MG/L										
Fluoride	4.0(M)	2.0(G)	0.34		0.33		0.25		0.25	
Chloride MG/L										
Chloride	250.0(G)		15.0		4.4		6.0		6.0	
Nitrate MG/L										
Nitrate + Nitrite	10.0(M)		0.52				0.26		0.25	
Nitrate, colorimetric					0.468					
Orthophosphate MG/L										
Orthophosphate			0.040	(0.020)	0.15	(0.020)	0.080	(0.020)	ND	(0.020)
Sulfate MG/L										
Sulfate, nephelometry	250.0(G)		29.0		30.0		26.0		28.0	
Metals MG/L										
Arsenic, graphite AA	0.050(M)		0.010^		0.039		0.044^		0.031	
Mercury	0.0020(M)		ND	(0.00012)	ND	(0.00012)	ND	(0.00012)	0.00010	(0.00012)
Lead, graphite AA	0.050(M)		0.0060				~~0.060^~~		0.048	
Selenium, graphite AA	0.010(M)		0.0040		ND	(0.0030)	ND	(0.0050)	ND	(0.0050)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

@: Indicates that the analytical spike recovery for this analysis was not within acceptance limits indicating an interferent present.

B: Detected in Reagent Blank; background subtraction not performed

R: Indicates that the matrix spike recovery for this analysis was not within acceptance limits indicating an interferent present.

^: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

( ): Detection limit

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TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER		EPA Standards, Criteria	Monitor Well Sample ID / Date Sampled: 12A 02-154 25-Feb-88		12A 04-04 06-Apr-88		12B 03-24 03-Mar-88		12B 03-25 03-Mar-88	
Metal Screen (ICP) MG/L										
Ag	Silver		ND	(0.0090)	ND	(0.0090)	ND	(0.0090)	ND	(0.0090)
Al	Aluminum		16.0	(0.20)	63.0	(0.20)	100.0	(0.20)	130.0B	(0.20)
As	Arsenic	0.050(M)	ND	(0.30)	[illegible]	(0.015)	ND	(0.30)	NDR	(0.30)
B	Boron		ND	(0.60)	ND	(0.60)	ND	(0.60)	NDR	(0.60)
Ba	Barium	1.0(M)	0.14	(0.0090)	0.29	(0.0090)	0.46	(0.0090)	0.53	(0.0090)
Be	Beryllium		0.0010	(0.0010)	0.0030	(0.0010)	0.0020	(0.0010)	0.0030	(0.0010)
Ca	Calcium		220.0	(0.060)	620.0	(0.060)	1100.0	(0.12)	1200.0B	(0.12)
Cd	Cadmium	0.010(M)	0.0030	(0.0030)	0.0040	(0.0030)	0.0070	(0.0030)	0.0080	(0.0030)
Co	Cobalt		ND	(0.010)	ND	(0.010)	0.060	(0.010)	0.070	(0.010)
Cr	Chromium	0.050(M)	0.033	(0.0090)	[illegible]	(0.0090)	[illegible]	(0.0090)	[illegible]	(0.0090)
Cu	Copper	1.0(G)	ND	(0.010)	0.010	(0.010)	0.070	(0.010)	0.080	(0.010)
Fe	Iron	0.30(G)	15.0	(0.030)	58.0	(0.030)	120.0	(0.030)	150.0B	(0.030)
K	Potassium		3.2	(0.30)	13.0	(0.30)	15.0	(0.60)	19.0R	(0.60)
Mg	Magnesium		6.4	(0.10)	17.0	(0.10)	24.0	(0.10)	29.0	(0.10)
Mn	Manganese	0.050(G)	0.17	(0.0030)	0.59	(0.0030)	3.1	(0.0030)	3.5	(0.0030)
Mo	Molybdenum		ND	(0.050)	ND	(0.050)	ND	(0.050)	ND	(0.050)
Na	Sodium		13.0	(0.080)	14.0	(0.080)	23.0	(0.080)	22.0	(0.080)
Ni	Nickel		ND	(0.020)	0.060	(0.020)	0.16	(0.020)	0.20	(0.020)
Pb	Lead	0.050(M)	0.041	(0.050)	[illegible]	(0.050)	[illegible]	(0.050)	0.23	(0.050)
Sb	Antimony		ND	(0.060)	0.15	(0.060)	0.30	(0.060)	0.24R	(0.060)
Se	Selenium	0.010(M)	ND	(0.30)	ND	(0.30)	ND	(0.30)	0.50	(0.30)
Si	Silicon		42.0	(0.30)	78.0^	(0.30)	150.0	(0.30)	160.0B	(0.30)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

@: Indicates that the analytical spike recovery for this analysis was not within acceptance limits indicating an interferent present.

B: Detected in Reagent Blank; background subtraction not performed

R: Indicates that the matrix spike recovery for this analysis was not within acceptance limits indicating an interferent present.

^: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

( ): Detection limit

335108

TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER		EPA Standards, Criteria	Monitor Well Sample ID / Date Sampled: 12A 02-154 25-Feb-88		12A 04-04 04-Apr-88		12B 03-24 03-Mar-88		12B 03-25 03-Mar-88	
Tl	Thallium		0.077	(0.090)	ND	(0.090)	ND	(0.090)	ND	(0.090)
V	Vanadium		0.053	(0.020)	0.17	(0.020)	0.33	(0.020)	0.39	(0.020)
Zn	Zinc	5.0(G)	0.018	(0.0060)	0.11	(0.0060)	0.23	(0.0060)	0.31	(0.0060)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

@: Indicates that the analytical spike recovery for this analysis was not within acceptance limits indicating an interferent present.

B: Detected in Reagent Blank; background subtraction not performed

R: Indicates that the matrix spike recovery for this analysis was not within acceptance limits indicating an interferent present.

^: Indicates duplicate analysis is not within control limits.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335109

TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FUTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well Sample ID / Date Sampled: 12B 04-57 13-Apr-88		12C 03-26 03-Mar-88		12C 04-59 11-Apr-88		12D 03-23 03-Mar-88	
Total Dissolved Solids MG/L										
Total Dissolved Solids			490.0	(1.0)	540.0	(1.0)	550.0	(1.0)	590.0	(1.0)
Fluoride MG/L										
Fluoride	4.0(M)	2.0(G)	0.29		0.26		0.34		0.31	
Chloride MG/L										
Chloride	250.0(G)		20.0		18.0		26.0		9.0	
Nitrate MG/L										
Nitrate + Nitrite	10.0(M)		0.43		ND	(0.10)	ND	(0.20)	0.46	
Orthophosphate MG/L										
Orthophosphate			0.040	(0.020)	0.070	(0.020)	ND	(0.020)	0.050	(0.020)
Sulfate MG/L										
Sulfate, nephelometry	250.0(G)		52.0		15.0		18.0		61.0	
Metals MG/L										
Arsenic, graphite AA	0.050(M)		0.019		0.086		0.074		[illegible]	
Mercury	0.0020(M)		ND#	(0.00012)	0.00030	(0.00012)	0.00020#	(0.00012)	0.00030	(0.00012)
Lead, graphite AA	0.050(M)				0.050				0.128+	
Selenium, graphite AA	0.010(M)		ND	(0.0030)	ND#	(0.020)	ND	(0.0030)	ND#	(0.0030)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

#: Matrix spike outside control limits.

@: Indicates that the analytical spike recovery for this analysis was not within acceptance limits indicating an interferent present.

B: Detected in Reagent Blank; background subtraction not performed

B+: Analyte detected in Reagent Blank. % Difference (MS and MS duplicate) outside control limits.

R: Indicates that the matrix spike recovery for this analysis was not within acceptance limits indicating an interferent present.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335110

TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER		EPA Standards, Criteria	Monitor Well Sample ID / Date Sampled: 12B 04-57 13-Apr-88		12C 03-26 03-Mar-88		12C 04-59 11-Apr-88		12D 03-23 03-Mar-88	
Metal Screen (ICP) MG/L										
Ag	Silver		ND	(0.0090)	ND	(0.0090)	0.010	(0.0090)	0.010	(0.0090)
Al	Aluminum		21.0	(0.20)	100.0	(0.20)	97.0	(0.20)	190.0	(0.20)
As	Arsenic	0.050(M)	ND#	(0.30)	ND	(0.30)	ND#	(0.30)	ND	(0.30)
B	Boron		ND	(0.60)	ND	(0.60)	ND	(0.60)	ND	(0.60)
Ba	Barium	1.0(M)	0.17	(0.0090)	0.66	(0.0090)	0.76	(0.0090)	0.79	(0.0090)
Be	Beryllium		ND	(0.0010)	0.0030	(0.0010)	0.0030	(0.0010)	0.0060	(0.0010)
Ca	Calcium		310.0	(0.060)	2000.0	(0.24)	2600.0	(0.24)	2300.0	(0.24)
Cd	Cadmium	0.010(M)	0.0040	(0.0030)	ND	(0.0030)	0.011	(0.0030)	0.015	(0.0030)
Co	Cobalt		0.010	(0.010)	0.050	(0.010)	0.080	(0.010)	0.12	(0.010)
Cr	Chromium	0.050(M)	0.035	(0.0090)	0.22	(0.0090)	[illegible]	(0.0090)	0.35	(0.0090)
Cu	Copper	1.0(G)	ND	(0.010)	0.050	(0.010)	0.080	(0.010)	0.24	(0.010)
Fe	Iron	0.30(G)	25.0	(0.030)	120.0	(0.030)	140.0	(0.030)	330.0	(0.030)
K	Potassium		2.7	(0.30)	18.0	(1.2)	16.0	(0.30)	28.0	(1.2)
Mg	Magnesium		8.4	(0.10)	34.0	(0.10)	39.0	(0.10)	45.0	(0.10)
Mn	Manganese	0.050(G)	0.79	(0.0030)	7.2	(0.0030)	7.9	(0.0030)	4.0	(0.0030)
Mo	Molybdenum		ND	(0.050)	ND	(0.050)	ND	(0.050)	ND	(0.050)
Na	Sodium		22.0	(0.080)	25.0	(0.080)	28.0	(0.080)	32.0	(0.080)
Ni	Nickel		0.030	(0.020)	0.18	(0.020)	0.18	(0.020)	0.31	(0.020)
Pb	Lead	0.050(M)	ND	(0.050)	[illegible]	(0.050)	0.19	(0.050)	0.27	(0.050)
Sb	Antimony		ND	(0.060)	0.39	(0.060)	0.39	(0.060)	0.50	(0.060)
Se	Selenium	0.010(M)	ND	(0.30)	ND	(0.30)	0.50	(0.30)	0.60	(0.30)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

#: Matrix spike outside control limits.

@: Indicates that the analytical spike recovery for this analysis was not within acceptance limits indicating an interferent present.

B: Detected in Reagent Blank; background subtraction not performed

B+: Analyte detected in Reagent Blank. % Difference (MS and MS duplicate) outside control limits.

R: Indicates that the matrix spike recovery for this analysis was not within acceptance limits indicating an interferent present.

ND: Not detected at specified detection limit

( ): Detection limit

335111

TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER		EPA Standards, Criteria	Monitor Well Sample ID / Date Sampled: 12B 04-57 13-Apr-88		12C 03-26 03-Mar-88		12C 04-59 11-Apr-88		12D 03-23 03-Mar-88	
Si	Silicon		48.0	(0.30)	130.0	(0.30)	110.0	(0.30)	140.0	(0.30)
Tl	Thallium		0.13	(0.090)	ND	(0.090)	ND	(0.090)	ND	(0.090)
V	Vanadium		0.060	(0.020)	0.36	(0.020)	0.40	(0.020)	0.93	(0.020)
Zn	Zinc	5.0(G)	0.034	(0.0060)	0.19	(0.0060)	0.22	(0.0060)	0.55	(0.0060)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

#: Matrix spike outside control limits.

@: Indicates that the analytical spike recovery for this analysis was not within acceptance limits indicating an interferent present.

B: Detected in Reagent Blank; background subtraction not performed

B+: Analyte detected in Reagent Blank. % Difference (MS and MS duplicate) outside control limits.

R: Indicates that the matrix spike recovery for this analysis was not within acceptance limits indicating an interferent present.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335112

TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well Sample ID Date Sampled 12D 04-53 13-Apr-88		12E 03-27 03-Mar-88		12E 04-56 13-Apr-88	
Total Dissolved Solids MG/L								
Total Dissolved Solids			570.0	(1.0)	530.0	(1.0)	590.0	(1.0)
Fluoride MG/L								
Fluoride	4.0(M)	2.0(G)	0.33		0.22		0.27	
Chloride MG/L								
Chloride	250.0(G)		23.0		15.0		16.0	
Nitrate MG/L								
Nitrate + Nitrite	10.0(M)		0.72		0.13		1.2	
Orthophosphate MG/L								
Orthophosphate			0.030	(0.020)	ND	(0.020)	ND	(0.020)
Sulfate MG/L								
Sulfate, nephelometry	250.0(G)		120.0		31.0		88.0	
Metals MG/L								
Arsenic, graphite AA	0.050(M)		0.054		0.028		0.033	
Mercury	0.0020(M)		ND#	(0.00012)	0.00010	(0.00012)	ND#	(0.00012)
Lead, graphite AA	0.050(M)				0.061			
Selenium, graphite AA	0.010(M)		ND	(0.0030)	ND	(0.0050)	ND	(0.0030)
Metal Screen (ICP) MG/L								
Ag Silver			ND	(0.0090)	ND	(0.0090)	ND	(0.0090)
Al Aluminum			76.0	(0.20)	120.0	(0.20)	27.0	(0.20)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

#: Matrix spike outside control limits.

ND: Not detected at specified detection limit

( ): Detection limit

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335113

TABLE 4.2.6-3 RESULTS OF INORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER		EPA Standards, Criteria	Monitor Well Sample ID Date Sampled 12D 04-53 13-Apr-88		12E 03-27 03-Mar-88		12E 04-56 13-Apr-88	
As	Arsenic	0.050(M)	ND#	(0.30)	ND	(0.30)	ND#	(0.30)
B	Boron		ND	(0.60)	ND	(0.60)	ND	(0.60)
Ba	Barium	1.0(M)	0.46	(0.0090)	0.70	(0.0090)	0.34	(0.0090)
Be	Beryllium		0.0030	(0.0010)	0.0020	(0.0010)	ND	(0.0010)
Ca	Calcium		1300.0	(0.24)	2900.0	(0.60)	860.0	(0.24)
Cd	Cadmium	0.010(M)	0.0040	(0.0030)	0.0070	(0.0030)	ND	(0.0030)
Co	Cobalt		0.060	(0.010)	0.060	(0.010)	0.020	(0.010)
Cr	Chromium	0.050(M)	0.17	(0.0090)	[illegible]	(0.0090)	0.009	(0.0090)
Cu	Copper	1.0(G)	0.11	(0.010)	0.13	(0.010)	0.040	(0.010)
Fe	Iron	0.30(G)	160.0	(0.030)	200.0	(0.030)	56.0	(0.030)
K	Potassium		10.0	(0.30)	20.0	(3.0)	3.0	(0.30)
Mg	Magnesium		25.0	(0.10)	40.0	(0.10)	13.0	(0.10)
Mn	Manganese	0.050(G)	1.9	(0.0030)	5.7	(0.0030)	1.8	(0.0030)
Mo	Molybdenum		ND	(0.050)	ND	(0.050)	ND	(0.050)
Na	Sodium		34.0	(0.080)	23.0	(0.080)	23.0	(0.080)
Ni	Nickel		0.15	(0.020)	0.23	(0.020)	0.060	(0.020)
Pb	Lead	0.050(M)	[illegible]	(0.050)	[illegible]	(0.050)	[illegible]	(0.050)
Sb	Antimony		0.16	(0.060)	0.59	(0.060)	ND	(0.060)
Se	Selenium	0.010(M)	0.60	(0.30)	0.50	(0.30)	ND	(0.30)
Si	Silicon		92.0	(0.30)	120.0	(0.30)	50.0	(0.30)
Tl	Thallium		0.11	(0.090)	0.11	(0.090)	0.12	(0.090)
V	Vanadium		0.46	(0.020)	0.53	(0.020)	0.15	(0.020)
Zn	Zinc	5.0(G)	0.27	(0.0060)	0.33	(0.0060)	0.12	(0.0060)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

#: Matrix spike outside control limits.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335114

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well Sample ID Date Sampled 12A 02-154 25-Feb-88		12A 04-04 04-Apr-88		12B 03-24 03-Mar-88		12B 03-25 03-Mar-88	
Petroleum Hydrocarbons UG/L										
Petroleum Hydrocarbons			ND	(200.0)	ND	(200.0)	ND	(200.0)	ND	(200.0)
Purgeable Halocarbons UG/L										
1,1,1-Trichloroethane	200.0(M)	200.0(G)	ND	(0.090)	ND	(0.090)	ND	(2.3)	ND	(2.3)
1,1,2,2-Tetrachloroethane			ND	(0.12)	ND	(0.12)	ND	(3.0)	ND	(3.0)
1,1,2-Trichloroethane			ND	(0.070)	ND	(0.070)	ND	(1.8)	ND	(1.8)
1,1-Dichloroethane			ND	(0.090)	ND	(0.090)	ND	(2.3)	ND	(2.3)
1,1-Dichloroethene	7.0(M)	7.0(G)	ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
1,2-Dichlorobenzene	620.0(G)		ND	(0.50)	ND	(0.50)	ND	(13.0)	ND	(13.0)
1,2-Dichloroethane	5.0(M)	0.0(G)	ND	(0.030)	ND	(0.030)	ND	(0.75)	ND	(0.75)
1,2-Dichloropropane			ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
1,3-Dichlorobenzene	400.0(G)		ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	ND	(0.40)	ND	(0.40)	ND	(10.0)	ND	(10.0)
2-Chloroethylvinyl ether			ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
Bromodichloromethane			ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
Bromoform			ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
Bromomethane			ND	(1.2)	ND	(1.2)	ND	(30.0)	ND	(30.0)
Carbon tetrachloride	5.0(M)	0.0(G)	ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
Chlorobenzene	60.0(G)		ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
Chloroethane			ND	(0.50)	ND	(0.50)	ND	(13.0)	ND	(13.0)
Chloroform			ND	(0.050)	[illegible]	(0.050)	ND	(1.3)	ND	(1.3)
Chloromethane			ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
Dibromochloromethane			ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
Methylene chloride			ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well Sample ID / Date Sampled: 12A 02-154 23-Feb-88		12A 04-04 06-Apr-88		12B 03-24 03-Mar-88		12B 03-25 03-Mar-88	
Tetrachloroethene	0.0(G)		ND	(0.030)	0.030	(0.030)	42.0	(0.75)	43.0	(0.75)
Trichloroethene	5.0(M)	0.0(G)	ND	(0.20)	0.20	(0.20)	220.0	(5.0)	220.0	(5.0)
Trichlorofluoromethane			ND	(0.10)	ND	(0.10)	ND	(2.5)	ND	(2.5)
Vinyl chloride	2.0(M)	0.0(G)	ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
cis-1,3-Dichloropropene			ND4		ND4		ND4		ND4	
trans-1,2-Dichloroethene	70.0(G)		ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
trans-1,3-Dichloropropene			ND	(0.30)	ND	(0.30)	ND	(7.5)	ND	(7.5)
Purgeable Aromatics UG/L										
1,2-Dichlorobenzene	620.0(G)		ND	(0.40)	ND	(0.40)	ND	(10.0)	ND	(10.0)
1,3-Dichlorobenzene	400.0(G)		ND	(0.40)	ND	(0.40)	ND	(10.0)	ND	(10.0)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	ND	(0.30)	ND	(0.30)	ND	(8.0)	ND	(8.0)
Benzene	5.0(M)	0.0(G)	ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
Chlorobenzene	60.0(G)		ND	(0.30)	ND	(0.30)	ND	(8.0)	ND	(8.0)
Ethylbenzene	680.0(G)		ND	(0.30)	ND	(0.30)	ND	(8.0)	ND	(8.0)
Toluene	2000.0(G)		1.1	(0.20)	1.2	(0.20)	9.8	(5.0)	ND	(5.0)
m-Xylene			ND	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
o-Xylene			ND	(0.10)	ND	(0.10)	ND	(3.0)	ND	(3.0)
p-Xylene			NDQ	(0.20)	ND	(0.20)	ND	(5.0)	ND	(5.0)
Extractable Priority Pollutants UG/L										
1,2,4-trichlorobenzene			ND	(2.0)						
1,2-dichlorobenzene			ND	(2.0)						
1,3-dichlorobenzene			ND	(2.0)						
1,4-dichlorobenzene	750.0(G)		ND	(4.5)						

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

4: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

335116

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria	Monitor Well Sample ID Date Sampled 12A 02-134 25-Feb-88	12A 04-04 04-Apr-88	12B 03-24 03-Mar-88	12B 03-25 03-Mar-88
2,4,5-trichlorophenol		ND (10.0)			
2,4,6-trichlorophenol		ND (2.8)			
2,4-dichlorophenol	3090.0(G)	ND (2.8)			
2,4-dimethylphenol	400.0(G)	ND (2.8)			
2,4-dinitrophenol		ND (43.0)			
2,4-dinitrotoluene		ND (5.9)			
2,6-dinitrotoluene		ND (2.0)			
2-chloronaphthalene		ND (2.0)			
2-chlorophenol		ND (3.4)			
2-methylnaphthalene		ND (10.0)			
2-methylphenol		ND (10.0)			
2-nitroaniline		ND (52.0)			
2-nitrophenol		ND (3.7)			
3,3'-dichlorobenzidine		ND (17.0)			
4,6-dinitro-2-methylphenol		ND (25.0)			
4-bromophenyl-phenylether		ND (2.0)			
4-chloro-3-methylphenol		ND (3.1)			
4-chloroaniline		ND (10.0)			
4-chlorophenyl-phenylether		ND (4.3)			
4-methylphenol		ND (10.0)			
4-nitroaniline		ND (52.0)			
4-nitrophenol		ND (2.5)			
acenaphthene	0.030(G)	ND (2.0)			
acenaphthylene		ND (3.6)			
aniline		ND (10.0)			

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

-DRAFT-

335117

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria	Monitor Well / Sample ID / Date Sampled: 12A 02-154 25-Feb-88		12A 04-04 06-Apr-88	12B 03-24 03-Mar-88	12B 03-25 03-Mar-88
anthracene		ND	(2.0)			
benzidine		ND	(45.0)			
benzo(a)anthracene		ND	(8.0)			
benzo(a)pyrene		ND	(2.6)			
benzo(b)fluoranthene		ND	(4.9)			
benzo(g,h,i)perylene		ND	(4.2)			
benzo(k)fluoranthene		ND	(2.6)			
benzoic acid		ND	(52.0)			
benzyl alcohol		ND	(52.0)			
bis(2-chloroethoxy)methane		ND	(5.5)			
bis(2-chloroethyl) ether		ND	(5.9)			
bis(2-chloroisopropyl)ether		ND	(5.9)			
bis(2-ethylhexyl)phthalate	15000.0(G)	17.0	(2.6)			
butylbenzylphthalate	940.0(G)	ND	(2.6)			
chrysene		ND	(2.6)			
di-n-butylphthalate	35000.0(G)	4.2B	(2.6)			
di-n-octyl phthalate		ND	(2.6)			
dibenzo(a,h)anthracene		ND	(2.6)			
dibenzofuran		ND	(10.0)			
diethylphthalate		ND	(2.0)			
dimethyl phthalate		ND	(1.6)			
fluoranthene	0.030(G)	ND	(2.3)			
fluorene	0.030(G)	ND	(2.0)			
hexachlorobenzene		ND	(2.0)			
hexachlorobutadiene		ND	(0.93)			

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

A: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

-DRAFT-

335118

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria	Monitor Well Sample ID / Date Sampled: 12A 02-154 25-Feb-88	12A 04-04 06-Apr-88	12B 03-24 03-Mar-89	12B 03-25 03-Mar-89
hexachlorocyclopentadiene		ND (6.2)			
hexachloroethane		ND (1.6)			
indeno(1,2,3-cd)pyrene		ND (3.8)			
isophorone	5200.0(G)	ND (2.3)			
n-nitroso-di-n-propylamine		ND (12.0)			
n-nitrosodimethylamine		ND (10.0)			
n-nitrosodiphenylamine		ND (2.0)			
naphthalene	620.0(G)	ND (1.6)			
nitrobenzene		ND (2.0)			
pentachlorophenol	200.0(G)	ND (3.7)			
phenanthrene	0.030(G)	ND (5.6)			
phenol	3500.0(G)	ND (1.5)			
pyrene	0.030(G)	ND (2.0)			

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

4: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

B: Detected in Reagent Blank; background subtraction not performed

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

-DRAFT-

335119

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well / Sample ID / Date Sampled: 12B 04-57 12-Apr-88		12C 03-26 03-Mar-88		12C 04-59 11-Apr-88		12D 03-23 03-Mar-88	
Petroleum Hydrocarbons UG/L										
Petroleum Hydrocarbons			ND	(200.0)	600.0		ND	(200.0)	ND	(200.0)
Purgeable Halocarbons UG/L										
1,1,1-Trichloroethane	200.0(M)	200.0(G)	ND	(2.3)	0.30	(0.090)	ND	(0.90)	ND	(2.3)
1,1,2,2-Tetrachloroethane			ND	(3.0)	ND	(0.12)	ND	(1.2)	ND	(3.0)
1,1,2-Trichloroethane			ND	(1.8)	ND	(0.070)	ND	(0.70)	ND	(1.8)
1,1-Dichloroethane			ND	(2.3)	[illegible]	(0.090)	ND	(0.90)	ND	(2.3)
1,1-Dichloroethene	7.0(M)	7.0(G)	ND	(2.5)	ND	(0.10)	ND	(1.0)	ND	(2.5)
1,2-Dichlorobenzene	620.0(G)		ND	(13.0)	ND	(2.5)	ND	(5.0)	ND	(13.0)
1,2-Dichloroethane	5.0(M)	0.0(G)	ND	(0.75)	ND	(0.030)	ND	(0.30)	ND	(0.75)
1,2-Dichloropropane			ND	(2.5)	ND	(0.10)	ND	(1.0)	ND	(2.5)
1,3-Dichlorobenzene	400.0(G)		ND	(7.5)	ND	(1.5)	ND	(3.0)	ND	(7.5)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	ND	(10.0)	ND	(2.0)	ND	(4.0)	ND	(10.0)
2-Chloroethylvinyl ether			ND	(5.0)	ND	(0.20)	ND	(2.0)	ND	(5.0)
Bromodichloromethane			ND	(2.5)	ND	(0.10)	ND	(1.0)	ND	(2.5)
Bromoform			ND	(7.5)	ND	(0.30)	ND	(3.0)	ND	(7.5)
Bromomethane			ND	(30.0)	ND	(1.2)	ND	(12.0)	ND	(30.0)
Carbon tetrachloride	5.0(M)	0.0(G)	ND	(2.5)	ND	(0.10)	ND	(1.0)	ND	(2.5)
Chlorobenzene	60.0(G)		ND	(7.5)	ND	(1.5)	ND	(3.0)	ND	(7.5)
Chloroethane			ND	(13.0)	ND	(0.50)	ND	(5.0)	ND	(13.0)
Chloroform			ND	(1.3)	ND	(0.050)	ND	(0.50)	ND	(1.3)
Chloromethane			ND	(7.5)	ND	(0.30)	ND	(3.0)	ND	(7.5)
Dibromochloromethane			ND	(5.0)	ND	(0.20)	ND	(2.0)	ND	(5.0)
Methylene chloride			ND	(7.5)	ND	(0.30)	ND	(3.0)	ND	(7.5)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

J: Estimated value (GC test codes)

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

335120

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well Sample ID / Date Sampled: 12B 04-57 12-Apr-89		12C 03-26 03-Mar-89		12C 04-59 11-Apr-89		12D 03-23 03-Mar-89	
Tetrachloroethene	8.0(G)		49.0	(0.75)	2.5	(0.030)	2.7	(0.30)	ND	(0.75)
Trichloroethene	5.0(M)	0.0(G)	100.0	(5.0)	3.0	(0.20)	ND	(2.0)	48.0	(5.0)
Trichlorofluoromethane			ND	(2.5)	ND	(0.10)	ND	(1.0)	ND	(2.5)
Vinyl chloride	2.0(M)	0.0(G)	ND	(5.0)	18.0	(0.20)	15.0	(2.0)	ND	(5.0)
cis-1,3-Dichloropropene			ND&		ND&		ND&		ND&	
trans-1,2-Dichloroethane	70.0(G)		ND	(5.0)	ND	(0.20)	ND	(2.0)	ND	(5.0)
trans-1,3-Dichloropropene			ND	(7.5)	ND	(0.30)	ND	(3.0)	ND	(7.5)
Purgeable Aromatics UG/L										
1,2-Dichlorobenzene	620.0(G)		ND	(2.0)	ND	(0.40)	2.3	(0.40)	ND	(0.40)
1,3-Dichlorobenzene	400.0(G)		ND	(2.0)	ND	(0.40)	ND	(0.40)	ND	(0.40)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	ND	(2.0)	ND	(0.30)	1.4	(0.30)	ND	(0.30)
Benzene	5.0(M)	0.0(G)	ND	(1.0)	ND	(0.20)	ND	(0.20)	ND	(0.20)
Chlorobenzene	60.0(G)		ND	(2.0)	ND	(0.30)	ND	(0.30)	ND	(0.30)
Ethylbenzene	680.0(G)		ND	(2.0)	ND	(0.30)	ND	(0.30)	ND	(0.30)
Toluene	2000.0(G)		ND	(1.0)	17.0	(0.20)	1.0	(0.20)	7.6	(0.20)
m-Xylene			ND	(1.0)	ND	(0.20)	ND	(0.20)	ND	(0.20)
o-Xylene			ND	(0.50)	ND	(0.10)	ND	(0.10)	ND	(0.10)
p-Xylene			NDQ	(1.0)	ND	(0.20)	NDQ	(0.20)	ND	(0.20)
Extractable Priority Pollutants UG/L										
1,2,4-trichlorobenzene							ND	(2.5)		
1,2-dichlorobenzene							2.3J	(2.5)		
1,3-dichlorobenzene							ND	(2.5)		
1,4-dichlorobenzene	750.0(G)						ND	(5.0)		

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

J: Estimated value (GC test codes)

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

335121

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria	Monitor Well Sample ID Date Sampled 12B 04-57 13-Apr-88	12C 03-26 03-Mar-88	12C 04-59 11-Apr-88	12D 03-23 03-Mar-88
2,4,5-trichlorophenol				ND (13.0)	
2,4,6-trichlorophenol				ND (3.6)	
2,4-dichlorophenol	3090.0(G)			ND (3.6)	
2,4-dimethylphenol	400.0(G)			ND (3.6)	
2,4-dinitrophenol				ND (55.0)	
2,4-dinitrotoluene				ND (7.5)	
2,6-dinitrotoluene				ND (2.5)	
2-chloronaphthalene				ND (2.5)	
2-chlorophenol				ND (4.4)	
2-methylnaphthalene				ND (13.0)	
2-methylphenol				ND (13.0)	
2-nitroaniline				ND (66.0)	
2-nitrophenol				ND (4.8)	
3,3'-dichlorobenzidine				ND (22.0)	
4,6-dinitro-2-methylphenol				ND (32.0)	
4-bromophenyl-phenylether				ND (2.5)	
4-chloro-3-methylphenol				ND (4.0)	
4-chloroaniline				ND (13.0)	
4-chlorophenyl-phenylether				ND (5.5)	
4-methylphenol				ND (13.0)	
4-nitroaniline				ND (66.0)	
4-nitrophenol				ND (3.2)	
acenaphthene	0.030(G)			ND (2.5)	
acenaphthylene				ND (4.6)	
anthracene				ND (2.5)	

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

J: Estimated value (QC test codes)

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335122

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria	Monitor Well Sample ID / Date Sampled: 12B 04-57 13-Apr-88	12C 03-26 03-Mar-88	12C 04-59 11-Apr-88	12D 03-23 03-Mar-88
benzo(a)anthracene				ND (10.0)	
benzo(a)pyrene				ND (3.3)	
benzo(b)fluoranthene				ND (6.3)	
benzo(g,h,i)perylene				ND (5.4)	
benzo(k)fluoranthene				ND (3.3)	
benzoic acid				ND (66.0)	
benzyl alcohol				ND (66.0)	
bis(2-chloroethoxy)methane				ND (7.0)	
bis(2-chloroethyl) ether				ND (7.5)	
bis(2-chloroisopropyl)ether				ND (7.5)	
bis(2-ethylhexyl)phthalate	15000.0(G)			2.3J (3.3)	
butylbenzylphthalate	940.0(G)			8.9 (3.3)	
chrysene				ND (3.3)	
di-n-butylphthalate	35000.0(G)			1.4J (3.3)	
di-n-octyl phthalate				ND (3.3)	
dibenzo(a,h)anthracene				ND (3.3)	
dibenzofuran				ND (13.0)	
diethylphthalate				ND (2.5)	
dimethyl phthalate				ND (2.1)	
fluoranthene	0.030(G)			ND (2.9)	
fluorene	0.030(G)			ND (2.5)	
hexachlorobenzene				ND (2.5)	
hexachlorobutadiene				ND (1.2)	
hexachlorocyclopentadiene				ND (7.9)	
hexachloroethane				ND (2.1)	

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

L: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

J: Estimated value (GC test codes)

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FOTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria	Monitor Well Sample ID Date Sampled 12B 04-57 13-Apr-88	12C 03-26 03-Mar-88	12C 04-59 11-Apr-88	12D 03-23 03-Mar-88
indeno(1,2,3-cd)pyrene				ND (4.9)	
isophorone	5200.0(G)			ND (2.9)	
n-nitroso-di-n-propylamine				ND (16.0)	
n-nitrosodiphenylamine				ND (2.5)	
naphthalene	620.0(G)			ND (2.1)	
nitrobenzene				ND (2.5)	
pentachlorophenol	200.0(G)			ND (4.8)	
phenanthrene	0.030(G)			ND (7.1)	
phenol	3500.0(G)			ND (2.0)	
pyrene	0.030(G)			ND (2.5)	

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

J: Estimated value (QC test codes)

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335124

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well Sample ID Date Sampled 12D 04-53 13-Apr-88		12E 03-27 03-Mar-88		12E 04-56 13-Apr-88	
Petroleum Hydrocarbons UG/L								
Petroleum Hydrocarbons			ND	(200.0)	ND	(200.8)	ND	(200.0)
Purgeable Halocarbons UG/L								
1,1,1-Trichloroethane	200.0(M)	200.0(G)	ND	(2.3)	ND	(0.090)	0.48	(0.090)
1,1,2,2-Tetrachloroethane			ND	(3.0)	ND	(0.12)	ND	(0.12)
1,1,2-Trichloroethane			ND	(1.8)	ND	(0.070)	ND	(0.070)
1,1-Dichloroethane			ND	(2.3)	0.80	(0.090)	0.48	(0.090)
1,1-Dichloroethene	7.0(M)	7.0(G)	ND	(2.5)	ND	(0.10)	ND	(0.10)
1,2-Dichlorobenzene	620.0(G)		ND	(13.0)	ND	(0.50)	ND	(0.50)
1,2-Dichloroethane	5.0(M)	0.0(G)	ND	(0.75)	ND	(0.030)	ND	(0.030)
1,2-Dichloropropane			ND	(2.5)	ND	(0.10)	ND	(0.10)
1,3-Dichlorobenzene	400.0(G)		ND	(7.5)	ND	(0.30)	ND	(0.30)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	ND	(10.0)	2.6	(0.40)	1.6	(0.40)
2-Chloroethylvinyl ether			ND	(5.0)	ND	(0.20)	ND	(0.20)
Bromodichloromethane			ND	(2.5)	ND	(0.10)	ND	(0.10)
Bromoform			ND	(7.5)	ND	(0.30)	ND	(0.30)
Bromomethane			ND	(30.0)	ND	(1.2)	ND	(1.2)
Carbon tetrachloride	5.0(M)	0.0(G)	ND	(2.5)	ND	(0.10)	ND	(0.10)
Chlorobenzene	60.0(G)		ND	(7.5)	ND	(0.30)	ND	(0.30)
Chloroethane			ND	(13.0)	1.5	(0.50)	0.60	(0.50)
Chloroform			ND	(1.3)	ND	(0.050)	ND	(0.050)
Chloromethane			ND	(7.5)	ND	(0.30)	ND	(0.30)
Dibromochloromethane			ND	(5.0)	ND	(0.20)	ND	(0.20)
Methylene chloride			ND	(7.5)	ND	(0.30)	ND	(0.30)
Tetrachloroethene	0.0(G)		ND	(0.75)	ND	(0.030)	0.30	(0.030)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335125

TABLE 4.2.6-4 RESULTS OF ORGANIC ANALYSES FOR WATER SAMPLES, SITE 12 (FUTA 2), CARSWELL AFB, TEXAS.

Primary Results

PARAMETER	EPA Standards, Criteria		Monitor Well Sample ID Date Sampled 12D 04-53 13-Apr-88		12E 03-27 03-Mar-88		12E 04-56 13-Apr-88	
Trichloroethene	5.0(M)	0.0(G)	55.0	(5.0)	0.80	(0.20)	1.1	(0.20)
Trichlorofluoromethane			ND	(2.5)	ND	(0.10)	ND	(0.10)
Vinyl chloride	2.0(M)	0.0(G)	ND	(5.0)	3.4	(0.20)	1.8	(0.20)
cis-1,3-Dichloropropene			ND&		ND&		ND&	
trans-1,2-Dichloroethene	70.0(G)		ND	(5.0)	ND	(0.20)	ND	(0.20)
trans-1,3-Dichloropropene			ND	(7.5)	ND	(0.30)	ND	(0.30)
Purgeable Aromatics UG/L								
1,2-Dichlorobenzene	620.0(G)		ND	(0.40)	ND	(0.40)	ND	(0.40)
1,3-Dichlorobenzene	400.0(G)		ND	(0.40)	ND	(0.40)	ND	(0.40)
1,4-Dichlorobenzene	750.0(M)	750.0(G)	ND	(0.30)	5.2	(0.30)	5.1	(0.30)
Benzene	5.0(M)	0.0(G)	ND	(0.20)	ND	(0.20)	0.30	(0.20)
Chlorobenzene	60.0(G)		ND	(0.30)	ND	(0.30)	ND	(0.30)
Ethylbenzene	680.0(G)		ND	(0.30)	ND	(0.30)	ND	(0.30)
Toluene	2000.0(G)		1.8	(0.20)	47.0	(0.20)	1.0	(0.20)
m-Xylene			ND	(0.20)	ND	(0.20)	ND	(0.20)
o-Xylene			ND	(0.10)	ND	(0.10)	ND	(0.10)
p-Xylene			ND	(0.20)	ND	(0.20)	NDQ	(0.20)

EPA Standards and Criteria are designated: M-Maximum Contaminant Level (MCL), G-Maximum Contaminant Level Goal (MCLG) or other secondary or proposed standard (Refer to Tables 4.1-1 and 4.1-2).

&: cis-1,3-Dichloropropene cannot be quantitated due to coelution.

Q: Daily EPA QC recovery outside 95% confidence limit.

ND: Not detected at specified detection limit

( ): Detection limit

- DRAFT -

335126

TABLE 4.2.6-5. RESULTS OF FIELD ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS

Analyte	Unit of Measure	Monitor Well Sample ID Date Sampled							
		12A 02-154 25-Feb-88		12A 04-04 06-Apr-88		12B 03-24 03-Mar-88		12B 04-37 13-Apr-88	
Alkalinity	mg/L			845.0	(5.0)			1215.0	(5.0)
Specific Conductance	uMHOS/CM	550.0	(10.0)	490.0	(10.0)	738.0	(1.0)	740.0	(10.0)
Temperature	C	19.0	(1.0)	17.0	(1.0)	19.0	(1.0)	19.0	(1.0)
pH	S.U.	7.1	(0.010)	6.9	(0.010)	6.5	(0.010)	6.9	(0.010)

( ): Detection Limit

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TABLE 4.2.6-5. RESULTS OF FIELD ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS

Analyte	Unit of Measure	Monitor Well Sample ID Date Sampled							
		12C 03-26 03-Mar-88		12C 04-59 11-Apr-88		12D 03-23 03-Mar-88		12D 04-53 13-Apr-88	
Alkalinity	mg/L			9235.0	(5.0)			3285.0	(5.0)
Specific Conductance	uMHOS/CM	820.0	(1.0)	820.0	(10.0)	838.0	(1.0)	820.0	(10.0)
Temperature	C	19.0	(1.0)	19.0	(1.0)	18.0	(1.0)	20.0	(1.0)
pH	S.U.	6.7	(0.010)	7.0	(0.010)	6.6	(0.010)	6.9	(0.010)

( ): Detec[illegible] limit

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TABLE 4.2.6-5. RESULTS OF FIELD ANALYSES FOR WATER SAMPLES, SITE 12 (FDTA 2), CARSWELL AFB, TEXAS

Analyte	Unit of Measure	Monitor Well Sample ID Date Sampled: 12E 03-27 03-Mar-88		12E 04-56 13-Apr-88	
Alkalinity	mg/L			4180.0	(5.0)
Specific Conductance	uMHOS/CM	930.0	(1.0)	830.0	(10.0)
Temperature	C	18.0	(1.0)	19.0	(1.0)
pH	S.U.	6.5	(0.10)	6.6	(0.010)

( ) Detection limit

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these wells remained fairly stable between sampling rounds. Vinyl chloride was also detected at 12C during both rounds of sampling (18 and 15 μg/L). All of these purgeable halocarbons were above their respective MCLs. Other purgeable halocarbons were detected in ground water at Site 12 at lower levels.

Purgeable Aromatics--Several purgeable aromatic compounds were found in low levels in ground water at Site 12. 1,4-dichlorobenzene was detected in monitor wells 12C and 12E, 1,2-dichlorobenzene in 12C, and benzene in 12E. All values were below MCLs for these compounds.

Extractable Priority Pollutants--Analyses for extractable priority pollutants at Site 12 were conducted on the first sample from well 12A and the second sample from 12C. 1,2-dichlorobenzene was found in low levels at monitor well 12C.

4.2.6.3 Significance of Findings

The principal effort for the Stage 2 field program at Site 12 was to determine the extent of contaminants in the soil underlying the bermed area of FDTA 2 and to determine downgradient water-quality conditions. The following paragraphs contain a discussion of the significance of the findings for soil and ground-water contamination.

Soil--Five soil borings were drilled within the bermed area of FDTA 2. Reviewing the Stage 1 hand-augering results and the results of the chemical analyses of Stage 2 borehole soils confirms that the major contaminants of concern are petroleum hydrocarbon compounds. These compounds include both the volatile and semivolatile organic compounds, with the semivolatile compounds apparently more prevalent in the subsurface probably because burning and evaporation of the volatile compounds impeded their infiltration of the soil.

As would be expected from the use of flammable liquids on the surface within the bermed area, the highest concentrations of petroleum hydrocarbons occurred near the surface, with concentrations decreasing with increasing depth. However, this trend was consistently interrupted by an abrupt increase in contaminant concentrations in the sand strata approximately 10 to 15 feet below the land surface. The levels of organic contaminants in the sand strata equaled or exceeded the levels of contaminants observed in the surface samples. This trend is best illustrated in data from boreholes 12H and 12I. The trend was not observed in samples from boreholes located away from the active training area.

Ground Water--The Stage 1 findings regarding the nature and occurrence of ground-water contaminants are supported and amplified by the Stage 2 results. The principal conclusions of the Stage 2 program are:

1. The principal ground-water contaminant in the upper zone is trichloroethene (TCE), with a variety of other organic compounds in lesser concentrations.

2. TCE occurs in upper zone wells downgradient (generally north and east) of the bermed area.

Zones of Contamination--The ground-water contamination at FDTA 2, is best illusted in terms of TCE, which has consistently been detected in the upper zone. Figure 4.2.2-1 is a contour map of TCE concentrations in the upper zone for Flightline area sites, including FDTA 2. The contour map illustrates a plume of TCE outlined by, but not limited to, the 1,000 μg/L TCE contour line that lies to the northeast of Site 12. Although levels of TCE occur in Site 12 downgradient wells, the distribution and level of contamination does not appear to be related to the large Flightline area plume. There are several reasons that may account for the distribution and concentration of contaminants at Site 12:

1. Boreholes directly under the site did not detect ground water (even though limited amounts may occur, considering the thin zone of saturation at 12A), thus reducing the opportunity for contaminants to become a part of the upper zone ground-water flow regime and move downgradient. Rather, the presence of hydrocarbon contamination in the sand strata is manifested by soil vapors and contaminants in the soil matrix.

2. Contamination in Site 12 wells appears to be localized in areas north of the bermed area in the vicinity of the drainageway leading to Farmers Branch. The introduction of contaminants to the ground water may be the result of recharge of runoff from the bermed area, which has been reported to be contaminated with JP-4.

4.2.6.4 Baseline Risk Assessment

Summary of Indicator Chemicals

Results of the Stage 2 investigation indicate the presence of these indicator chemicals in at least one soil and/or ground water sample at the site:

Metals	PNAs	VOCs
Antimony	Bis(2-ethylhexyl)-phthalate	Benzene
Arsenic		Chloroform
Barium		Methylene chloride
Beryllium		Tetrachloroethylene
Cadmium		Toluene
Chromium		Trichloroethene
Lead		Vinyl chloride
Nickel		
Selenium		
Silver		

Tables 3.8-2, 3.8-3, and 3.8-4 in Section 3.8 present important physical, chemical, and biological characteristics for these and all other indicator chemicals.

Some of the above indicator chemicals, particularly those at very low concentrations, may be due in part to matrix interferences or sample vial contamination. Nevertheless, these chemicals were included in the risk assessment process in order to ensure a conservative (stringent-case) evaluation of possible health risks.

Source and Release Characterization

Possible sources of contaminant release from Fire Department Training Area 2, as discussed previously for Landfill 3, include: 1) volatilization to the air, 2) fugitive dust generation, 3) recharge to ground water, 4) surface runoff, and 5) direct release to surface water. It is important to note that this site is an active fire department training area. The source of contamination includes periodic applications to the surface of the soil in conjunction with fire department training exercises as well as contaminated subsurface soil and ground water. The site is open; it is not covered with uncontaminated soil, vegetation, or impervious materials as is the case for other Flightline Area sites.

Volatilization to the Air--VOCs present in the soil are subject to volatilization to the air by virtue of high vapor pressures. PNAs generally have very low vapor pressures and are not subject to volatilization. Most metals are nonvolatile as well. Indicator chemicals detected at the site which can volatilize include benzene, chloroform, methylene chloride, tetrachloroethene, toluene, trichloroethene, and vinyl chloride.

Estimated emission rates for volatiles based conservatively on maximum concentrations detected in the soil or ground water at the site are:

Indicator Chemical	Emission Rate (grams/second)
Benzene	8.80×10^{-5}
Chloroform	1.94×10^{-7}
Methylene chloride	3.70×10^{-4}
Tetrachloroethene	5.20×10^{-7}
Toluene	1.68×10^{-4}
Trichloroethene	1.05×10^{-5}
Vinyl chloride	1.30×10^{-5}

The methodology used to estimate emission rates is described in Section 3.8.

Fugitive Dust Generation--Contaminants must be present in surface soil uncovered by impervious materials or vegetation to be subject to fugitive dust generation. Because FDTA 2 is active and uncovered, contaminants present in the surface soil at this site are subject to fugitive dust generation.

Estimated emission rates for indicator chemicals adsorbed to soil particles are:

Indicator Chemical	Emission Rate (grams/second)
Antimony	1.04×10^{-7}
Arsenic	1.76×10^{-7}
Barium	1.39×10^{-7}
Beryllium	1.05×10^{-9}
Cadmium	2.64×10^{-9}
Chromium	6.17×10^{-8}
Lead	4.76×10^{-8}
Nickel	5.47×10^{-8}
Selenium	1.05×10^{-7}
Silver	1.76×10^{-9}
Bis(2-ethylhexyl)phthalate	2.12×10^{-6}

The methodology used to estimate emission rates is described in Section 3.8.

Recharge to Ground Water--Indicator chemicals detected in the ground water near FDTA 2 include: antimony, arsenic, barium, beryllium, cadmium, chromium, lead, nickel, selenium, silver, bis(2ethylhexyl)phthalate, benzene, chloroform, tetrachloroethene, toluene, trichloroethene, and vinyl chloride. Section 4.2.6.3 summarizes and discusses the significance of the concentrations detected in the ground water at the site.

Surface Runoff--Contaminants must be present in surface soil uncovered by impervious materials to be subject to significant surface runoff during precipitation. Although FDTA 2 is surrounded by a low earthern berm which normally prevents surface runoff during slight to moderate precipitation events, heavy precipitation can potentially cause overflow or berm failure and runoff.

Discharge to Surface Water--There have been direct discharge of contaminants from this site to surface water, specifically a drainage ditch that leads to Farmers Branch.

Transport and Fate of Contaminants

FDTA 2 potentially releases VOCs, bis(2-ethylhexyl)phthalate, and metals to the air via volatilization and fugitive dust generation and to the ground and surface water via site leaching and surface runoff. Potentially significant contaminant transport and fate mechanisms in the air and ground and surface water media include: 1) air dispersion, 2) ground water migration, 3) transport in surface water, and 4) subsequent uptake by plants and animals.

Air Dispersion--Emissions of VOCs and dust-generated particulates from FDTA 2 occur at ground level. The gases and particulates disperse in the ambient atmosphere according to local meteorological conditions. Annual ambient air concentrations of both VOCs and particulates resulting from FDTA 2

emissions were estimated using the ISCLT model. The dispersion modeling methodology is discussed in Section 3.8.

Particulate emissions will deposit, or settle to the ground at a rate dependent on particle shape and density and atmospheric conditions. Particles in the 10-20 μm size range deposit at a rate of approximately 0.0002 m/5. Larger dust particles in the 30-100 μm range will tend to settle at a higher rate and deplete from the plume. A relatively high deposition velocity of 0.02 m/sec was assumed because dust generated emissions can involve fairly large particles. This deposition velocity was used to calculate deposition flux at selected receptor locations [deposition flux ($\mu g/m^2/s$) = ground level concentration ($\mu g/m^2$) per gm/sec of pollutant emitted x deposition velocity (m/sec)].

It should be noted that it was assumed that deposition has no effect on ground-level concentrations. In reality, as particles are removed by deposition, the plume becomes depleted and ground level concentrations decrease. This assumption is inherently conservative, overstating both ground-level air concentrations and particulate deposition, particularly at distant receptors.

Ground-Water Migration--The migration of ground water from FDTA 2 will follow the same pathways as described for Landfill 4 in Section 4.2.2.4. Refer to this section for details on ground-water migration.

Available water-level and geologic data indicate that all ground-water flow under Flightline Area sites moves toward Farmers Branch and is discharged in the vicinity of the creek.

Transport in Surface Water--As is true for all Flightline Area sites, contaminants which reach Farmers Branch via ground-water migration and/or surface runoff are subject to dilution and movement with the surface flow downstream to the West Fork of the Trinity River located east of the base. The West Fork of the Trinity River is downstream of Lake Worth, which

is the source of drinking water for Fort Worth and Carswell AFB. VOCs present in surface water may volatilize to the air.

Dust-generated particulates will settle to the ground and can contribute to contaminant concentrations in surface water as well. Deposition of particulate emissions is the only pathway for contaminants originating from FDTA 2 to reach Lake Worth.

Uptake by Plants and Animals--Food crops including commercial agricultural crops and backyard gardens, are subject to accumulation of contaminants originating at FDTA 2 via root uptake of any contaminants present in the water used for watering or irrigation, deposition of particulates onto the soil and subsequent uptake by plants, and direct deposition of particulates onto plant surfaces. Since farming operations in the area generally rely on natural precipitation or irrigation of crops with ground water, deposition of particulates onto the soil and plant surfaces represents the most significant potential pathway to human exposure.

Terrestrial organisms, including farm animals and wildlife, are subject to accumulation of contaminants originating at FDTA 2 by: 1) inhalation of ambient air, 2) ingestion of soil and plants contaminated via deposition of particulates, and 3) ingestion of surface water contaminated via deposition of particulates and/or ground-water migration. As discussed above, farm operations in the area do not use surface water to irrigate crops. Therefore, farm animals are not subject to ingestion of plants irrigated or watered with surface water contaminated via ground-water migration.

Aquatic organisms, including fish, are subject to accumulation of contaminants originating at FDTA 2 by uptake from surface water contaminated via particulate deposition and/or ground-water migration/surface transport. Contaminants can bioaccumulate in the food chain of both terrestrial and aquatic organisms.

Exposure Pathways

Figure 4.2.6-6 depicts potential pathways for contaminants to move from FDTA 2 to human exposure points. Pathways which are not complete have been crossed out. Remaining pathways include:

1. Volatilization to the air and fugitive dust generation/air dispersion/inhalation of ambient air;

2. Volatilization to the air and fugitive dust generation/air dispersion/inhalation by animals/ingestion of meat and dairy products;

3. Fugitive dust generation/deposition on soil/ingestion of soil;

4. Fugitive dust generation/deposition on soil/skin contact with soil;

5. Fugitive dust generation/deposition on soil, water, and plants/ingestion by animals/ingestion of meat and dairy products;

6. Fugitive dust generation/deposition on soil/root uptake by plants/ingestion of fruits and vegetables;

7. Fugitive dust generation/deposition on surface water (potable source)/ingestion of and skin contact with drinking water;

8. Fugitive dust generation/deposition on surface water used to water or irrigate plants/root uptake by plants/ingestion of fruits and vegetables;

NOTE
① 3' Excavation and back fill using "remediated" soil eliminated fugitive dust and surface runoff pathways
② clay liner did not eliminate ground water leaching pathway.

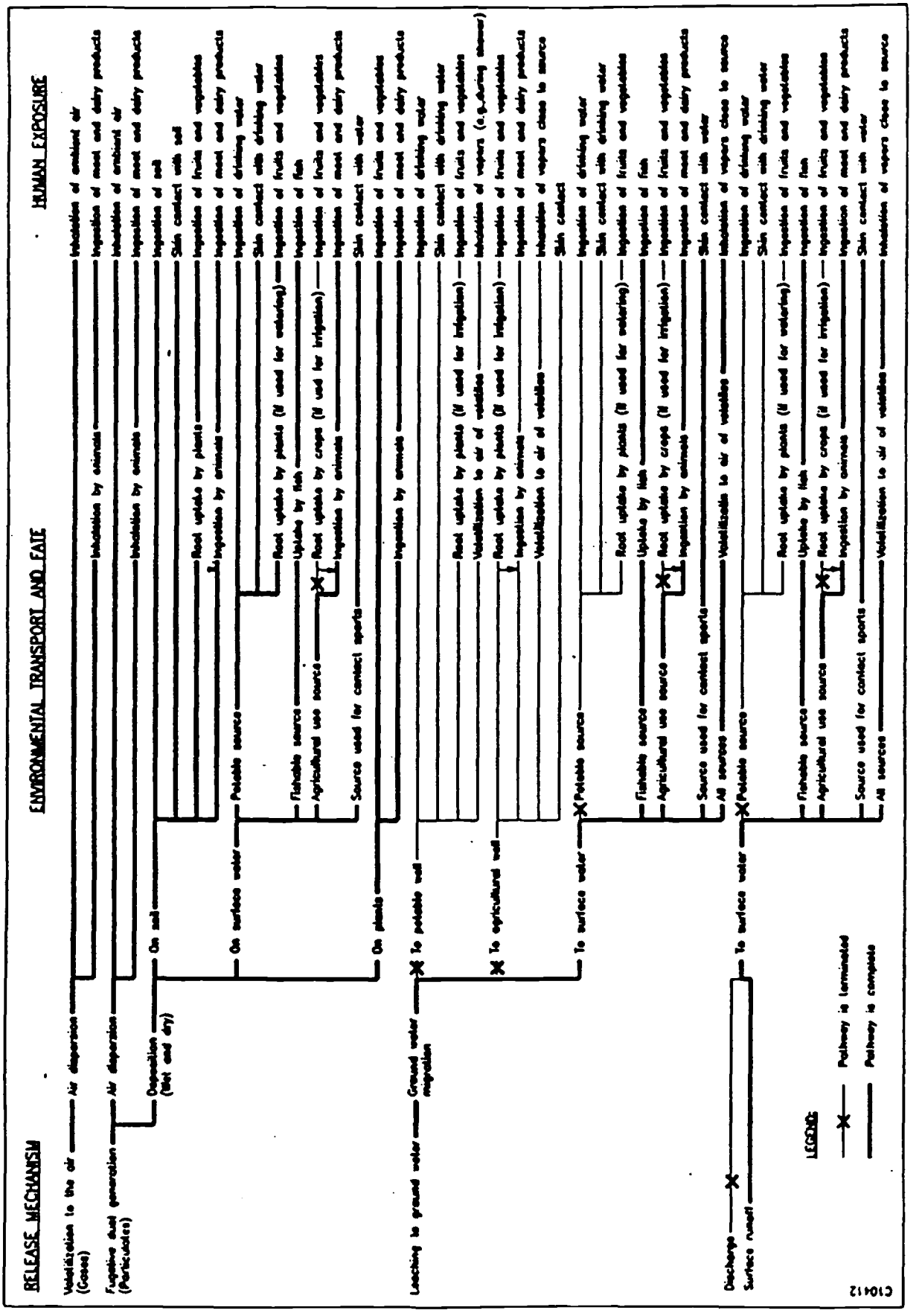

Figure 4.2.6-6. Potential Pathways to Human Exposure from Fire Department Training Area 2

9. Fugitive dust generation/deposition on surface water (fishable source)/uptake by fish and other aquatic organisms/ingestion of aquatic organisms;

10. Fugitive dust generation/deposition on surface water used for contact sports/skin contact with water;

11. Fugitive dust generation/deposition on plants/ingestion of fruits and vegetables;

12. Leaching to ground water/ground-water migration to surface water (fishable source)/uptake by fish and other aquatic organisms/ingestion of aquatic organisms;

13. Leaching to ground water/ground-water migration to surface water (agricultural use source)/ingestion by animals/ingestion of meat and dairy products;

14. Leaching to ground water/ground-water migration to surface water (source used for contact sports)/skin contact with water; and

15. Leaching to ground water/ground-water migration to surface water/volatilization of volatiles/inhalation of vapors close to source.

As is also true for Landfill 5 and FDTA 1, contaminant contributions to surface water can also derive from surface runoff.

Identification of Receptors

Based on available exposure pathways, potential human receptors for exposure to contaminants originating from FDTA 2 include: 1) persons residing and/or working in nearby areas, particularly downwind of the site; 2) persons

ingesting meat and dairy products from animals exposed to contaminants in the ambient air, surface water, soil or plants; 3) persons ingesting fish or other aquatic organisms exposed to contaminated surface water; 4) persons ingesting or having skin contact with surface dust on which contaminants have deposited; 5) persons ingesting plants on which contaminants have deposited or which have accumulated contaminants present in the soil; 6) persons ingesting drinking water on which contaminants have deposited; and 7) persons swimming or participating in other contact sports in contaminated water.

Potential wildlife receptors include: 1) terrestrial organisms with habitats close to the site that inhale ambient air and ingest surface water, particularly from Farmers Branch, and otherwise come into contact with deposted particulates; and 2) aquatic organisms in Farmers Branch, West Fork of the Trinity River, and Lake Worth.

Threat to Human Health

Inhalation Exposure--Inhalation of ambient air is the most direct exposure pathway for contaminants to move from FDTA 2 to human receptors. Table 4.2.6-6 presents the on-site maximum and off-site maximum predicted annual ambient air concentrations resulting from estimated FDTA 2 emissions, and predicted concentrations at several discrete locations: site of the proposed base day care center, which is central to the largest on-base residential area, the Fort Worth National Fish Hatchery, and the closest dairy and beef operations. The table also lists Texas Air Control Board (TACB) health Effects Screening Levels (ESLs) which the agency uses to evaluate the impacts of air contaminants. TACB screening levels are based on occupational exposure limits (American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), Occupational Health and Safety Administration (OSHA) standards, or National Institute for Occupational Safety and Health (NIOSH) recommendations), odor nuisance potential, vegetation effects, or corrosion effects. Generally, the annual ESL corresponds to 0.1% of the lowest occupational exposure limit.

TABLE 4.2.6-6. PREDICTED ANNUAL AVERAGE AMBIENT AIR CONCENTRATIONS RESULTING FROM ESTIMATED FIRE DEPARTMENT TRAINING AREA 2 EMISSIONS

Contaminant	Predicted Annual Average Ambient Air Concentration (ug/m^3)						TACB Annual Effects Screening Level (ug/m^3)
	On-Site Maximum	Off-Site Maximum	Day Care	Fish Hatchery	Dairy Operation	Beef Operation	
Benzene	$8.5x10^{-4}$	$3.0x10^{-5}$	$5.6x10^{-5}$	$2.0x10^{-8}$	$8.4x10^{-7}$	$2.2x10^{-7}$	3
Chloroform	$2.1x10^{-8}$	$8.7x10^{-8}$	$1.3x10^{-7}$	$6.0x10^{-8}$	$1.0x10^{-8}$	< 10^{-8}	10
Methylene chloride	$4.0x10^{-3}$	$1.7x10^{-4}$	$2.4x10^{-4}$	$1.2x10^{-5}$	$2.7x10^{-6}$	$8.5x10^{-7}$	26
Tetrachloroethane	$5.7x10^{-8}$	$2.3x10^{-7}$	$3.4x10^{-7}$	$1.7x10^{-8}$	$4.0x10^{-8}$	$1.0x10^{-8}$	33.5
Toluene	$1.0x10^{-3}$	$7.6x10^{-5}$	$1.1x10^{-4}$	$5.5x10^{-6}$	$1.2x10^{-6}$	$4.3x10^{-7}$	375
Trichloroethene	$1.1x10^{-4}$	$4.7x10^{-6}$	$6.7x10^{-6}$	$3.4x10^{-6}$	$7.7x10^{-8}$	$2.7x10^{-8}$	135
Vinyl chloride	$1.4x10^{-4}$	$5.0x10^{-6}$	$8.4x10^{-6}$	$4.3x10^{-7}$	$8.6x10^{-8}$	$3.3x10^{-6}$	10
Antimony	$1.1x10^{-6}$	$4.7x10^{-8}$	$6.7x10^{-8}$	$3.4x10^{-8}$	$7.6x10^{-10}$	$2.7x10^{-10}$	0.5
Arsenic	$1.0x10^{-6}$	$7.0x10^{-8}$	$1.1x10^{-7}$	$5.0x10^{-8}$	$1.3x10^{-8}$	$4.5x10^{-10}$	0.010
Barium	$1.5x10^{-6}$	$6.2x10^{-8}$	$8.0x10^{-8}$	$4.0x10^{-8}$	$1.0x10^{-8}$	$3.6x10^{-10}$	0.5
Beryllium	$1.1x10^{-8}$	$4.7x10^{-10}$	$6.0x10^{-10}$	$3.5x10^{-11}$	$7.0x10^{-12}$	$2.7x10^{-12}$	0.01 (24 hour average)
Cadmium	$2.0x10^{-8}$	$1.2x10^{-8}$	$1.7x10^{-8}$	$8.7x10^{-11}$	$1.0x10^{-11}$	$6.0x10^{-12}$	0.01
Chromium	$8.7x10^{-7}$	$2.0x10^{-8}$	$4.0x10^{-8}$	$2.0x10^{-8}$	$4.5x10^{-10}$	$1.6x10^{-10}$	0.025 (+6 valence)
Lead	$5.2x10^{-7}$	$2.1x10^{-8}$	$3.1x10^{-8}$	$1.6x10^{-8}$	$3.5x10^{-10}$	$1.2x10^{-10}$	1.5 (quarterly average)[a]
Nickel	$5.0x10^{-7}$	$2.4x10^{-8}$	$3.5x10^{-8}$	$1.0x10^{-8}$	$4.0x10^{-10}$	$1.4x10^{-10}$	0.015
Selenium	$1.1x10^{-6}$	$4.7x10^{-8}$	$6.0x10^{-8}$	$3.5x10^{-8}$	$7.0x10^{-10}$	$2.7x10^{-10}$	0.2
Silver	$1.0x10^{-8}$	$7.0x10^{-10}$	$1.1x10^{-8}$	$5.0x10^{-11}$	$1.3x10^{-11}$	$4.5x10^{-12}$	0.01
Bis(2-ethylhexyl) phthalate	$2.3x10^{-5}$	$0.5x10^{-7}$	$1.4x10^{-6}$	$6.0x10^{-9}$	$1.6x10^{-6}$	$5.4x10^{-9}$	5

[a] National Ambient Air Quality Standard.

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The maximum predicted annual average concentations resulting from estimated FDTA 2 emissions for all indicator chemicals are lower than the conservative TACB Effects Screening Levels by orders of magnitude ranging from 3 to 7.

Table 4.2.6-7 shows estimates of average daily inhalation exposure (in mg/kg body weight/day) at the location of the on-site and off-site maximum predicted annual average concentration, and at the proposed on-site day care facility, and compares these values with inhalation Acceptable Daily Intakes (ADIs) for chronic (long-term) exposure. An inhalation ADI is an estimate of the dose of a chemical that can be inhaled daily for a lifetime without producing adverse noncarcinogenic health effects. Section 3.8 discusses the derivation of ADIs used in this assessment.

Average daily inhalation exposures for all indicator chemicals are lower than pollutant-specific ADIs in all cases by more than 4 orders of magnitude.

Ingestion Exposure--Potential ingestion exposures include ingestion of 1) meat and dairy products from animals exposed to contaminants in the ambient air, surface water, soil, or plants, 2) fish exposed to contaminated surface water, 3) plants on which particulates have deposited or which have accumulated contaminants present in the soil; 4) drinking water on which particulates have deposited, and 5) soil on which particulates have deposited.

FDTA 2 contributes very low concentrations of VOCs and particulates to the ambient air. At the sites of the nearest dairy and beef operations, concentrations are predicted on the order of 1/1,000,000 $\mu g/m^3$ and lower (see Table 4.2.6-6). Although cows, as humans, will absorb inhaled VOCs and metals, these chemicals do not tend to accumulate in milk or edible tissues which humans might consume. Bis(2-ethylhexyl)phthalate, however, is lipid-soluble and will accumulate in milk and meat products. Cattle are theoretically exposed to bis(2-ethylhexyl)phthalate originating from FDTA 2 in the

TABLE 4.2.6-7. ESTIMATED ANNUAL AVERAGE DAILY INHALATION EXPOSURES FOR CONTAMINANTS ORIGINATING FROM FIRE DEPARTMENT TRAINING AREA 2

Contaminant	Inhalation Acceptable Daily Intake[a] (mg/kg/day)	On-Site Maximum		Off-Site Maximum		Day Care	
		Inhalation Exposure[b] (mg/kg/day)	Safety Factor[c]	Inhalation Exposure[b] (mg/kg/day)	Safety Factor[c]	Inhalation Exposure[b] (mg/kg/day)	Safety Factor[c]
Benzene	1.00×10^{-2}	2.77×10^{-7}	6.87×10^{4}	1.13×10^{-8}	1.66×10^{6}	1.61×10^{-8}	1.16×10^{6}
Chloroform	1.00×10^{-2}	6.10×10^{-10}	1.64×10^{7}	2.40×10^{-11}	4.01×10^{8}	3.55×10^{-11}	2.81×10^{8}
Methylene chloride	6.00×10^{-2}	1.16×10^{-6}	5.18×10^{4}	4.76×10^{-8}	1.26×10^{6}	6.78×10^{-8}	8.85×10^{5}
Tetrachloroethene	2.00×10^{-3}	1.63×10^{-9}	1.22×10^{7}	6.60×10^{-11}	2.80×10^{6}	9.52×10^{-11}	2.10×10^{6}
Toluene	1.5	5.28×10^{-7}	2.84×10^{6}	2.18×10^{-8}	6.84×10^{7}	3.08×10^{-8}	4.88×10^{7}
Trichloroethene	2.46×10^{-2}	3.30×10^{-8}	7.45×10^{5}	1.35×10^{-8}	1.82×10^{7}	1.92×10^{-8}	1.28×10^{7}
Vinyl chloride	1.30×10^{-3}	4.80×10^{-8}	3.10×10^{4}	1.67×10^{-8}	7.78×10^{5}	2.38×10^{-8}	5.46×10^{5}
Antimony	4.00×10^{-4}	3.27×10^{-10}	1.22×10^{6}	1.34×10^{-11}	2.98×10^{7}	1.90×10^{-11}	2.10×10^{7}
Arsenic	1.70×10^{-3}	5.53×10^{-10}	3.07×10^{6}	2.26×10^{-11}	7.51×10^{7}	3.22×10^{-11}	5.27×10^{7}
Barium	1.40×10^{-4}	4.37×10^{-10}	3.20×10^{5}	1.78×10^{-11}	7.85×10^{6}	2.55×10^{-11}	5.50×10^{6}
Beryllium	5.00×10^{-4}	3.30×10^{-12}	1.52×10^{8}	1.35×10^{-13}	3.70×10^{8}	1.92×10^{-13}	2.60×10^{8}
Cadmium	2.00×10^{-4}	8.30×10^{-12}	3.50×10^{7}	3.38×10^{-13}	8.54×10^{8}	4.83×10^{-13}	6.00×10^{8}
Chromium	5.00×10^{-3}	1.94×10^{-10}	2.58×10^{7}	7.93×10^{-12}	6.30×10^{8}	1.13×10^{-11}	4.42×10^{8}
Lead	4.30×10^{-4}	1.50×10^{-10}	2.87×10^{6}	6.12×10^{-12}	7.03×10^{7}	8.72×10^{-12}	4.93×10^{7}
Nickel	1.00×10^{-2}	1.72×10^{-10}	5.82×10^{7}	7.03×10^{-12}	1.42×10^{8}	1.00×10^{-11}	9.98×10^{8}
Selenium	1.00×10^{-3}	3.30×10^{-10}	3.03×10^{6}	1.35×10^{-11}	7.41×10^{7}	1.92×10^{-11}	5.20×10^{7}
Silver	3.00×10^{-3}	5.53×10^{-12}	5.42×10^{8}	2.26×10^{-13}	1.33×10^{10}	3.22×10^{-13}	9.31×10^{9}
Bis(2-ethylhexyl) phthalate	2.00×10^{-2}	6.66×10^{-8}	3.00×10^{6}	2.73×10^{-10}	7.34×10^{7}	3.88×10^{-10}	5.15×10^{7}

[a] Estimate of the dose of a chemical that can be inhaled daily for a lifetime without producing adverse noncarcinogenic health effects.

[b] Inhalation exposure assumes inhalation for 24 hours/day of predicted annual average ambient concentrations by an individual with an average body weight of 70 kg and with an average inhalation rate of 20 m^3/day.

[c] Inhalation Acceptable Daily Intake/Inhalation Exposure

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ambient air at the closest diary and beef operations and deposited on soil, plants, and surface water ingested by the cattle.

The most significant fishable resource in the vicinity of Carswell AFB is Lake Worth. The Fort Worth National Fish Hatchery is located at the western end of the lake. The only available pathway for contaminants to move from FDTA 2 to Lake Worth is via fugitive dust generation and deposition on the lake. Fish can then accumulate contaminants present in the water. There is also some theoretical potential for fish in the West Fork of the Trinity River to accumulate contaminants from FDTA 2 in the area downstream of the intersection of Farmers Branch with the river. However, contaminant contributions to the river from FDTA 2 via ground-water migration to Farmers Branch are likely to be very minimal due to the distance between the site and the river (more than 1 mile), dilution, and other factors. As the ground-water contribution to Farmers Branch is unknown and the potential for significant contaminant contributions from FDTA 2 to the river is low, concentrations of contaminants in the river which originate from this site were not quantified.

Particulates can also deposit on crops in the area as well as on fruits and vegetables grown in the backyards of nearby residents. Particulates deposited on the soil can enter edible plant tissue via root uptake as well. Particulates which deposit on Lake Worth theoretically can enter the Fort Worth drinking water supply, which provides drinking water to Carswell AFB and other area residents and businesses. Particulates which deposit on the soil can be directly ingested by humans.

Table 4.2.6-8 shows estimates of average daily ingestion exposures (in mg/kg body weight/day) based on assumptions outlined in Section 3.8 and listed in Table 3.8-8. The estimated ingestion exposures derive entirely from fugitive dusts generated at the site and deposited on the soil, surface water, and plants. Ingestion Acceptable Daily Intakes (ADIs) for chronic (long-term) exposure are also listed. An ingestion ADI is an estimate of the dose of a chemical that can be ingested daily for a lifetime without producing adverse

TABLE 4.2.6-8. ESTIMATED ANNUAL AVERAGE DAILY INGESTION EXPOSURES FOR CONTAMINANTS ORIGINATING FROM FIRE DEPARTMENT TRAINING AREA 2

Contaminant	Ingestion Acceptable Daily Intake[a] (mg/kg/day)	On-Site Maximum		Off-Site Maximum		Day Care	
		Ingestion Exposure[b] (mg/kg/day)	Safety Factor[c]	Ingestion Exposure[b] (mg/kg/day)	Safety Factor[c]	Ingestion Exposure[b] (mg/kg/day)	Safety Factor[c]
Antimony	4.00×10^{-4}	6.73×10^{-9}	5.95×10^{4}	2.81×10^{-10}	1.42×10^{6}	3.97×10^{-10}	1.01×10^{6}
Arsenic	1.70×10^{-3}	3.93×10^{-9}	4.32×10^{5}	2.61×10^{-10}	6.51×10^{6}	3.27×10^{-10}	5.19×10^{6}
Barium	5.10×10^{-2}	6.41×10^{-9}	7.95×10^{6}	2.71×10^{-10}	1.88×10^{8}	3.81×10^{-10}	1.34×10^{8}
Beryllium	5.00×10^{-4}	2.04×10^{-11}	2.45×10^{7}	1.12×10^{-12}	4.46×10^{8}	1.47×10^{-12}	3.41×10^{8}
Cadmium	2.80×10^{-4}	4.43×10^{-10}	6.55×10^{5}	2.08×10^{-11}	1.40×10^{7}	2.84×10^{-11}	1.02×10^{7}
Chromium	5.00×10^{-3}	1.22×10^{-8}	4.10×10^{6}	6.48×10^{-11}	7.75×10^{7}	8.54×10^{-11}	5.86×10^{7}
Lead	1.40×10^{-3}	1.12×10^{-8}	1.25×10^{6}	7.50×10^{-11}	1.85×10^{7}	9.47×10^{-11}	1.48×10^{7}
Nickel	1.00×10^{-2}	1.82×10^{-9}	5.50×10^{6}	1.08×10^{-10}	9.28×10^{7}	1.38×10^{-10}	7.22×10^{7}
Selenium	3.00×10^{-3}	3.53×10^{-9}	8.51×10^{5}	1.69×10^{-10}	1.77×10^{7}	2.30×10^{-10}	1.31×10^{7}
Silver	3.00×10^{-3}	2.63×10^{-10}	1.14×10^{7}	7.53×10^{-11}	3.98×10^{7}	7.67×10^{-11}	3.91×10^{7}
Bis(2-ethylhexyl) phthalate	2.80×10^{-2}	1.57×10^{-7}	1.27×10^{5}	2.08×10^{-8}	6.68×10^{5}	3.22×10^{-8}	8.21×10^{5}

[a] Estimate of the dose of a chemical that can be ingested daily for a lifetime without producing adverse noncarcinogenic health effects.

[b] See Table 3.8-6 in Section 3.6 for key assumptions used to estimate ingestion exposure.

[c] Ingestion Acceptable Daily Intake/Ingestion Exposure.

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noncarcinogenic health effects. Section 3.8 discusses the derivation of ADIs used in this assessment.

Average ingestion exposures for all indicator chemicals associated with fugitive dust-generated emissions are lower than pollutant-specific ADIs in all cases by more than 4 orders of magnitude.

Dermal Exposure--Skin contact with contaminants originating from FDTA 2 can occur while swimming in (or otherwise in contact with) contaminated surface water. Lake Worth is the most highly utilized surface water body for swimming and other water contact sports in the area. Since particulates can deposit on the lake there is some potential for human exposure to contaminants originating from FDTA 2 via skin contact with lake water. Due to the size of the lake and very low level of emissions, exposure by this pathway is likely to be minimal. As discussed above, contaminant contributions to the West Fork of the Trinity River from FDTA 2 are theoretically possible as well but likely to be very minimal; therefore, skin contact with lake or river water is not considered a significant exposure pathway for this site. Skin contact with water in Farmers Branch, which is not amenable to swimming or other contact sports other than possibly wading, could contribute to dermal exposure. The exposure potential from this pathway is not quantified, however.

Dermal exposure can also occur by skin contact with particulates in the ambient air. Exposure by this pathway has been quantified and incorporated into the ingestion exposures presented in 4.2.6-8.

Carcinogenic Risks

Cancer potency estimates developed by EPA were used in conjunction with total daily contaminant doses to develop estimates of individual cancer risk:

individual cancer risk = total daily dose x cancer potency
(mg/kg/day) (mg/kg/day)$^{-1}$

Individual cancer risk is the increased probability of getting cancer in one's lifetime.

Total 70 year risk, including potential inhalation, ingestion, and dermal exposures are:

On-site maximum exposed individual	1.056×10^{-7}
Off-site maximum exposed individual	5.882×10^{-9}
Individual exposed at day care facility	7.682×10^{-9}

The risk to the hypothetical maximally exposed on-site individual, which was calculated based on very conservative assumptions of transport, fate, and exposure (see Section 3.8), is one order of magnitude lower than a risk of one in one million, which is generally considered an "acceptable" risk by regulatory agencies. Results of the RRAM calculations for this site are included in Appendix J. Inhalation, ingestion, and dermal exposure risk are discussed individually in the paragraphs that follow.

Inhalation Risk--Of the 18 indicator chemicals estimated to be emitted to the air from FDTA 2, 12 are potential carcinogens if inhaled. These are benzene, chloroform, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, arsenic, beryllium, cadmium, chromium, nickel, and bis(2-ethylhexyl)phthalate.

Table 4.2.6-9 shows estimates of individual inhalation cancer risk for the maximum on-site and maximum off-site exposed individual and for an individual inhaling ambient concentrations in the immediate vicinity of the proposed day care facility continuously for a lifetime. The highest of these risks totals 4.6 in 100 million.

TABLE 4.2.6-9. ESTIMATED INDIVIDUAL CANCER RISK ASSOCIATED WITH INHALATION OF POTENTIAL CARCINOGENS ORIGINATING FROM FIRE DEPARTMENT TRAINING AREA 2

Contaminant	Inhalation Potency Slope[a] ($(mg/kg/day)^{-1}$)	Individual Inhalation Cancer Risk[b]		
		On-Site Maximum Exposed Individual	Off-Site Maximum Exposed Individual	Individual Exposed at Day Care Facility
Benzene	$2.6x10^{-2}$	$7.2x10^{-9}$	$2.0x10^{-10}$	$4.2x10^{-10}$
Chloroform	$8.1x10^{-2}$	$4.9x10^{-11}$	$2.0x10^{-12}$	$2.9x10^{-12}$
Methylene chloride	$1.65x10^{-3}$	$1.9x10^{-9}$	$7.8x10^{-11}$	$1.1x10^{-10}$
Tetrachloroethene	$1.7x10^{-3}$	$2.8x10^{-12}$	$1.1x10^{-13}$	$1.8x10^{-13}$
Trichloroethene	$4.6x10^{-3}$	$1.5x10^{-10}$	$6.2x10^{-12}$	$8.8x10^{-12}$
Vinyl chloride	$2.5x10^{-2}$	$1.0x10^{-9}$	$4.2x10^{-11}$	$6.0x10^{-11}$
Arsenic	$5.0x10^{+1}$	$2.8x10^{-8}$	$1.1x10^{-9}$	$1.6x10^{-9}$
Beryllium	8.4	$2.0x10^{-11}$	$1.1x10^{-12}$	$1.8x10^{-12}$
Cadmium	6.1	$5.1x10^{-11}$	$2.1x10^{-12}$	$2.9x10^{-12}$
Chromium	$4.1x10^{+1}$	$8.0x10^{-9}$	$3.3x10^{-10}$	$4.6x10^{-10}$
Nickel	1.19	$2.0x10^{-10}$	$8.4x10^{-12}$	$1.2x10^{-11}$
Bis(2-ethylhexyl) phthalate	$6.84x10^{-4}$	$4.8x10^{-12}$	$1.9x10^{-13}$	$2.7x10^{-13}$
TOTAL 70 year risk		$4.8x10^{-8}$	$1.9x10^{-9}$	$2.7x10^{-9}$

[a] See Section 3.8 for discussion and documentation.

[b] Risk calculation assumes inhalation for 24 hours/day for a 70 year lifetime of predicted annual average ambient concentrations by an individual with an average body weight of 70 kg and with an average inhalation rate of 20 m^3/day.

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Ingestion Risk--Of the 11 indicator chemicals estimated to be emitted from FDTA 2 as dust-generated particulate emissions, three are potential carcinogens if ingested. These are arsenic, nickel, and bis(2-ethylhexyl)phthalate.

Table 4.2.6-10 shows estimates of individual ingestion cancer risk based on exposures associated with deposition of particulate emissions. The risk calculations assume: 1) residence at the site of the maximum on-site ambient air concentrations, the maximum off-site ambient air concentrations, or in the vicinity of the proposed base day care facility; 2) ingestion of fruits and vegetables from a backyard garden; 3) ingestion of fish from Lake Worth; 4) ingestion of beef and dairy products produced at the closest dairy and beef operations; 5) ingestion of water from Lake Worth; 6) ingestion of some soil at the place of residence; 7) dermal exposure to soil and dusts at the place of residence; and 8) ingestion of mother's milk for one year as an infant from a similary exposed mother. Refer to Table 3.8-8 in Section 3.8 for other key assumptions used to estimate ingestion exposure. The highest of these risks totals 6.8 in 100 million. Almost all of this risk is associated with ingestion of arsenic.

The potential for ingestion exposure to contaminants originating from FDTA 2 via ground-water migration/surface water transport is theoretically possible but likely to be minimal. Ingestion risks by this pathway were not incorporated into the risk calculations.

Dermal Risk--The potential for dermal exposure to dust generated emissions originating from FDTA 2 was incorporated into the ingestion risk calculations presented in Table 4.2.6-10. The potential for dermal exposure by other pathways is remote. Unless an individual immersed frequently in the waters of Farmers Branch for a long period of time, skin contact exposure can be considered insignificant. The risk of dermal exposure by this pathway was therefore not quantified.

TABLE 4.2.6-10. ESTIMATED INDIVIDUAL CANCER RISK ASSOCIATED WITH INGESTION OF POTENTIAL CARCINOGENS ORIGINATING FROM FIRE DEPARTMENT TRAINING AREA 2

Contaminant	Ingestion Potency Slope[a] (q_1^*) (mg/kg/day)	Individual Ingestion Cancer Risk[b]		
		On-Site Maximum Exposed Individual	Off-Site Maximum Exposed Individual	Individual Exposed at Day Care Facility
Arsenic	$1.5 \times 10^{+1}$	5.9×10^{-8}	4.0×10^{-8}	4.8×10^{-8}
Nickel	1.10	3.0×10^{-10}	5.2×10^{-11}	5.6×10^{-11}
Bis(2-ethylhexyl) phthalate	8.84×10^{-4}	1.1×10^{-10}	2.1×10^{-11}	2.2×10^{-11}
TOTAL 70 year risk		6.0×10^{-8}	4.0×10^{-8}	5.0×10^{-8}

[a] See Section 3.8 for discussion and documentation.
[b] See Table 3.8-8 in Section 3.8 for key assumptions used to estimate ingestion exposure.

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Threat to Wildlife

Contaminants originating from FDTA 2 pose some risk to terrestrial wildlife that use Farmers Branch as a source of drinking water as well as aquatic organisms in Farmers Branch. In the past, there have been some instances of fish kills in Farmers Branch. The potential contribution of FDTA 2 to contaminant concentrations in Farmers Branch was not estimated because neither the ground-water inflow to Farmers Branch nor existing contaminant concentrations in Farmers Branch is known. Sampling and analysis of Farmers Branch water at several points in its flow across the base to the West Fork of the Trinity River would provide more useful data with which to evaluate the threat to area wildlife.

Because of the potential for dust-generated emissions, contaminants originating from this site can be transported a greater distance from Carswell AFB and deposited on aquatic and terrestrial habitats. However, because emission rates are so low, the potential risk to wildlife by this pathway can be considered insignificant.

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Findings, Remedial Alternatives, and Recommendation as of 1988 Radian Corporation

5.2.7 FDTA 2 (Site 12)

The upper zone soils consist of surficial deposits of clayey silt with variable amounts of fine sand and gravel, in turn underlain by sand and gravel deposits. The thickness of the upper zone ranges from 18 to 40 feet. Limestone crops out just southeast of the site in a stream that flows to Farmers Branch. Ground water occurs in the upper zone at depths ranging from 15 to 30 feet. The direction of ground water flow is to the northeast.

Contaminants of Concern and Risk Assessment Conclusions

Arsenic, lead, cadmium, and chromium exceeded the MCLs in the down gradient upper zone ground water; chromium and lead were detected in the upgradient ground water. Iron and manganese exceeded the MCLGs. The soils samples collected within the boundaries of Site 12 contained elevated concentrations of cadmium with no apparent depth trend, as well as selenium at depths less than 12 feet. Lead was also detected in the soils at depths between 4 and 8 feet.

TCE and tetrachloroethene were detected in concentrations above the MCLs in the upper zone ground water northeast of the site, while vinyl chloride was detected above the MCL east of the site. Several organic constituents were found in a soil sample taken at the southwest center portion of the site at significant levels. These included benzene, ethylbenzene, xylenes, 2-methylnaphthalene, 4-methylphenol, phenol, and naphthalene. The concentration trend was high values at the surface , decreasing with depth until encountering the sand zone at 19 feet below land surface where the maximum values were found. High values for petroleum hydrocarbons were also reported in the soils, with the same trend.

The contaminants from the FDTA 2 may be released through volatilization to air, fugitive dust generation, leaching to ground water, and surface runoff. Inhalation of ambient air and ingestion of fruits and vegetables contaminated with fugitive dust from this site pose a low potential cancer risk. Risk associated with all other pathways are considered negligible or nonexistent. This site does not pose an immediate and direct health hazard, but the remedial action is appropriate to reduce the low risks associated with this site.

Remedial Alternatives

As of October, 1988, Carswell AFB is planning to improve the FDTA 2 facility by installing a concrete pad at the burn area with facilities to contain and store unburned flammable liquids that accumulate after training exercises. The remedial alternatives for this site will therefore need to be closely coordinated with Base Civil

Engineering plans. Remedial alternatives are presented in Tables 5.2.2 (ground-water mitigation) and 5.2.3 (contaminated soil mitigation).

The contaminated near surface soils should be excavated and/or treated in conjunction with the improvement plans to prevent contamination. The contaminated ground water should also be mitigated , but may continue to be treated after the facility is improved.

6.2.3 FDTA 2 (Site 12)

The Stage 2 field and laboratory program confirmed and extended the findings of the Stage 1investigation at FDTA 2. Although the site is upgradient of the Flightline Area TCE plume, ground water at some wells contains metals and volatile aromatic hydrocarbon compounds in concentrations exceeding federal MCLs. The upper zone at Site 12 is either dry or has thin zone of saturation directly on the bedrock (limestone) surface. Petroleum hydrocarbons occur in the upper zone soil profile, both at and near the surface and at greater depths coinciding with a laterally continuous sand stratum. Petroleum hydrocarbons in the soil profile represent a potential source of ground-water contamination downgradient of the site.

The recommended program for additional work at Site 12 consists of:

1. Carswell AFB should continue to proceed with plans to construct a fully-contained, concrete-lined pad at the site to replace the current unlined facility. Since contaminants have been documented to extend the full thickness of the unsaturated zone, feasibility study efforts should be accelerated to provide remedial action concepts to the construction of the new facility. Remedial actions, such as in-situ treatment or soil vapor venting, will probably be considered in the feasibility study to reduce the existing level of contaminants in the soil.
2. Continued monitoring of the existing well network should include the collection and analysis of ground-water samples for volatile organic compounds (EPA 601, 602), petroleum hydrocarbons, metals, and general water-quality parameters.

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Remedial Investigation Report
Dames & Moore

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VOLUME I
FINAL SUMMARY REPORT
REMEDIATION PROJECT
SWMUs 19, 20, AND 53
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
CONTRACT # DACA6393C0012
for
U.S. ARMY CORPS OF ENGINEERS
February 17, 1995
Dames & Moore Project No. 11851-010-135

DAMES & MOORE

DALLAS

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U.S. ARMY CORPS OF ENGINEERS
FINAL SUMMARY REPORT
CARSWELL AIR FORCE BASE
SWMUs 19, 20, AND 53
REMEDIATION PROJECT

1.0 INTRODUCTION

Dames & Moore, Inc. dba Dames & Moore CORE Services (Dames & Moore) has prepared this Final Summary Report on behalf of the United States Army Corps of Engineers (USACOE) and Carswell Air Force Base (CAFB) documenting the remediation program conducted at Carswell Air Force Base located in Fort Worth, Texas (Figure 1). This remediation program was a culmination of a United States Department of Defense (USDOD) comprehensive Installation Restoration Program (IRP) which was initiated at the site in February 1984. This remediation program was awarded to Dames & Moore on November 3, 1992 and commenced under Contract No. DACA63-93-C-0012 on January 21, 1993.

This remediation program included restoration activities at Solid Waste Management Units (SWMUs) 19, 20, and 53. Figure 2 illustrates the overall Carswell SWMU layout. SWMU 19 is the Former Fire Training Area #2 (Figure 3); SWMU 20 is the Former Waste Fuel Aboveground Storage Tank (AST) Area (Figure 3); and, SWMU 53 is the Flightline Drainage Ditch (Figure 4).

This remediation program is summarized within this Final Summary Report in accordance with USACOE Contract No. DACA63-93-C-0012, Section 01720, Subsection 1.0 through 3.2 and included the following general tasks:

- Review of previous site information;
- Work Plan preparations/Pre-Construction Meeting attendance;
- Initial soil delineation sampling;
- SWMU 19/20 demolition;
- Identified soil excavation and staging;
- Biological cleanup unit (biocell) construction;
- Staged soil transportation and loading;

- Soil excavation verification sampling;
- Biocell operation;
- Flightline drainage ditch reconstruction;
- Biocell verification sampling/demolition activities;
- Site restoration, regrading and reseeding; and,
- Final summary reporting.

The objective of this remediation program was to verify the location of site impacts, excavation and treatment aboveground by biological methods and site restoration. The following sections of this report includes a background information summary of the site, the cleanup goals for site remediation, the remedial activities undertaken at the site, associated sampling activities, and provides Dames & Moore's conclusions and recommendations.

2.0 BACKGROUND

The USDOD is conducting a nationwide program to evaluate waste disposal practices on DOD property, to control the migration of hazardous constituents, and to control hazards that may result from these waste disposal practices. This program, the Installation Restoration Program (IRP), consists of four phases:

- Phase I - Problem Identification/Records Search;
- Phase II - Problem Confirmation and Quantification;
- Phase III - Technology Base Development; and,
- Phase IV - Remedial Actions.

To provide some insight into the background of this site and project, Dames & Moore provides a historical summary of site information within the following subsections.

2.1 HISTORICAL INFORMATION

Carswell Air Force Base (CAFB) has been operational since 1942. The major industrial operations at CAFB included:

- Maintenance of aircraft and engines;
- Maintenance of aerospace ground equipment (AGE);
- Maintenance of fuel systems, weapon systems, and pneudraulic systems;
- Maintenance of general and special purpose vehicles;
- Aircraft corrosion control; and,
- Non-destructive inspection activities.

All of these activities generated various amounts of wastes such as primary oils, recoverable fuels, spent solvents, and cleaners. Practices for past and present industrial waste disposal at CAFB are summarized below:

- 1942-1970: The majority of waste oils, recovered fuels, spent solvents, and cleaners were burned at the fire department training areas during practice exercises. Some waste oils and spent solvents were disposed of through contractor removal, while some waste paints (contaminated with thinners and solvents), waste oils, and PD-680 are suspected of having been disposed of in the base landfills. Some waste oils, recovered fuels, spent solvents, and cleaners were also discharged to sanitary and storm sewers. These discharges occurred primarily at the washracks. In 1955, an oil/water separator (Facility 1190) was installed to recover waste materials discharged from the washracks. Materials from the oil/water separators were pumped out and disposed of through contractor removal. Discharge from the oil/water separator was and still is into the sanitary sewers.

- 1970-1975: During this period, most waste oils, spent solvents, and cleaners were disposed of by contractor removal. A private contractor would pump the materials from oil/water separators and from 55-gallon drums and bowsers. Recovered JP-4 was still stored at the fire department training area and burned in practice exercises. Recovered JP-4 was also reused by AGE. Some waste paints (contaminated with thinners and solvents), waste oils, and PD-680 are suspected of having been disposed of in the base landfills. Some waste oils, solvents, and cleaners were discharged into sanitary drains. This primarily occurred at the washracks that discharge to the Facility 1190 oil/water separator. This oil/water separator was routinely pumped out by a private contractor, and the recovered materials removed from the base by the contractor.

- 1975-1982: The majority of waste oils, spent solvents and cleaners were disposed of by service contract either directly or through the Defense Reutilization and Marketing Office (DRMO). Recovered JP-4 was stored at the fire department training area and burned during practice exercises. Recovered JP-4 was also used by AGE. PD-680 used at the washracks was discharged to the Facility 1190 oil/water separator which discharges to the sanitary sewers.

- 1982-Present: Waste oils, solvents, and cleaners are collected in 55-gallon drums and temporarily (less than 90 days) stored at 12 hazardous waste accumulation points located throughout the flightline area. They are subsequently disposed of by contractor removal through DRMO. Recovered JP-4 fuel is stored at the fire department training area for subsequent burning in practice exercises or is reused by AGE. Removal of waste oils and PD-680 (Type II) from oil/water separators is also handled by an off-base contractor through DRMO.

In 1976, the USDOD developed the comprehensive IRP, in response to the Resource Conservation and Recovery Act of 1976 (RCRA), and in anticipation of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, the legislation that authorizes the U.S. EPA "Superfund" program). DOD issued a Defense Environmental Quality Program Policy Memorandum (DEQPPM) dated June 1980 (DEQPPM 80-6), that required the identification of past hazardous waste disposal sites at DOD agency installations. The Air Force implemented the DEQPPM in December 1980. The program was revised by DEQPPM 81-5, dated December 1981, which reissued and amplified all previous directives and memoranda on the IRP. The Air Force implemented DEQPPM 81-5 in January of 1982. CAFB initiated Phase I of their IRP program in August 1983. CAFB completed Phase II of the IRP program in October 1988, and Phase III (Technology Base Development) was completed in April 1990.

Dames & Moore received a Request for Qualifications to conduct Phase IV Remedial Actions at CAFB in February 1992. After receipt of Dames & Moore's qualifications, Dames & Moore received a Request for Proposal/Quote to conduct the specified Remediation Program at SWMUs 19, 20, and 53. On November 3, 1992, Dames & Moore was notified that we were awarded the contract for remedial activities. On January 21, 1993, Dames & Moore received the official Notice to Proceed with the Remediation Program at CAFB SWMUs 19, 20, and 53. Appendix A contains a Chronology of Events where more specific information is available. Appendix B contains a Listing of Record Documents and the transmittal sheets of referenced documents for further specific information.

2.2 SITE LOCATION AND DESCRIPTION

CAFB is located on 2,751 acres of land in Tarrant County, Texas, six miles west of the center of Fort Worth and lies between the communities of White Settlement and River Oaks (Figure 1). CAFB lies within a bend of the West Fork of the Trinity River which flows along the northern and eastern boundaries of the base. The river is dammed to form Lake Worth, a drinking water supply and recreation reservoir bordering CAFB to the north. To the west, CAFB is neighbored by AF Plant 4, an Air Force-owned, General Dynamics Corporation-operated, aircraft production plant that shares the runway and several facilities with CAFB. To the south, CAFB is bordered by urban areas. Off-base facilities include the ILS Marker Beacon west of CAFB and the Weapons Storage Area (WSA), four miles west of CAFB.

Until recently, CAFB was the home of the Strategic Air Command's (SAC) 7th Bombardment Wing. As such, the mission of CAFB was to maintain the capability of strategic warfare and air refueling operations. Assigned weapon systems included the Boeing B-52 "H" model bomber and the KC-135A tanker.

As host unit, the 7th Bombardment Wing oversaw aircraft operations and maintenance agencies. In addition to maintaining bombers, tankers, and combat crews capable of strategic warfare, CAFB also housed an extensive air training effort which included the air training requirements of three tactical squadrons. The 7th combat Support Group and the USAF Regional Hospital supported the combat mission of the Wing. The total work force at CAFB (as of 1984) was approximately 5,100 military and 1,000 civilian personnel. Since that time fewer aircraft have been operational at CAFB, and downsizing due to the BRAC Program has dwindled the active number of military and civilian personnel at CAFB during recent years.

Currently, the Pentagon is planning to move the Dallas Naval Air Station to CAFB. The overall plan is to convert CAFB into a regional reserve center. This consolidation could include approximately 5,000 active duty military personnel and more than 8,000 reservists beginning the summer of 1995.

PHYSICAL DESCRIPTIONS OF THE SWMUs

SWMU 20, the Aboveground Storage Tank (AST) and its associated piping, is located adjacent to and on the southwest side of SWMU 19 (Figure 3). The capacity of this steel AST is approximately 8,500 gallons. The AST reportedly contained approximately 4,000 gallons of jet fuel (JP-4) at the time of this project. Due to the dirt mounded around this tank (greater than 10% of tank and piping volume is underground), this AST meets the regulatory requirements and descriptions of an underground storage tank (UST). Piping runs from the AST to the dumpsters located in SWMU 19.

SWMU 19 is located between the north-south taxiway and the radar facility (Figure 2) on the southwest portion of the base. SWMU 19 consists of the bermed Fire Training Area 2. The SWMU contains two bermed areas (Figure 3). The outer berm (2 feet high) is constructed of a clayey soil that is approximately 260 feet in diameter covering approximately 1.2 acres. The surface elevation is essentially flat. A drainage pipe is located on the northeast side of the outer bermed area. Drainage from the pipe is controlled by a manual valve.

The inner berm (2 feet high) is constructed of a clayey material with an approximate diameter of 120 feet covering approximately 0.25 acres. The inner bermed area contains 25-30 steel dumpsters which are arranged in the outline of an airplane. A drainage pipe is located on the northeast side of the inner berm. Drainage from the pipe is controlled by a manual valve.

SWMU 53, the Flightline Drainage Ditch, is located on the eastern portion of the base and is approximately a 600-foot long earthen drainage ditch located to the east of Haile Drive adjacent to the main aircraft washrack and Hangars 1048 and 1049 (Figure 2). The ditch is unlined from Haile Drive to its intersection with the POL Tank Farm, at which point the ditch becomes concrete lined.

Contamination was visible at SWMU 53 during the base visit (1983) in the form of a white liquid (aircraft soap) originating at the washrack and entering the ditch through a small pipe; the presence of petroleum products on the surface of the water further downstream; and the presence of a dark zone of fuel or oil saturation along the banks of the ditch at least 10 inches above the surface of the water.

In addition to normal storm drainage, this ditch receives discharges from the aircraft washracks (18 and 29) and discharges from the Fuel Systems Shop (Building 1048). Washrack wastes (PD-680, a cleaning solvent, and soap) can be discharged directly to the Facility 1190 oil/water separator, located adjacent to the Flightline Drainage Ditch, or into the drainage ditch via an overflow pipe in the drain line between the washracks and the oil/water separator. Discharge to the oil/water separator or to the drainage ditch is controlled by a valve in the drain line just upstream of the separator.

Discharges from the Fuel Systems Shop consists of JP-4 fuel drained from fuel tanks. Prior to 1978, this fuel was piped via gravity to the Facility 1190 oil/water separator. The pipe was routed through the much larger stormwater culvert that begins the Flightline Drainage Ditch. Approximately 16 years ago (1979), the pipe ruptured, and JP-4 entered the stormwater culvert and thus the ditch. The pipe was repaired in March 1984.

Associated with the remediation activities of the Flightline Drainage Ditch is the removal of a wooden trestle and four asbestos containing telephone conduits. The concrete headwall of the ditch will be removed and replaced with a new concrete headwall.

SWMUs OPERATION

SWMUs 19 and 20 were operated as one unit. Jet Fuel and other fuels were stored in the AST for fire training purposes. Jet Fuel was transferred via the piping from the AST to the dumpsters inside the inner bermed area. The dumpsters were filled, and the inner bermed area was flooded intentionally with Jet Fuel. The dumpsters and inner bermed area were then ignited to simulate a burning aircraft, and fire fighting training proceeded. Sometimes the inner bermed area was overfilled, and the jet fuel flooded into the outer bermed area. At some unknown time in the past, a pit was reportedly present to collect runoff from the bermed areas. However, over time, the pit was filled with sediment and today's location of the pit is unknown.

A UST of an approximate capacity of 9,500 gallons was located at the SWMUs. The tank was removed by local contractors at an earlier date. Solvents and waste oils from the flightline shops were reportedly stored in the UST. It is possible that the waste oils and solvents from this tank have been used in the past during training exercises.

SWMU 53 collects stormwater runoff from the flightline and hangar areas. Stormwater runoff from the oil/water separator and hazardous materials storage area drains into the ditch (Figure 4). SWMU 53 also receives discharges from the washrack area and Hangar 1048 which contains the Fuel System Shop. Additional discharges from the oil/water separator unit via a 6-inch steel pipe into the SWMU occurs. Past management practices for aircraft cleaning operations usually involved the use of solvents, and it is possible the unlined ditch received solvent waste discharges from the washrack.

2.3 SITE SETTING AND GEOLOGY

The following discussion of the CAFB environmental setting is derived primarily from the Installation Restoration Program Phase I Records Search Report (CH2M Hill, 1984). Information from that report is supplemented by information from initial record search literature and from the general findings of this study. The following sections describe the environmental setting of CAFB. Basic features and history of the sites investigated in this study are also discussed below.

hysical Setting

CAFB is located in northeastern Texas in Tarrant County, six miles west of downtown Fort Worth. The base is bordered by Lake Worth to the north, the West Fork of the Trinity River and the community of Westworth to the east and southeast, the community of White Settlement to the south and southwest and Air Force (AF) Plant 4 to the west. One off-base facility, the Weapons Storage Area (WSA), is included in this site area. The WSA location is four miles west of CAFB on White Settlement Road.

The base lies within an area of primarily residential, recreational, and industrial/commercial land use. The principal industrial use of the area is AF Plant 4, an aircraft production plant that borders CAFB to the west and shares the runway with the base. Recreational land use includes the YMCA's Camp Carter, and various parks on the shores of Lake Worth.

Physiography

The majority of CAFB is located within the Grand Prairie section of the Central Lowlands Physiographic Province. This area is characterized by broad terrace surfaces sloping gently eastward, interrupted by westward-facing escarpments. The land is typically grass-covered and treeless, except for isolated stands of upland timber. The northwestern part of the CAFB is within the Western Cross Timbers Physiographic Province that is characterized by rolling topography and a heavy growth of post and black-jack oaks.

Topography

The topography of the base is fairly flat except for areas near Farmer's Branch and the Trinity River. Land surface slopes gently northeast toward Lake Worth and east toward the West Fork of the Trinity River. Elevations on base range from a high of approximately 690 feet above mean sea level (msl) at the southwest corner of the base to a low of approximately 550 feet msl at the east side of the base. The elevation of Lake Worth usually approximates the elevation of the dam spillway, 594 feet msl.

The principal drainage for CAFB is the West Fork of the Trinity River. Farmers Branch drains the southern portion of the base, but in turn discharges into the Trinity. A small portion of the north end of the base drains into Lake Worth.

Geology - Surficial Soils

The USDA Soil Conservation Service has identified four soil associations at CAFB. The surficial soils of the installation area are primarily nearly level to gently sloping clayey soils of the Sanger-Purves-Slidell and Aledo-Bolar-Sanger Associations. In addition to the above, the clayey soil of the Frio-Trinity Association and the loamy soil of the Bastsil-Silawa Association occur on the floodplain and stream terraces of the West Fork of the Trinity River.

From youngest to oldest, the geologic units of interest at CAFB are as follows: 1) Quaternary Alluvium, 2) Cretaceous Goodland Limestone, 3) Cretaceous Walnut Formation, 4) Cretaceous Paluxy Formation, 5) Cretaceous Glen Rose Formation, and 6) Cretaceous Twin Mountains Formation.

The majority of the base is covered by alluvium deposited by the Trinity River. The alluvium is composed of gravel, sand, silt, and clay of varying thicknesses and lateral extent. The Goodland Limestone is exposed on the southern portion of the base, south of White Settlement Road. The Goodland is a chalky-white, fossiliferous limestone and marl. A small area exposing the Walnut and Paluxy Formations occurs in the northwestern corner of the base along the shores of Lake Worth. The Walnut Formation is a shell-agglomerate limestone with varying amounts of clay and shale. The Paluxy Formation is primarily a fine- to coarse-grained sand with minor amounts of clay, sandy clay, pyrite, lignite, and shale. Neither the Glen Rose Limestone, nor the Twin Mountains Formation are exposed at CAFB.

Structure

CAFB is located on the relatively stable Texas craton, west of the faults that lie along the Ouachita Structural Belt. No major faults or fracture zones have been mapped near the base. The regional dip of the rocks beneath CAFB is between 35 and 40 feet per mile in an easterly to southeasterly direction.

2.4 SITE HYDROGEOLOGY AND LAND USE

Surface Water

CAFB is located within the Trinity River basin just south of Lake Worth, a man-made reservoir. Part of the base is drained by Farmers Branch which discharges into the West Fork of the Trinity

ver just south of the Containment area. Farmers Branch begins within the community of White Settlement and flows eastward. Just south of AF Plant 4, Farmers Branch flows under the runway within two large culverts.

Most of the base surface drainage is intercepted by a series of storm drains and culverts, directed to oil/water separators and discharged to the West Fork of the Trinity River downstream of Lake Worth. A small portion of the north end of the base drains into Lake Worth.

Groundwater

On the basis of their water-bearing properties, the geologic units at CAFB may be divided into the following five hydrogeologic units, listed from most shallow to deepest: 1) an upper perched-water zone occurring in the alluvial terrace deposits left by the Trinity River; 2) an aquitard of predominantly dry limestone of the Goodland and Walnut Formations; 3) an aquifer in the Paluxy sand; 4) an aquitard of relatively impermeable limestone in the Glen Rose Formation; and, 5) a major aquifer in the sandstone of the Twin Mountains Formation. Each of these units is examined in more detail below.

pper Zone

Groundwater occurs within the coarse sand and gravels deposited by the Trinity River, but these deposits are usually limited in areal extent and isolated by surrounding low-permeability clays and silts. Recharge to the water-bearing deposits is local, from rainfall and infiltration from stream channels and drainage ditches. Water flow in the alluvium is basically eastward, toward the West Fork of the Trinity River.

In parts of Tarrant County, generally close to the Trinity River, water in the alluvium is developed for irrigation and residential use. The community of River Oaks, immediately east of CAFB, had supply wells that developed water from the alluvial deposits at a location near the USAF Hospital. The wells were abandoned when CAFB purchased the property for hospital construction. For the most part, groundwater is not economical to develop from the alluvium due to the water's limited distribution and susceptibility to surface/stormwater pollution.

Goodland/Walnut Aquitard

The perched water present in the alluvium is separated from the aquifers below by the low permeability limestones and shales of the Goodland Limestone and Walnut Formation. The

aquitard is composed of moist clay and shale layers interbedded with dry limestone beds. Though primarily dry, drillers in the area report that small amounts of water enter the borehole while drilling through the Walnut Formation, suggesting that groundwater may move through the Walnut along bedding planes (Hargis and Associates, Inc., 1984). The thickness of the Goodland/Walnut aquitard is approximately 25 feet or greater beneath most of CAFB. However, the top of the aquitard is an erosional surface and weathering may haver reduced the thickness of the limestone in isolated areas. It is also reported that the upper zone and Paluxy Formation are in contact at the eastern boundary of AF Plant 4, where both the Goodland and Walnut Formations have been removed by erosion (Hargis and Associates, 1985). In areas of similarly extensive erosion, water in the upper zone would come in contact with water in the Paluxy aquifer.

Paluxy Aquifer

The Paluxy aquifer is the most shallow aquifer occurring beneath CAFB. In the base area, water in the Paluxy would naturally occur under confined conditions beneath the Goodland/Walnut aquitard (except where the aquitard is missing due to erosion, as discussed above). However, extensive pumping in the Fort Worth area has lowered the Paluxy potentiometric surface below the top of the formation, resulting in unconfined conditions beneath the base. The Paluxy Formation is divided into upper and lower sand members and the aquifer is likewise divided into upper and lower aquifers. The upper sand is fine-grained and shaley and the lower sand is coarser; therefore, most wells are completed in the lower section.

The Paluxy aquifer is an important source of potable groundwater in the Fort Worth area. Communities surrounding CAFB, especially White Settlement, develop municipal water supplies from the Paluxy, as well as from the deeper Twin Mountains aquifer. As a result of its extensive use as a water supply, water levels in the Paluxy aquifer have declined significantly over the years. Water levels in the immediate CAFB vicinity have not decreased as much as in the Fort Worth area in general because of the proximity of the Lake Worth recharge area and because the base does not develop water from the Paluxy. Water quality in the Paluxy aquifer is generally good and is satisfactory for potable use.

Glen Rose Aquitard

Below the Paluxy aquifer are the fine-grained limestone, shale, marl, and sandstone beds of the Glen Rose Formation. The thickness of the formation varies from 250 to 450 feet. Though the sands in the Glen Rose Formation yield small supplies to wells in Fort Worth and western

Tarrant County, the relatively impermeable limestone is an aquitard restricting water movement between the Paluxy aquifer above and the Twin Mountains aquifer below.

Twin Mountains Aquifer

The Twin Mountains Formation is the oldest formation used for water supply in the CAFB area. The formation consists of a vasal conglomerate of chert and quartz, grading upward into coarse- to fine-grained sand interbedded with shale. The thickness of the formation varies between 250 and 430 feet.

Recharge to the Twin Mountains aquifer occurs west of CAFB, where the formation crops out. Water movement is eastward in the downdip direction. Like water in the Paluxy aquifer, Twin Mountains water occurs under water-table conditions in the recharge area and becomes confined as it moves downdip. The Twin Mountains aquifer is the principal aquifer in Tarrant County. The formation yields large water supplies for municipal and industrial purposes.

Groundwater withdrawals from the Twin Mountains aquifer, primarily for municipal water supply, have resulted in declining water levels. Between 1955 and 1976, the potentiometric surface of the aquifer dropped approximately 250 feet. Water quality in the Twin Mountains aquifer is suitable for potable use throughout the Fort Worth area. Water in the upper sands of Fort Worth may be too mineralized for human consumption.

Land Use

The base is surrounding by residential, commercial, recreational, and industrial land. Residential land use is to the southwest, southeast, and east of the base. Commercial property is south and recreational (Lake Worth) is north of the base. AF Plant 4 is the industrial facility directly west of CAFB.

2.5 RESULTS OF PREVIOUS SITE INVESTIGATIONS

Initial site investigations were conducted at SWMUs 19, 20, and 53 by Radian Corporation as documented in their reports dated April 1990 (Radian, 1990 - Phase III Reports). Dames & Moore acquired these reports from the USACOE after contract commencement and did not have the benefit of this data prior to project award.

During these preliminary site investigations, 5 groundwater monitor wells and 5 separate borings were installed in the area of SWMUs 19 and 20 (the Former Fire Training Area 2). These wells were completed in the upper zone aquifer, and the borings were installed to depths of up to 25 feet below ground surface (bgs) and sampled at various depths. Collected analytical data indicated soil and groundwater impacts by heavy metals (EPA Test Method 7000), Total Petroleum Hydrocarbons, (TPH-EPA Test Method 418.1), Volatile Organic Compounds (VOCs-EPA Test Method 8240), and Semivolatile Organic Compounds (SVOCs-EPA Test Method 8270). The boring soil samples were collected within the outer berm area of SWMU 19. TPH concentrations within site soils ranged from below detection limits (BDL) to 5,760 parts per million (ppm). Benzene, Toluene, Ethylbenzene and Xylene (BTEX) concentrations within site soils ranged from BDL to 47.47 ppm. Total SVOC concentrations within site soils ranged from BDL to 17.3 ppm. Previous analytical data have been tabulated and summarized on Table 1. Dames & Moore's contract included only soil remediation within SWMUs 19, 20, and 53; therefore, previous groundwater data are not summarized or included in this report.

During initial investigations at CAFB by Radian within SWMU 53, the Flightline Drainage Ditch, 5 surface and subsurface soil samples were collected for purposes of site screening at 5 equally spaced locations along the ditch. These surface soil samples were collected from the surface and 0.1 feet bgs. Collected analytical data indicated soil impacts by heavy metals, TPH, VOCs and SVOCs. TPH concentrations ranged from 34 ppm to 3,500 ppm. BTEX concentrations ranged from 0.034 ppm to 4.82 ppm. Total SVOC concentrations ranged from 1.11 ppm to 88.3 ppm within site soils. Based upon these investigations, CAFB elicited cost proposals to conduct a decommissioning/remediation program at SWMUs 19, 20, and 53 by Bioremediation. Dames & Moore was notified on November 3, 1992, that we had been selected to implement this program. Dames & Moore then developed a scope of work based on USACOE-supplied Contract No. DACA6393C0012 documents which is discussed in the following section.

3.0 SCOPE OF WORK

Dames & Moore received the Notice To Proceed from the USACOE on January 21, 1993 and attended a Pre-Construction Meeting at CAFB on January 26, 1993, to discuss CAFB rules, policies, and requirements in order to implement the requested Scope of Work.

Dames & Moore performed the following activities before performing the scope of work outlined in the Request for Proposal (RFP):

- Attended the Pre-Construction Meeting at CAFB;
- Prepared all the necessary Work Plans to be approved prior to the start of field work;
- Obtained security passes for contractor and subcontractor personnel for site access;
- Mobilized office trailer to the trailer site;
- Mobilized the equipment to be used during the project to the job site;
- Held kickoff Site Safety Meeting with Contractor and Subcontractor personnel;
- Build the decontamination areas at each SWMU area;
- Set up personnel decontamination facilities; and,
- Designed the Bioremediation Cleanup Unit or Biocell for the site specified by USACOE/CAFB personnel.

For SWMU 20 (AST area), the order of the scope of work included the following:

- Analyzed the liquid contents of the AST for determination of a proper disposal facility;
- Removed the tank contents by use of a vacuum truck and disposed of the contents at an appropriately-licensed disposal facility;
- Purged the AST and its associated piping to prepare them for removal;
- Removed the concrete pad and its associated piping, and hauled to appropriate disposal facility;

- Decommissioned the AST and its associated piping and hauled to an appropriately-licensed disposal facility for destruction;

- Per characterization soil sampling around the AST as detailed in the RFP to evaluate appropriate soil volume to remove. A maximum of 3 feet below ground surface was to be removed;

- Excavated the appropriate soil amount as identified by the characterization sampling, and hauled to the Biocell for remediation as detailed in the RFP;

- Performed verification sampling around the former site of the AST to confirm reaching the USACOE prescribed excavation depth;

- Upon receiving verification sampling results and approval from USACOE to backfill the excavation areas, Dames & Moore placed clean clay for a liner, backfilled SWMU 20 with treated soils, and graded the site to conform with the surrounding area; and,

- Placed topsoil and reseeded the soil with grass.

For SWMU 19, the order of the scope of work included the following:

- Analyzed the liquid contents of the dumpsters to identify the proper disposal facility;

- Removed the liquid contents by use of a vacuum truck and transported liquids to the appropriately-licensed disposal facility;

- Decontaminated the dumpsters by rinsing according to RFP specifications and transported them to the appropriately-licensed disposal facility for destruction;

- Removed, decontaminated and disposed of the 10 foot diameter steel ring;

- Removed and disposed of outlet pipes and valves;

- Performed characterization sampling as detailed in the RFP to identify the appropriate volume of soil to remove. A maximum of 3 feet below ground surface was to be removed;

- Excavated the soil and hauled to the Biocell for remediation as detailed in the RFP;

- Performed verification sampling as detailed in the RFP throughout the site to confirm reaching the USACOE prescribed excavation depth;

- Upon receiving verification sampling results, placed clean clay liner, backfilled SWMU 19 with treated soils, and graded the site to conform with the surrounding area; and,

- Placed an appropriate amount of topsoil and reseeded the soil with grass.

For SWMU 53, the order of the scope of work included the following:

- Performed the characterization sampling as detailed in the RFP;

- Removed the asbestos telephone pipe as detailed in the RFP;

- Transported the asbestos pipe as detailed in the RFP to the appropriately-licenses disposal facility;

- Demolished the headwall and concrete rubble with a backhoe equipped with demo hammer;

- Removed and transported the rubble to an appropriately-licensed disposal facility;

- Removed the 3 foot wide concrete footing at the entrance to the POL Facility;

- Excavated the appropriate volume of soils as specified by the USACOE in order to lay the new Flightline Drainage Ditch;

- Stockpiled the excavated soil in designated area (adjacent parking lot) on top of 20 mil plastic, surrounded by berms and covered with 6 mil plastic for future characterization and proper disposal by USACOE;

- Regraded the channel walls and floor;

- Installed the 66" reinforced concrete pipe (RCP);

- Placed and compacted the backfill materials;

- Installed the new concrete headwall;

- Installed new drain lines and manhole;

- Installed the 6-inch collector pipe;

- Installed Concrete Slope Paving;

- Performed final grading and reseeded barren backfill as necessary;

- Survey the final results;
- Create final As-Built drawings; and,
- Prepared Summary Report.

4.0 CLEANUP GOALS

Based on negotiations that CAFB and USACOE held with the Texas Natural Resources Conservation Commission [TNRCC - then the Texas Water Commission (TWC)], the RFP indicated that the cleanup goals to be achieved in the excavated areas would be 100 ppm TPH and 30 ppm total BTEX. Likewise, the treatment goals for the remediated soils were to be 100 ppm TPH and 30 ppm total BTEX.

Within the contract documents, it was made clear that the USACOE had the option to deviate from these cleanup goals if attainment was deemed unrealistic.

5.0 WORK PLAN PREPARATION

Based on the requirements contained within the RFP and Contract Documents, Dames & Moore was required to prepare Work Plans for conducting the remediation job at CAFB and have them approved by the USACOE prior to the commencement of any field work.

Therefore, Dames & Moore prepared the required Work Plans, and on February 5, 1993, the following Draft Work Plans were submitted to the USACOE for review and approval:

- Site Health and Safety Plan (SHSP);
  - Accident Prevention Plan (APR);
  - Emergency Response Plan (ERP);
- General Site Work Plan (GSWP);
- Asbestos Removal and Disposal Plan (ARDP);
- Materials Handling Plan (MHP);
  - Spill Control and Discharge Plan (SCDP);
- Contractor Quality Control Plan (CQCP);
- Environmental Protection Plan (EPP); and,
- Quality Control Sampling Plan (QCSP).

On April 5, 1993, USACOE notified Dames & Moore (Appendix A and B) that the final modifications to the final Work Plan (CQCP) had been accepted, and all the Work Plans were approved for implementation.

6.0 REMEDIAL ACTIONS

Once the Work Plans were approved by the USACOE, Dames & Moore obtained the appropriate passes and CAFB training for employees and subcontractors to be involved in remedial activities. Once in hand Dames & Moore's team was able to mobilize to the site to set up the necessary logistical site facilities to enable smooth field work progression. While setting up the temporary field trailer, equipment trailer, decontamination areas, power and phones, Dames & Moore mobilized to the SWMUs to collect the initial delineation samples.

6.1 INITIAL SOIL DELINEATION SAMPLING

After receiving the approval from USACOE to commence initial soil delineation sampling at SWMUs 19, 20, and 53, Dames & Moore mobilized to SWMUs 19 and 20 on March 24, 1993. In accordance with the contract documents, Dames & Moore collected initial delineation soil samples at nine locations within SWMU 19. In all Dames & Moore collected 30 soil samples at SWMU 19 comprised of nine locations at three depths (DFT-1 through DFT-30 at 0.5, 1.5 and 2.5 bgs) and three duplicates (D-3, D-12, and D-24). A surface water sample (WFT-1) was also collected at SWMU 19. All samples were analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020). Figure 5 indicates these sample locations. Table 2 summarizes the analytical data which was forwarded to the USACOE on March 30, 1993. TPH concentrations in soil ranged from BDL to 13,000 ppm. BTEX concentrations in soil ranged from BDL to 25.5 ppm. The surface water contained TPH concentrations of 1.1 ppm, and BTEX concentrations were BDL. Analytical data sheets and associated Chain-of-Custody documentation are provided in Appendix C. Laboratory analyses were conducted by NDRC/Inchcape Laboratory Services, a MRD/USACOE-approved laboratory.

Dames & Moore collected one delineation soil sample at SWMU 20 (AST Area) at a 0.5 foot bgs depth on March 24, 1993 (AST-1). Two additional delineation soil samples were collected at a 0.5 foot bgs depth on April 26, 1993, after the AST had been removed. Table 2 summarizes this data, and Figure 5 shows these sample collection locations. TPH concentrations in these soil samples ranged from 2,800 ppm to 6,100 ppm. BTEX concentrations in all these soil samples were BDL. Analytical data sheets and Chain-of-Custody documentation are provided in Appendix C.

On March 25, 1993, Dames & Moore mobilized to the Flightline Drainage Ditch, SWMU 53, to collect initial delineation samples. Soil samples were collected along the drainage ditch in accordance with contract requirements at 0.5 and 1.5 feet bgs at six locations (DFLD-1 through DFLD-12). One surface water sample was also collected (WFLD-1). All samples were analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020). Sample DFLD-2 was attempted to be collected at 1.5 bgs at the first sample location at the top of the ditch, but was unable to be collected due to auger refusal. A duplicate soil sample was collected from DFLD-3. Figure 6 indicates these sample locations, and Table 2 summarizes the analytical data. TPH concentrations within SWMU 53 sampled soils ranged from BDL to 120 ppm. BTEX concentrations ranged from BDL to 14.8 parts per billion (ppb). The surface water sample collected in the drainage ditch exhibited BDL concentrations for both TPH and BTEX. On June 9, 1993, Dames & Moore collected another delineation sample (FLD-7) along the drainage ditch which exhibited 76 ppm TPH and 5.9 ppb BTEX. Analytical data sheets and Chain-of-Custody documentation are provided in Appendix C. All preliminary delineation data was submitted to the USACOE on March 30, 1993.

6.2 ASBESTOS CEMENT PIPING REMOVAL/DEMOLITION ACTIVITIES

On April 8, 1993, Dames & Moore and subcontractors (West, Inc. of Dallas, Texas and TASCO of Rowlett, Texas) mobilized to SWMU 53, Flightline Drainage Ditch and began work to remove the asbestos-containing transite piping (transite). Associated with the remediation of SWMU 53 were four asbestos cement (transite) pipes. The pipes were approximately 160 linear feet in length and, at one time, held telephone conduits.

West, Inc. conducted air monitoring during the removal process in accordance with contract specifications, and TASCO conducted the asbestos containing material removal in accordance with State of Texas Department of Health (TDH) protocols and contract requirements.

The transite was removed by first wetting the material, double-wrapping the pipes in polyethylene plastic, and then un-coupling each pipe at the joint. The abatement workers utilized wet removal methods, dual cartridge half-face respirators, and double-suit full-body protection. The asbestos-containing material (ACM) was wrapped in two layers of 6 mil polyethylene plastic, properly marked with the owner and contractor identification information, and loaded into a poly-lined vehicle for transportation. Following removal of the transite, measurement of the total linear footage was performed and consisted of a total of 167 linear feet. A copy of the manifest signed by CAFB and provided by TASCO is presented in Appendix D.

.ir samples collected during the project were analyzed and found to contain airborne fiber concentrations at levels less than the recommended limits for the respiratory protection equipment exposure ratings. Personnel samples collected and analyzed exhibited levels less than the recommended limits for the eight (8) hour time-weighted averages for the respiratory protection equipment exposure ratings. Upon completion of the abatement, work area and environment samples (upwind and downwind) for the work area were analyzed and were found to be less than 0.010 fibers per cubic centimeter (f/cc) of air, which is below the acceptable EPA industry standard level for clean air of 0.01 f/cc. All samples were analyzed utilizing Phase Contrast Microscopy (PCM) in conformance with the National Institute of Industrial and Occupational Health (NIOSH) 7400 method (see Appendix D for copy of report).

On April 20, 1993, Dames & Moore mobilized to SWMUs 19 and 20 and commenced demolition activities. On April 21, 1993, the 8,500 gallon waste fuel AST was emptied of 3,054 gallons of waste fuel, properly evacuated, triple rinsed, marked and shipped off-site for destruction. The fuel was transported off-site for recycling/disposal by Mobley Company of Corsicana, Texas. The tank was decommissioned at Texas Tank Destroyal in Venus, Texas. On April 26, 1993, the 25 steel dumpsters were also transported and decommissioned at the Texas Tank Destroyal yard in Venus, Texas. The associated rubble, debris, fire ring and associated underground piping was transported and disposed at CSC Landfill in Avalon, Texas. Associated tank/dumpster destruction certificates, waste fuel manifest, and piping/debris manifest are provided in Appendix D.

6.3 BIOCELL CONSTRUCTION

Prior to construction of the Biocell, the USACOE moved the location of the Biocell to the southeast corner of the south ramp of the CAFB airfield. The Biocell was to be situated just north of Building 1050 and just south of Hangar 1041. Dames & Moore used the provided dimensions to design the configuration and assemble the Biocell. On April 26, 1993, a 60 mil HDPE liner was delivered to CAFB for use in constructing the Biocell. On April 29, 1993, the geotextile fabric to go under the liner arrived at CAFB. On May 5, 1993, Dames & Moore collected two samples (BS-1 and BS-2) of the borrow source for the clay to be utilized in the construction of the Biocell berms. The analytical data exhibited TPH concentrations of 12 ppm (BS-1) and < 10 ppm (BS-2), and the analytical data sheets and Chain-of-Custody documentations is provided in Appendix E. The borrow source was approved for use by the USACOE.

Dames & Moore's design of the Biocell and its associated sprinkler system is exhibited on Figure 7. The 60 mil HDPE liner for the Biocell was constructed on the concrete ramp and overlaid with the geotextile fabric to preserve the integrity of the 60 mil HDPE liner which was overlaid by 3 to 6 inches of hay (drainage/visual discing layer). The impacted soil to be treated in the Biocell was then laid on top of the hay in an 18 inch lift. The Biocell was then surrounded by 4 feet high and 4 feet wide clay berms which anchor the fabric and liner to contain runoff, and deflect runon. The impacted soils were surrounded within the bermed area by a 4 feet wide drainage path which led to a sump at the downgradient end of the Biocell. The sump was used to collect runoff to keep the soils from becoming too moist for microbial hydrocarbon degradation activities. A sprinkler system was constructed across the middle of the Biocell with two separate lines with 3 sprinkler heads per line in order to reach all areas of the Biocell. By May 17, 1993, the Biocell was completely constructed and ready to accept soils for bioremediation activities.

6.4 SOIL EXCAVATION AND BIOCELL LOADING

On May 20, 1993, once the Biocell was constructed, Dames & Moore commenced the excavation of identified soils at SWMUs 19 and 20. Based upon the initial delineation sampling and visual evaluation of subsurface soils at the Former Fire Training Area, the USACOE gave Dames & Moore the direction to continue excavating below the two foot depth to three feet bgs in SWMUs 19 and 20.

From May 20 to June 8, 1993, a total of 690 full tandem dump truck loads of impacted soils were excavated, hauled and placed into the Biocell for treatment. Documentation of these transported loads of soils are provided on trip tickets in Appendix D.

On June 7, 1993, Dames & Moore moved over to SWMU 53, the Flightline Drainage Ditch, to excavate the impacted soils to add them to the Biocell. Once the headwall of the old drainage ditch was removed, Dames & Moore encountered red and black waste materials. The USACOE directed Dames & Moore to place booms in a nearby creek and to excavate and stockpile the red/black waste materials and impacted soils of SWMU 53. The soils were to be stockpiled on a 20 mil liner, surrounded by a clay berm and covered with 6 mil liner until a decision was made on how to dispose of it. These soils, due to the nature of the waste materials, would not be added to the Biocell for remediation. In total 668 cubic yards of impacted soils were surveyed and stockpiled in the parking lot adjacent to SWMU 53.

6.5 SOIL EXCAVATION VERIFICATION SAMPLING

Once the soils were excavated, transported and loaded into the Biocell from SWMUs 19 and 20, the USACOE gave the approval to collect the excavation verification samples. On June 9, 1993, Dames & Moore collected the verification samples in accordance with the contract requirements. A total of five soil samples (VFT-28 through VFT-32) were collected within the excavation area of SWMU 19, Former Fire Training Area. Figure 8 indicates the locations of these samples. These 5 soil samples were collected at a depth of 3.5 feet below original surface grade. Sample VFT-32 was collected and split from VFT-31 to form a duplicate sample. TNRCC representatives were present to view our verification sampling procedures and to collect split samples for their own analyses. TPH concentrations ranged from BDL to 6,400 ppm, and BTEX concentrations ranged from BDL to 74.3 ppm. A summary of these analytical data is provided on Table 3. Analytical data sheets and Chain-of-Custody documentation is provided in Appendix F.

Dames & Moore also collected a total of two excavation verification soil samples (VAST-4 and VAST-5) per contract terms from SWMU 20 - AST Area (Figure 8). These two soil samples were collected at a depth of 3.5 feet below original surface grade. TPH concentrations ranged from 38 ppm to 3,900 ppm, and BTEX concentrations ranged from BDL to 1.83 ppm. These data are summarized on Table 3, and the analytical data sheets and Chain-of-Custody documentation is provided in Appendix F.

Does Frank Grey have copy of this letter?

Based on a review of these data, it was evident that one half of the verification samples exceeded the cleanup goals of 100 ppm TPH and 30 ppm BTEX. After these analyses were reviewed by the USACOE, they negotiated with the TNRCC concerning the remaining soil levels. On July 27, 1993, the USACOE sent Dames & Moore a letter releasing us from the requirement of further excavation in SWMUs 19 and 20. The USACOE stated that they had the option to complete the remediation program without attaining the cleanup goals or site closure due to on-going work at the base (Appendix A and B).

Dames & Moore was notified in writing on June 29, 1993, that we were released from the requirement of biotreating the waste-impacted, stockpiled soils at SWMU 53. This letter also released Dames & Moore from the contract requirement to collect any excavation verification soil samples from SWMU 53 (Appendix A and B).

clay liner

In addition, Dames & Moore was notified to cover the bottom of the excavations of SWMUs 19 and 20 with an impermeable clay liner to create a barrier between deeper impacted soils and

.ture backfill soils. Dames & Moore was also put on notice to stop work at SWMU 53 until decisions could be made, and the USACOE directed Dames & Moore to proceed with Biocell operations.

6.6 BIOCELL OPERATIONS

Once the impacted soils had been loaded in the Biocell (8,894 cubic yards in all), on July 14, 1993, Dames & Moore collected initial Biocell background soil samples. These baseline soil samples were collected from 10 grids within the biocell (Figure 9). The samples (BCUBGS-1 through BCUBGS-13) were composited from a 5-star grid within each of 10 grids and analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020) along with selected nutrient levels. Along with these 10 samples, a duplicate (Grid 7) sample, a rinsate sample and a USACOE split sample were collected (this also occurred with all 5 of the Biocell progress sampling events). TPH concentrations ranged from 530 ppm to 1,200 ppm with an average value of 857 ppm. Total BTEX concentrations ranged from BDL to 25.3 ppb. A summary of the periodic progress sampling of the Biocell is provided on Table 4. Analytical data sheets and Chain-of-Custody documentation are provided in Appendix G.

On August 2, 1993, Dames & Moore spread 2 tons (80 bags) of fertilizer (20-30-0) on the Biocell to stimulate biological growth and hydrocarbon degradation. Dames & Moore monitored the moisture content of the soils and watered the Biocell, as necessary, to keep an optimum water content throughout the Biocell operation process. On August 16, 1993, Dames & Moore conducted the first periodic Biocell progress sampling to compare to the baseline samples collected in July, 1993. Once again, the 10 grids were composite sampled (BCU-14 to BCU-26). TPH concentrations ranged from 210 ppm to 710 ppm (Figure 9). All BTEX levels were BDL. The average TPH concentration had dropped to 470 ppm (Table 4). Analytical data sheets and Chain-of-Custody documentation are provided in Appendix G.

On September 17, 1993, Dames & Moore collected the 2nd Biocell progress samples from the 10 grids (BCU-27 to BCU-39). TPH concentrations ranged from 130 ppm to 330 ppm (Figure 9), and BTEX concentrations were all BDL (Table 4). The average TPH concentrations had dropped to 211 ppm (Appendix G).

On September 29, 1993, Dames & Moore spread 500 pounds (10 bags) of fertilizer (20-20-2) on the Biocell to further promote microbial growth and hydrocarbon degradation. On October 18, 1993, Dames & Moore conducted the 3rd Biocell progress sampling of the 10 grids (BCU-40

to BCU-52). TPH concentrations ranged from 36 ppm to 125 ppm, and BTEX concentrations again were all BDL (Table 4). The average TPH concentration had dropped to 64 ppm (Figure 9). All grids but two (#4 and #9) were below the TPH cleanup goal of 100 ppm (Appendix G). On October 25, 1993, Dames & Moore spread another 100 pounds of fertilizer (20-20-2) to promote the final degradation step.

On November 16, 1993, Dames & Moore collected two more (Grids #4 and #9) periodic Biocell progress soil samples (BCU-53 and BCU-54). TPH concentrations were 90 ppm and 186 ppm (Appendix G), respectively, with BTEX remaining BDL (Table 4). The average TPH concentration for these two grids was 138 ppm (Figure 9). Based upon the last two sampling events, Dames & Moore notified the USACOE that final Biocell verification sampling could take place within a month's time and approval was granted.

6.7 FLIGHTLINE DRAINAGE DITCH CONSTRUCTION

As a recap, in June, 1993, Dames & Moore removed the headwall of the Flightline Drainage Ditch (SWMU 53) and rebuilt the CAFB water pump. During these demolition activities, Dames & Moore encountered red and black wastes which necessitated the USACOE to release Dames & Moore from the obligation to bioremediate these soils or to collect verification samples at SWMU 53. Then on June 25, 1993, the USACOE suspended work at SWMU 53.

On July 29, 1993, the USACOE lifted the suspension of work at SWMU 53 and directed Dames & Moore to only excavate enough soil to allow the installation of the new concrete drainage system. The USACOE instructed Dames & Moore to cut one foot more off the sides of the old ditch to the grass from stations 0+00 to 1+00 and from 4+50 to the end of the old ditch. Dames & Moore was to stockpile the excavated impacted soils in the adjacent parking lot on 20 mil plastic surrounded by berms and covered by 6 mil plastic until the USACOE characterized the material. The USACOE sampled the waste and arranged for the transportation and disposal of the 668 surveyed cubic yards of soil.

During August 1993, Dames & Moore continued to remove and stockpile concrete and rubble from the old drainage ditch area of SWMU 53. On August 30, 1993, Dames & Moore plugged "Line A" at SWMU 53. On August 31 and September 1, 1993, Dames & Moore transported and disposed 12 loads (240 cubic yards) of concrete rubble from SWMU 53 at Laidlaw Landfill in Fort Worth. Corresponding manifests for this material are provided in Appendix D. On September 15, 1993, Dames & Moore received the 66 inch reinforced concrete pipe (RCP) for

the new SWMU 53 drainage ditch and began installation. Dames & Moore hauled in clay from the approved borrow source to backfill around the RCP.

On October 6, 1993, Dames & Moore formed the new headwall and bottom slab of the drainage system in accordance with the contract requirements. The manhole area for Haile Drive was excavated and fabricated. SWMU 53 was now ready for final backfill and reseeding.

6.8 BIOCELL VERIFICATION SAMPLING AND DISMANTLEMENT ACTIVITIES

On November 30 and December 1, 1993, Dames & Moore conducted the final Biocell verification sampling in accordance with contract specifications as scheduled with the USACOE, CAFB and TNRCC personnel. Figure 10 indicates the grid spacing and final Biocell verification soil sample locations. In total, 113 grid samples were collected and analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020). All BTEX concentrations were BDL; however, the TPH values all raised considerably and none of the grids met the cleanup goal of 100 ppm TPH (Table 5). This analytical data and Chain-of-Custody documentation are provided in Appendix G.

Dames & Moore, on our own behalf, conducted an evaluation of this phenomena since the past sampling a month before had indicated that all but one grid (#9) was treated to below the 100 ppm TPH cleanup goal. The unexpected results were investigated and found to be confirmed. Dames & Moore concluded that the TPH could have elevated due to decreased microbial action with decreased temperatures which contributed to the TPH levels in soils from the broken down biomass. The biomass is the non-polar lipid soluble material comprising the cell wall matrix of the bacteria cultured in the soils over the course of the treatment process. Therefore, Dames & Moore chose seven of the highest TPH (by EPA Test Method 418.1) sample grids and analyzed collected samples for Extractable TPH by EPA Test Method 8000. EPA Test Method 8000 targets fuel source contamination instead of total organic content like EPA Test Method 418.1. All results were well below the 100 ppm TPH cleanup goal (Table 5 - Figure 10 - Appendix G).

On March 14, 1994, the USACOE sent Dames & Moore a letter stating that they, CAFB and TNRCC had come to an agreement concerning the treated soil levels, approved the bioremediation and directed the backfill of the treated soils into SWMUs 19 and 20 excavation areas and dismantling the Biocell (Appendix B).

On June 13, 1994, Dames & Moore commenced with the removal of the Biocell soils to backfill the excavated areas of SWMUs 19 and 20 with the approval of the USACOE, CAFB and the TNRCC. By June 28, 1994, Dames & Moore had hauled 647 loads of treated soils and 198 loads of clay from the Biocell berms to SWMUs 19 and 20. Dames & Moore sampled the water collected in the Biocell (BC-1) which indicated a TPH concentration of 0.5 ppm and BTEX of BDL. Dames & Moore also sampled the water pooled on the liner (LW-1) which indicated a TPH and BTEX concentration of BDL (Table 3 - Appendix E). Dames & Moore transported and disposed of 8 loads of cut up liner and geotextile fabric at the Laidlaw Landfill in Fort Worth. Manifests documenting the disposal of this material are presented in Appendix D.

Graham Associates, Inc. surveyed the backfilled material in SWMUs 19 and 20 (no clay, only treated soils were included in this survey volume) for payment. After negotiations, the USACOE accepted and approved for payment a volume of 9,562 cubic yards of soil excavated, hauled and stockpiled and 8,894 cubic yards of soil remediated, backfilled and compacted (Appendix B).

6.9 SITE RESTORATION, REGRADING AND RESEEDING

After Dames & Moore, USACOE and CAFB representatives conducted the Pre-Final Inspection, Dames & Moore was approved for site restoration completion activities to include regrading, general site cleanup, reseeding, final surveying, and final As-Built Drawings transmittal.

Dames & Moore mobilized to SWMU 53 and prepared the subsurface and top soil, and returfing in accordance with contract specifications. Dames & Moore mobilized to SWMUs 19 and 20 (after the payment survey of treated soils was conducted) and restored, compacted and regraded that site prior to returfing. On August 3, 1994, Dames & Moore met USACOE and CAFB representatives at the site to have the Final Site Inspection. Dames & Moore passed the inspection with some general site cleanup work. Dames & Moore conducted the general site cleanup activities, turned over the Biocell sprinkler system to CAFB personnel, and demobilized equipment and personnel from the job. The last day Dames & Moore was physically on the site was August 17, 1994.

The two sites (SWMU 19/20 and SWMU 53) were then final surveyed after a stand of grass appeared, and the final As-Built Drawings were developed and submitted to the USACOE (Figures 11 and 12). The USACOE accepted the Final As-Builts on November 21, 1994.

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Official Government

Document

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Analytical Data Tables

TABLE 1
PREVIOUS SOIL SAMPLING ANALYTICAL DATA SUMMARY
SWMUs 19, 20, AND 53
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

AREA	BORING	DEPTH BGS (FT)	DATE	TPH (mg/kg)[3]	VOLATILE ORGANICS (mg/kg)						SEMI VOLATILE ORGANICS (mg/kg)
					BENZENE	TOLUENE	ETHYL BENZENE	XYLENE	TOTAL BTEX	METHYLENE CHLORIDE	TOTAL SVOCS
FTA2[1,2]	12G	14-17	2-20-88	ND[4]	ND	0.19	ND	ND	0.19	ND	ND
FTA2	12H-1	0-4	2-23-88	3,230	0.37	11.0	4.1	32	47.47	ND	17.3
FTA2	12H-2	4-9	2-23-88	2,110	ND	8.8	4.8	31	44.6	ND	6.97
FTA2	12H-3	9-14	2-23-88	450	ND	1.9	1.1	6.4	9.4	ND	0.97
FTA2	12H-4	14-19	2-23-88	340	ND	0.24	0.89	4.0	5.13	ND	1.32
FTA2	12H-5	19-25	2-23-88	5,760	ND	3.7	5.0	32	40.7	ND	15.7
FTA2	12I-2	4-9	2-23-88	670	ND	1.7	1.3	8.6	11.6	ND	4.35
FTA2	12I-3	9-14	2-24-88	450	0.54	2.2	5.6	35	42.8	ND	3.2
FTA2	12I-5	19-24	2-24-88	1,250	ND	0.016	ND	0.0063	0.022	0.005	1.28
FTA2	12J-2	4-9	2-24-88	ND	ND	0.013	ND	ND	0.013	0.12	ND
FTA2	12J-3	9-14	2-24-88	ND	ND	ND	ND	ND	ND	0.0039	ND
FTA2	12J-5	19-23	2-24-88	17.0	ND	0.0064	ND	ND	0.0064	0.0062	ND
FTA2	12K-5	20-25	2-20-88	14.0	ND	0.0011	ND	ND	0.0011	ND	ND

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TABLE 1
PREVIOUS SOIL SAMPLING ANALYTICAL DATA SUMMARY
SWMUs 19, 20, AND 53
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

AREA	BORING	DEPTH BGS (FT)	DATE	TPH (mg/kg)[3]	VOLATILE ORGANICS (mg/kg)						SEMI VOLATILE ORGANICS (mg/kg)
					BENZENE	TOLUENE	ETHYL BENZENE	XYLENE	TOTAL BTEX	METHYLENE CHLORIDE	TOTAL SVOCS
FDD[5]	13G-1	0	3-5-88	1,130	0.011	0.16	0.75	3.9	4.82	ND	64.24
FDD	13G-2	0.1	3-31-88	410	ND	3.0	ND	ND	3.0	ND	7.93
FDD	13H-1	0	3-5-88	1,320	0.0031	0.034	0.011	0.063	0.11	ND	34.74
FDD	13H-2	0.1	3-31-88	3,500	ND	0.023	0.003	0.018	0.044	ND	5.0
FDD	13I-1	0	3-5-88	960	0.0075	0.36	0.017	0.15	0.535	ND	51.72
FDD	13I-2	0.1	3-31-88	99	ND	0.018	0.0021	0.014	0.034	ND	69.77
FDD	13J-1	0	3-5-88	420	0.003	0.0083	0.0037	0.02	0.035	ND	14.74
FDD	13J-2	0.1	3-31-88	230	0.0015	0.095	0.0051	0.036	0.138	ND	23.28
FDD	13K-1	0	3-5-88	34	0.0038	0.012	0.0041	0.028	0.048	ND	1.11
FDD	13K-2	0.1	3-31-88	55	0.0025	0.11	0.0044	0.021	0.138	0.0016	88.3

NOTE
(1) Data received after contract started. Data from Radian RI/FS, April 1990.
(2) All FTA2 samples collected within outer berm area of SWMU 19.
(3) mg/kg = milligrams per kilogram or parts per million (ppm)
(4) ND = Not Detected
(5) All FDD samples collected in soils within SWMU 53.

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TABLE 2
DELINEATION SAMPLING ANALYTICAL DATA SUMMARY
SWMUs 19, 20, AND 53
CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

		Analyte:	TPH	B	T	E	X	BTEX
		Units:	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Cleanup Goals:			100	NA	NA	NA	NA	30,000
Field I.D.	Depth	Lab I.D.						
DFT-1	0.5	1	5,300	<50	57	300	1,600	1,960
DFT-2	1.5	2	45	11	12	26	220	269
DFT-3	2.5	3	20	11	3.1	19	140	173
DFT-28 (D-3)	2.5	28	180	11	11	16	83	121
DFT-4	0.5	4	4,000	<2.0	<2.0	<2.0	4.9	4.9
DFT-5	1.5	5	13,000	1,300	4,300	2,600	13,000	21,200
DFT-6	2.5	6	8,300	1,500	4,700	3,300	16,000	25,500
DFT-7	0.5	7	1,500	<2.0	<2.0	<2.0	4.5	4.5
DFT-8	1.5	8	2,100	<200	710	1,100	7,100	8,910
DFT-9	2.5	9	150	<50	88	100	840	1,030
DFT-10	0.5	10	290	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-11	1.5	11	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-12	2.5	12	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-29 (D-12)	2.5	29	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-13	0.5	13	66	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-14	1.5	14	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-15	2.5	15	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-16	0.5	16	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-17	1.5	17	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-18	2.5	18	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-19	0.5	19	1,600	<2.0	<2.0	<2.0	62	62
DFT-20	1.5	20	<10	<2.0	12	42	280	334
DFT-21	2.5	21	23	<2.0	41	76	470	587
DFT-22	0.5	22	80	<2.0	19	2.4	120	141
DFT-23	1.5	23	95	<2.0	7.9	12	50	69.9
DFT-24	2.5	24	51	<2.0	14	<2.0	38	52
DFT-30 (D-24)	2.5	30	<10	<2.0	<2.0	<2.0	7.9	7.9
DFT-25	0.5	25	450	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-26	1.5	26	2,300	<200	2,000	2,600	12,000	16,600
DFT-27	2.5	27	3,100	<50	2,100	3,000	12,000	17,100
AST-1	0.5	36	3,500	<2.0	<2.0	<2.0	<2.0	<2.0
AST-2	0.5	1	6,100	<2.0	<2.0	<2.0	<2.0	<2.0

TABLE 2
DELINEATION SAMPLING ANALYTICAL DATA SUMMARY
SWMUs 19, 20, AND 53
CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

		Analyte:	TPH	B	T	E	X	BTEX
		Units:	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Cleanup Goals:			100	NA	NA	NA	NA	30,000
Field I.D.	Depth	Lab I.D.						
AST-3	0.5	2	2,800	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-1	0.5	1	120	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-2	NS							
DFLD-3	0.5	2	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-13 (D-3)	0.5	12	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-4	1.5	3	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-5	0.5	4	20	<2.0	<2.0	2.8	12.0	14.8
DFLD-6	1.5	5	37	<2.0	<2.0	<2.0	3.8	3.8
DFLD-7	0.5	6	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-8	1.5	7	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-9	0.5	8	<10	<2.0	<2.0	2.0	11.0	13.0
DFLD-10	1.5	9	<10	<2.0	<2.0	<2.0	6.5	6.5
DFLD-11	0.5	10	93	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-12	1.5	11	<10	<2.0	<2.0	<2.0	<2.0	<2.0
FLD-7	0.5	9A	76	<2.0	<2.0	<2.0	5.9	5.9
		Units:	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
WFT-1	Surface Water	34	1.1	<1.0	<1.0	<1.0	<1.0	<1.0
WFLD-1	Surface Water	14	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0

NOTES:
TPH = Total Petroleum Hydrocarbon
< = not detected at or above method detection limit
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes
BTEX = Total BTEX
mg/l = milligrams per liter
mg/kg = milligrams per kilogram or parts per million (ppm)
ug/l = micrograms per liter
ug/kg = micrograms per kilogram or parts per billion (ppb)
D-# = Duplicate Sample of #
NA = Not Applicable
NS = No sample collected at DFLD-2 due to hand auger refusal

TABLE 3
VERIFICATION SOIL SAMPLING ANALYTICAL DATA SUMMARY
SWMUs 19 AND 20
CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

		Analyte:	TPH	B	T	E	X	BTEX
		Units:	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Cleanup Goals:			100	NA	NA	NA	NA	30,000
Field I.D.	Depth	Lab I.D.						
VFT-28	3.5	1	<10	<2	<2	<2	<2	<2
VFT-29	3.5	2	1,100	240	4,900	3,200	17,000	25,300
VFT-30	3.5	3	<10	<2	<2	<2	<2	<2
VFT-31	3.5	4	4,700	960	12,000	5,100	26,000	44,100
VFT-32 (D-31)	3.5	5	6,400	1,200	16,000	8,100	49,000	74,300
VAST-4	3.5	7	3,900	<50	73	260	1,500	1,830
VAST-5	3.5	8	38	<2.0	<2.0	<2.0	<2.0	<2.0
			mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
BS-1 (Borrow Source)	0.0	13406	12	NA	NA	NA	NA	NA
BS-2 (Borrow Source)	0.0	13407	<10	NA	NA	NA	NA	NA
BC-1 (Biocell Water)	0.0	20897	0.50	<5.0	<5.0	<5.0	<5.0	<5.0
LW-1 (Liner Water)	0.0	32726	<0.50	<5.0	<5.0	<5.0	<5.0	<5.0

NOTES:
TPH = Total Petroleum Hydrocarbon
< = not detected at or above method detection limit
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes

BTEX = Total BTEX
mg/l = milligrams per liter
mg/kg = milligrams per kilogram
ug/l = micrograms per liter or parts per million (ppm)
ug/kg = micrograms per kilogram or parts per billion (ppb)

NA = Not Analyzed
D-# = Duplicate Sample of #

335200

TABLE 4
INITIAL BIOCELL BASELINE AND
PERIODIC SOIL SAMPLING ANALYTICAL DATA SUMMARY
CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

SAMPLE NUMBER	DATE COLLECTED	GRID #	DESCRIPTION	TPH (mg/kg[1])	BTEX (ug/kg[2])	AVERAGE TPH (mg/kg) PER EVENT
BCUBGS-1	7-14-93	1	Soil Baseline	550	BDL[3]	NA[4]
BCUBGS-2	7-14-93	2	Soil Baseline	1,000	BDL	NA
BCUBGS-3	7-14-93	3	Soil Baseline	1,100	BDL	NA
BCUBGS-4	7-14-93	4	Soil Baseline	910	BDL	NA
BCUBGS-5	7-14-93	5	Soil Baseline	1,200	25.3	NA
BCUBGS-6	7-14-93	6	Soil Baseline	760	BDL	NA
BCUBGS-7	7-14-93	7	Soil Baseline	530	23.6	NA
BCUBGS-8	7-14-93	8	Soil Baseline	890	BDL	NA
BCUBGS-9	7-14-93	9	Soil Baseline	700	BDL	NA
BCUBGS-10	7-14-93	10	Soil Baseline	840	BDL	NA
BCUBGS-11	7-14-93	DUP	Duplicate 7	950	BDL	857
BCUBGS-12	7-14-93	COE	Split Sample	NA	NA	NA
BCUBGS-13	7-14-93	RW	Rinse Water	BDL	BDL	NA
BCU-14	8-16-93	1	1st BCU Progress Sampling	440	BDL	NA
BCU-15	8-16-93	2	1st BCU Progress Sampling	450	BDL	NA
BCU-16	8-16-93	3	1st BCU Progress Sampling	430	BDL	NA
BCU-17	8-16-93	4	1st BCU Progress Sampling	710	BDL	NA
BCU-18	8-16-93	5	1st BCU Progress Sampling	320	BDL	NA
BCU-19	8-16-93	6	1st BCU Progress Sampling	660	BDL	NA
BCU-20	8-16-93	7	1st BCU Progress Sampling	210	BDL	NA
BCU-21	8-16-93	8	1st BCU Progress Sampling	450	BDL	NA
BCU-22	8-16-93	9	1st BCU Progress Sampling	510	BDL	NA
BCU-23	8-16-93	10	1st BCU Progress Sampling	520	BDL	470
BCU-24	8-16-93	DUP	Duplicate 7	60	BDL	NA

TABLE 4
INITIAL BIOCELL BASELINE AND
PERIODIC SOIL SAMPLING ANALYTICAL DATA SUMMARY
CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

SAMPLE NUMBER	DATE COLLECTED	GRID #	DESCRIPTION	TPH (mg/kg[1])	BTEX (ug/kg[2])	AVERAGE TPH (mg/kg) PER EVENT
BCU-25	8-16-93	COE	Split Sample	NA	NA	NA
BCU-26	8-16-93	RW	Rinse Water	BDL	BDL	NA
BCU-27	9-17-93	1	2nd BCU Progress Sampling	330	BDL	NA
BCU-28	9-17-93	2	2nd BCU Progress Sampling	200	BDL	NA
BCU-29	9-17-93	3	2nd BCU Progress Sampling	130	BDL	NA
BCU-30	9-17-93	4	2nd BCU Progress Sampling	260	BDL	NA
BCU-31	9-17-93	5	2nd BCU Progress Sampling	200	BDL	NA
BCU-32	9-17-93	6	2nd BCU Progress Sampling	190	BDL	NA
BCU-33	9-17-93	7	2nd BCU Progress Sampling	160	BDL	NA
BCU-34	9-17-93	8	2nd BCU Progress Sampling	230	BDL	NA
BCU-35	9-17-93	9	2nd BCU Progress Sampling	130	BDL	NA
BCU-36	9-17-93	10	2nd BCU Progress Sampling	280	BDL	211
BCU-37	9-17-93	DUP	Duplicate 5	210	BDL	NA
BCU-38	9-17-93	COE	Split Sample	NA	NA	NA
BCU-39	9-17-93	RW	Rinse Water	BDL	BDL	NA
BCU-40	10-18-93	1	3rd BCU Progress Sampling	[illegible]	BDL	NA
BCU-41	10-18-93	2	3rd BCU Progress Sampling	36	BDL	NA
BCU-42	10-18-93	3	3rd BCU Progress Sampling	69	BDL	NA
BCU-43	10-18-93	4	3rd BCU Progress Sampling	121	BDL	NA
BCU-44	10-18-93	5	3rd BCU Progress Sampling	50	BDL	NA
BCU-45	10-18-93	6	3rd BCU Progress Sampling	43	BDL	NA
BCU-46	10-18-93	7	3rd BCU Progress Sampling	57	BDL	NA
BCU-47	10-18-93	8	3rd BCU Progress Sampling	50	BDL	NA
BCU-48	10-18-93	9	3rd BCU Progress Sampling	125	BDL	NA

TABLE 4
INITIAL BIOCELL BASELINE AND
PERIODIC SOIL SAMPLING ANALYTICAL DATA SUMMARY
CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

SAMPLE NUMBER	DATE COLLECTED	GRID #	DESCRIPTION	TPH (mg/kg[1])	BTEX (ug/kg[2])	AVERAGE TPH (mg/kg) PER EVENT
BCU-49	10-18-93	10	3rd BCU Progress Sampling	50	BDL	65
BCU-50	10-18-93	DUP	Duplicate 1	27	BDL	NA
BCU-51	10-18-93	RW	Rinse Water	1.6	BDL	NA
BCU-52	10-18-93	COE	Split Sample	NA	NA	NA
BCU-53	11-4-93	4	4th BCU Progress Sampling	90	BDL	NA
BCU-54	11-4-93	9	4th BCU Progress Sampling	186	BDL	138

NOTES:
(1) mg/kg = milligrams per kilogram or parts per million (ppm)
(2) ug/kg = micrograms per kilogram or parts per billion (ppb)
(3) BDL = Below Detection Limits
(4) NA = Not Analyzed/or Not Applicable

TABLE 5
BIOCELL VERIFICATION SOIL SAMPLING ANALYTICAL DATA SUMMARY
CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS
FOR
U.S. ARMY CORPS OF ENGINEERS

ID No.	TPH (418.1)[1]	ID No.	TPH (418.1)	EXTRACTABLE TPH (8000)	ID No.	TPH (418.1)
B-1	214	B-51	314		B-101	244
B-2	350	B-52	228		B-102	137
B-3	323	B-53	281			
B-4	290	B-54	167			
B-5	260	B-55	434		B-126 (Resample of B-9)	310
B-6	280	B-56	355		B-127 (B-27)	226
B-7	210	B-57	260		B-128 (B-18)	385
B-8	240	B-58	623	<10	B-129 (B-36)	250
B-9	270	B-59	253		B-130 (B-54)	294
B-10	300	B-60	524	<10	B-131 (B-45)	127
B-11	257	B-61	580	13	B-132 (B-63)	350
B-12	336	B-62	362		B-133 (B-81)	190
B-13	250	B-63	394	10	B-134 (B-72)	346
B-14	244	B-64	300		B-135 (B-90)	380
B-15	210	B-65	234		B-136 (B-99)	198
B-16	370	B-66	310			
B-17	370	B-67	330			
B-18	286	B-68	373			
B-19	310	B-69	450	25		
B-20	307	B-70	294			
B-21	386	B-71	256			
B-22	464	B-72	300			
B-23	220	B-73	216			
B-24	230	B-74	295			
B-25	211	B-75	160			
B-26	185	B-76	132			
B-27	326	B-77	208			
B-28	180	B-78	194			
B-29	194	B-79	260			
B-30	153	B-80	310	<10		
B-31	200	B-81	260			
B-32	140	B-82	210			
B-33	176	B-83	200			
B-34	233	B-84	200			
B-35	177	B-85	207			
B-36	163	B-86	350			
B-37	257	B-87	460	46		
B-38	160	B-88	400			
B-39	266	B-89	332			
B-40	408	B-90	230			
B-41	200	B-91	315			
B-42	276	B-92	475			
B-43	246	B-93	340			
B-44	234	B-94	231			
B-45	120	B-95	183			
B-46	220	B-96	172			
B-47	154	B-97	225			
B-48	186	B-98	246			
B-49	162	B-99	256			
B-50	526	B-100	159			

NOTE: (1) TPH = Total Petroleum Hydrocarbons by EPA Test Method 418.1 (and EPA Test Method 8000 for comparison) in mg/kg or parts per million (ppm)

(2) All BTEX data were below method detection limits.

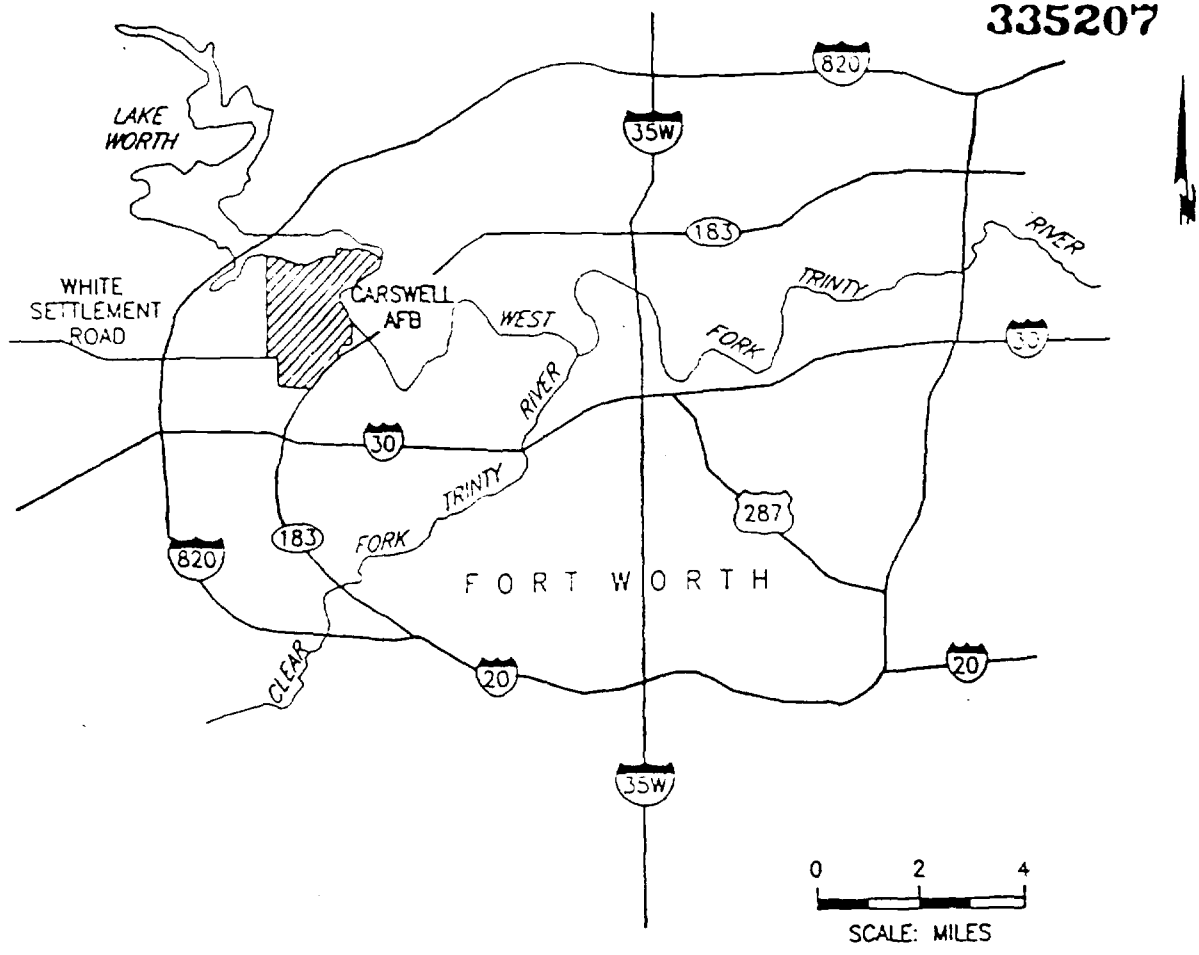
335205

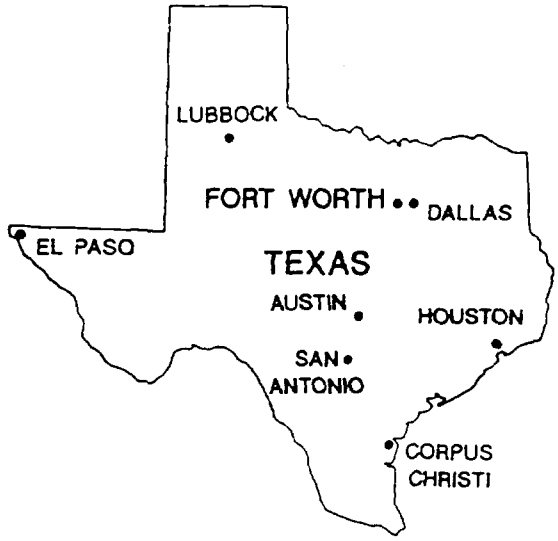
TAB

6

Figures

335207





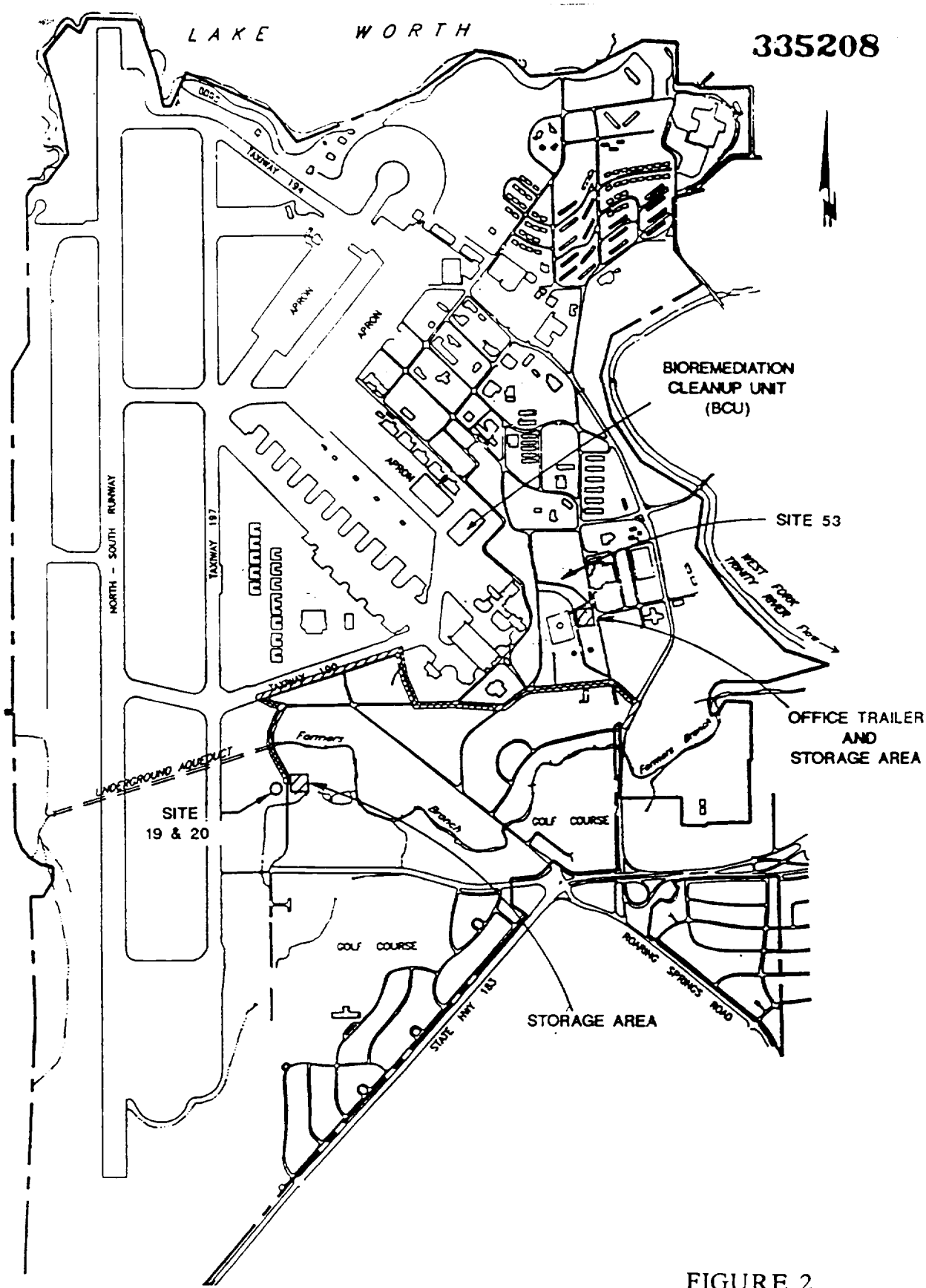
SOURCE : U.S. ARMY CORPS OF ENGINEERS
RFP FOR CARSWELL AFB

FIGURE 1
VICINITY MAP
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

DAMES & MOORE

1-010-135 | FILE NO | REVISIONS: | DATE: 2-16-95 | APPROV: | DATE: 2-16-95 | CHECKED BY: | DATE 2-16-95 | DRAWN BY:

335208



EXPLANATION

ACCESS ROUTE TO SITE

BASE BOUNDARY

SOURCE : U.S. ARMY CORPS OF ENGINEERS RFP FOR CARSWELL AFB

0 1000 2000

SCALE: FEET

FIGURE 2
SITE LOCATION MAP
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

DAMES & MOORE

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335209

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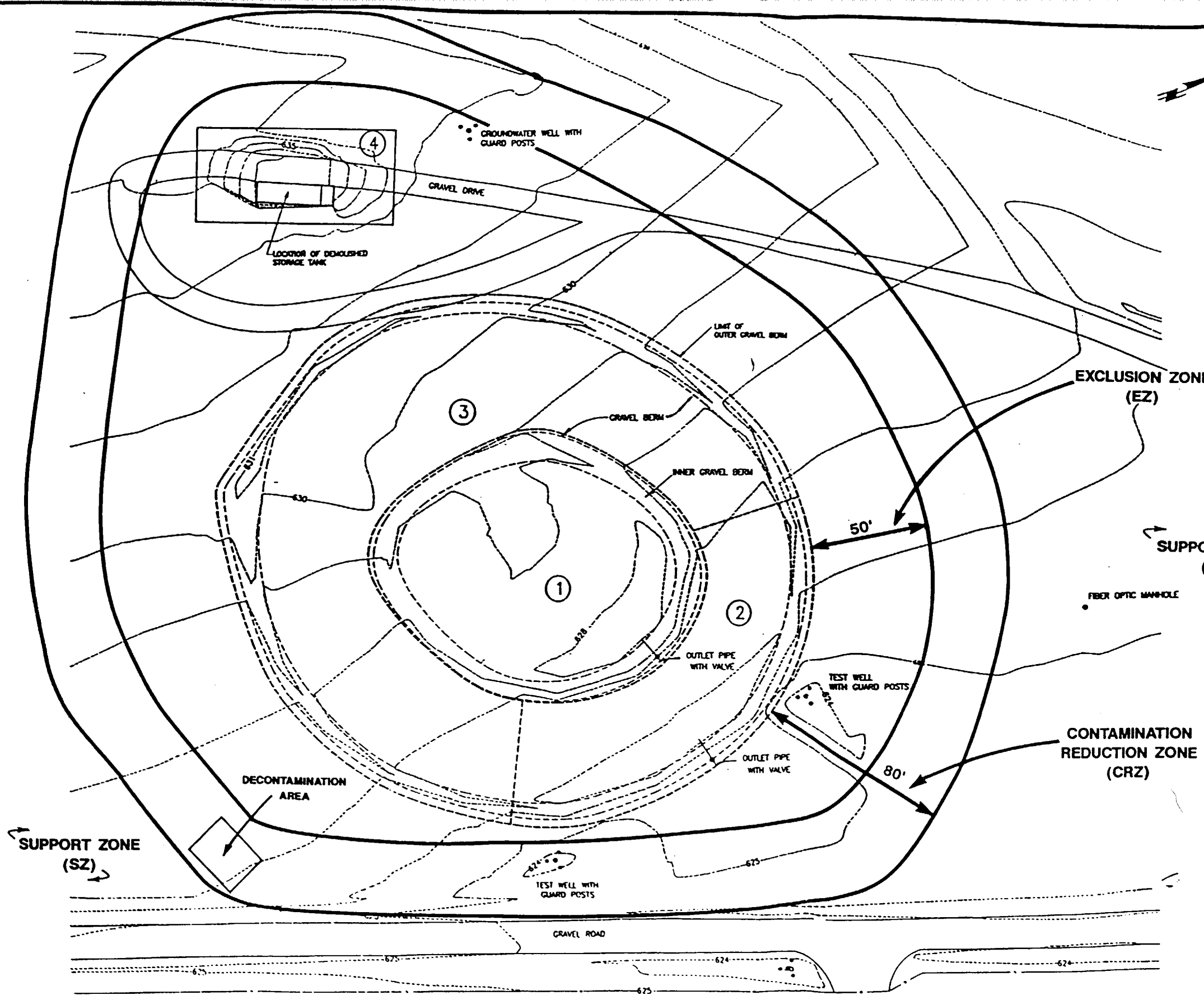

LEGEND

- EXISTING CONTOUR LINES
- SECTION ④ BOUNDARY
- ① SECTION NUMBERS
- SECTION BOUNDARIES

REFERENCE POINTS

POINT	NORTHING	EASTING	ELEV	BEARING	DISTANCE
#1	2,013,613.39	402,723.76	627.67	N 04°48'34" E	646.85'
#2	2,014,252.96	402,717.99	624.50		

SCALE : 0.45 INCH = 20 FEET

20' 0 20'

SOURCE : U.S. ARMY CORPS OF ENGINEERS RFP FOR CARSWELL AFB

FIGURE 3
SWMU 19 & 20
FORMER FIRE TRAINING AREA
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

DAMES & MOORE

335210

FILE NO: 11851-010-135

REVISIONS:

APPROVED BY: DATE: 2-16-95

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DRAWN BY: DATE: 2-16-95

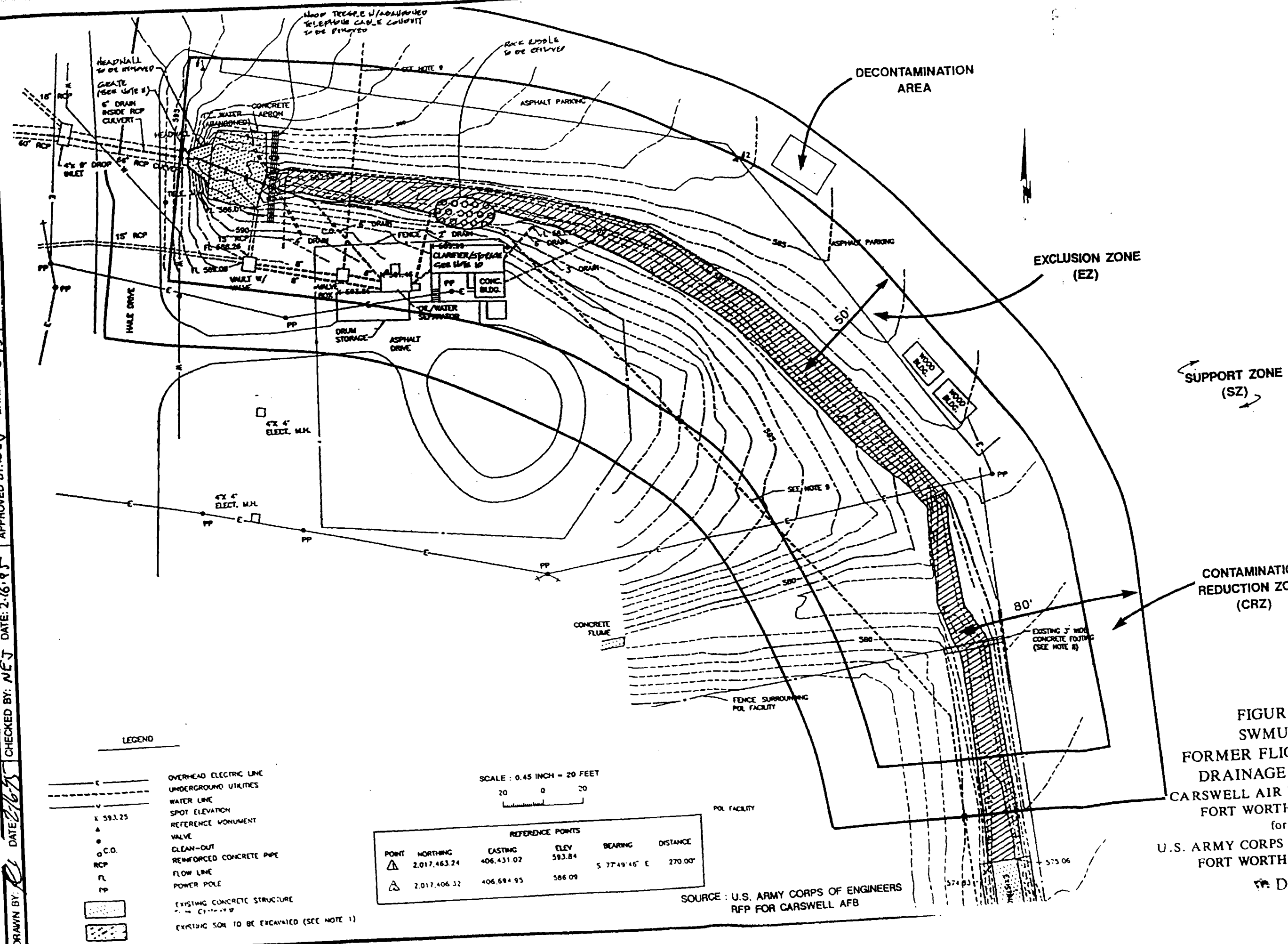
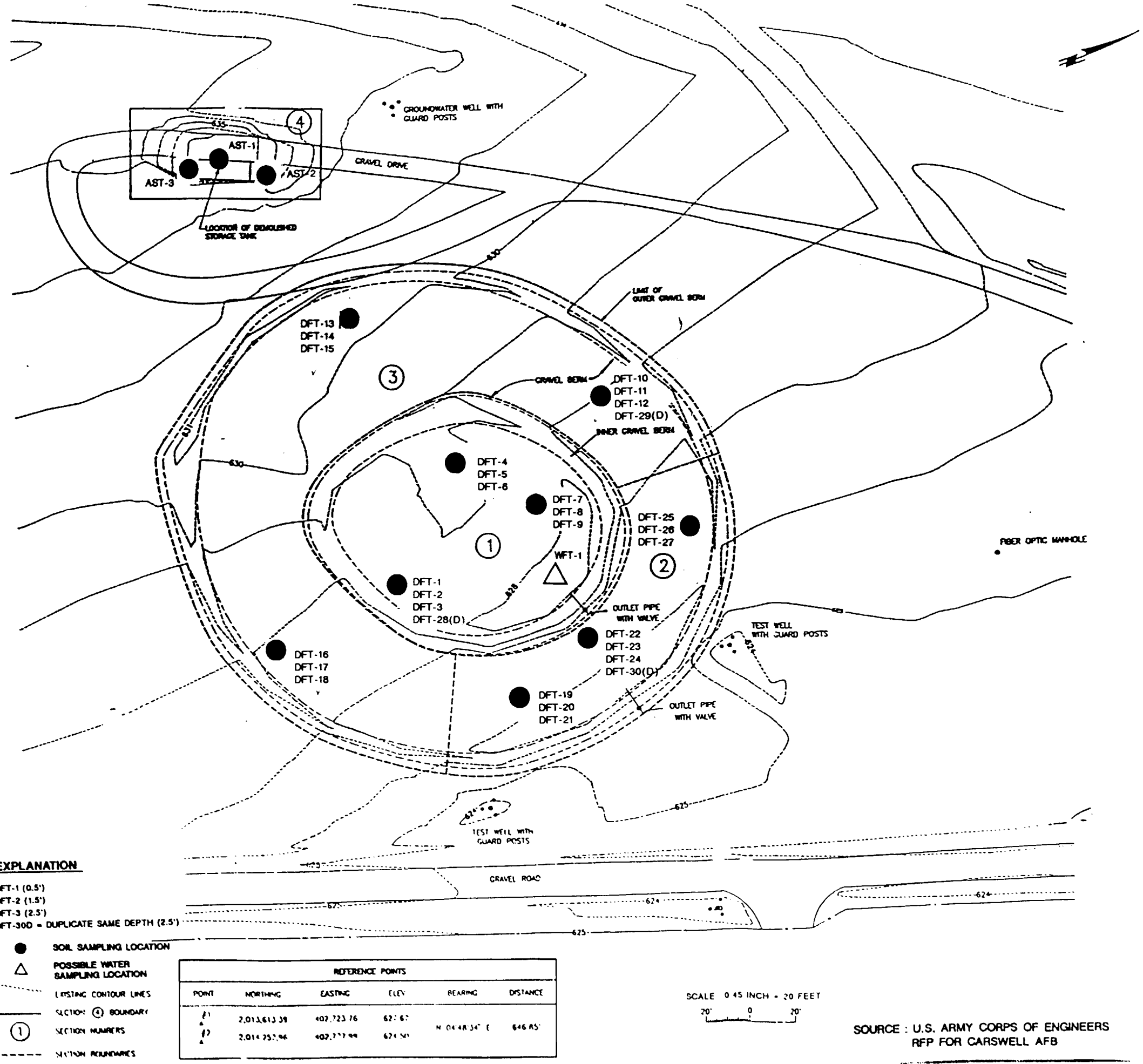


FIGURE 4
SWMU 53
FORMER FLIGHTLINE DRAINAGE DITCH
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

DAMES & MOORE

335211

FILE NO: 11851-010-135 | REVISIONS: | DATE: 2-16-95 | APPROVED BY: MCJ | DATE: 2-16-95 | CHECKED BY: MCJ | DATE: 2-16-95 | DRAWN BY:



Outer berm - 2ft high
- clayey soil, 260 feet dia

Inner berm - 2ft high
- clayey soil - 120ft diameter

FIGURE 5
INITIAL CHARACTERIZATION
SAMPLING LOCATIONS
FORMER FIRE TRAINING AREA
SWMU'S 19 & 20
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
DAMES & MOORE

335212

FILE NO: 11851-010-135

REVISIONS:

DATE: 2/16/95 APPROVED BY: NCT

DATE: 2/16/95 CHECKED BY: NCT

DATE: 2/16/95 DRAWN BY:

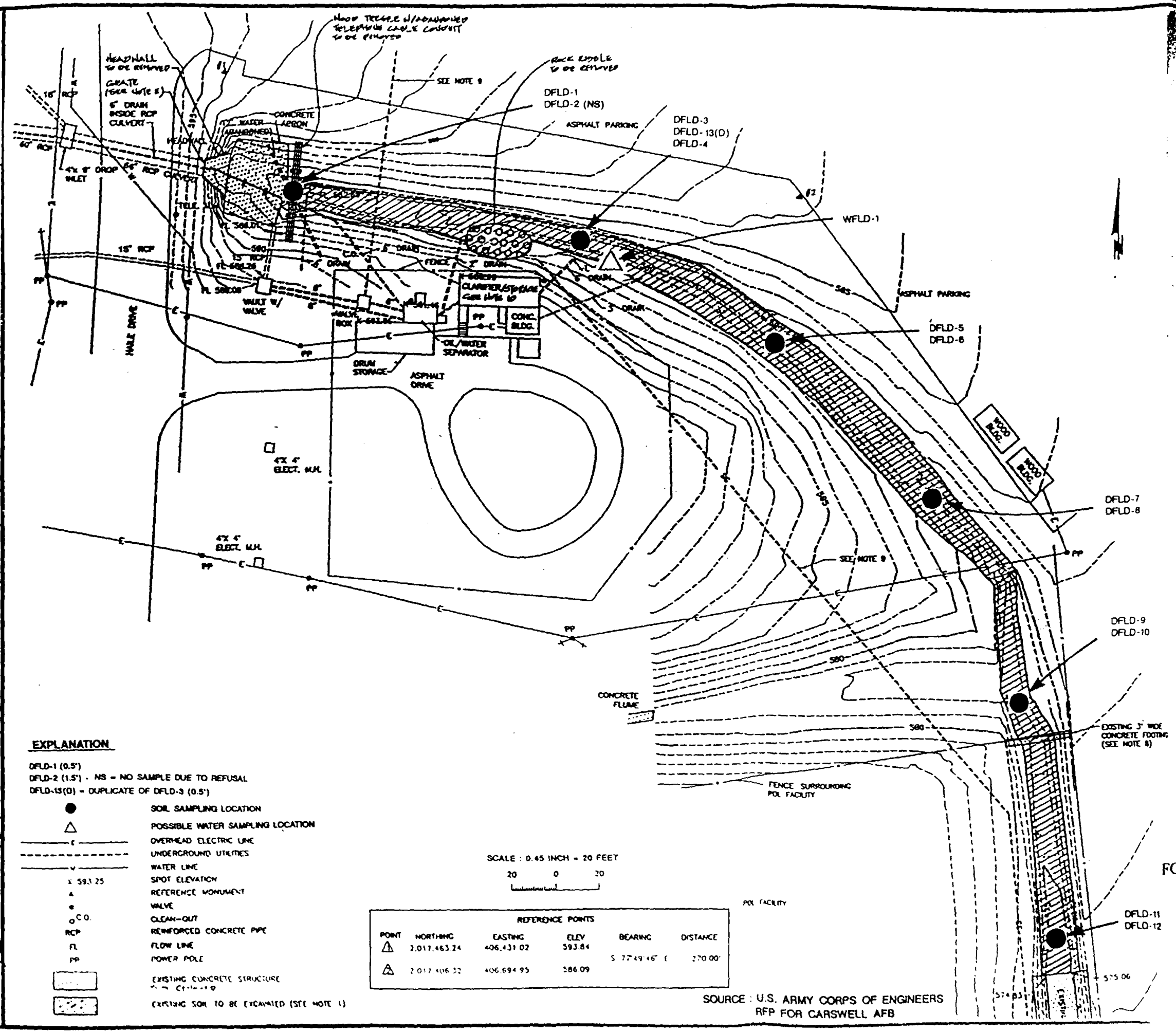


FIGURE 6
INITIAL CHARACTERIZATION
SAMPLING LOCATIONS
FORMER FLIGHTLINE DRAINAGE DITCH
SWMU 53
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

DAMES & MOORE

335213

FILE NO: 11851-010

REVISIONS:

DATE: 2/16/95

APPROVED BY: MET

DATE: 2/16/95

CHECKED BY: MET

DATE: 2/16/95

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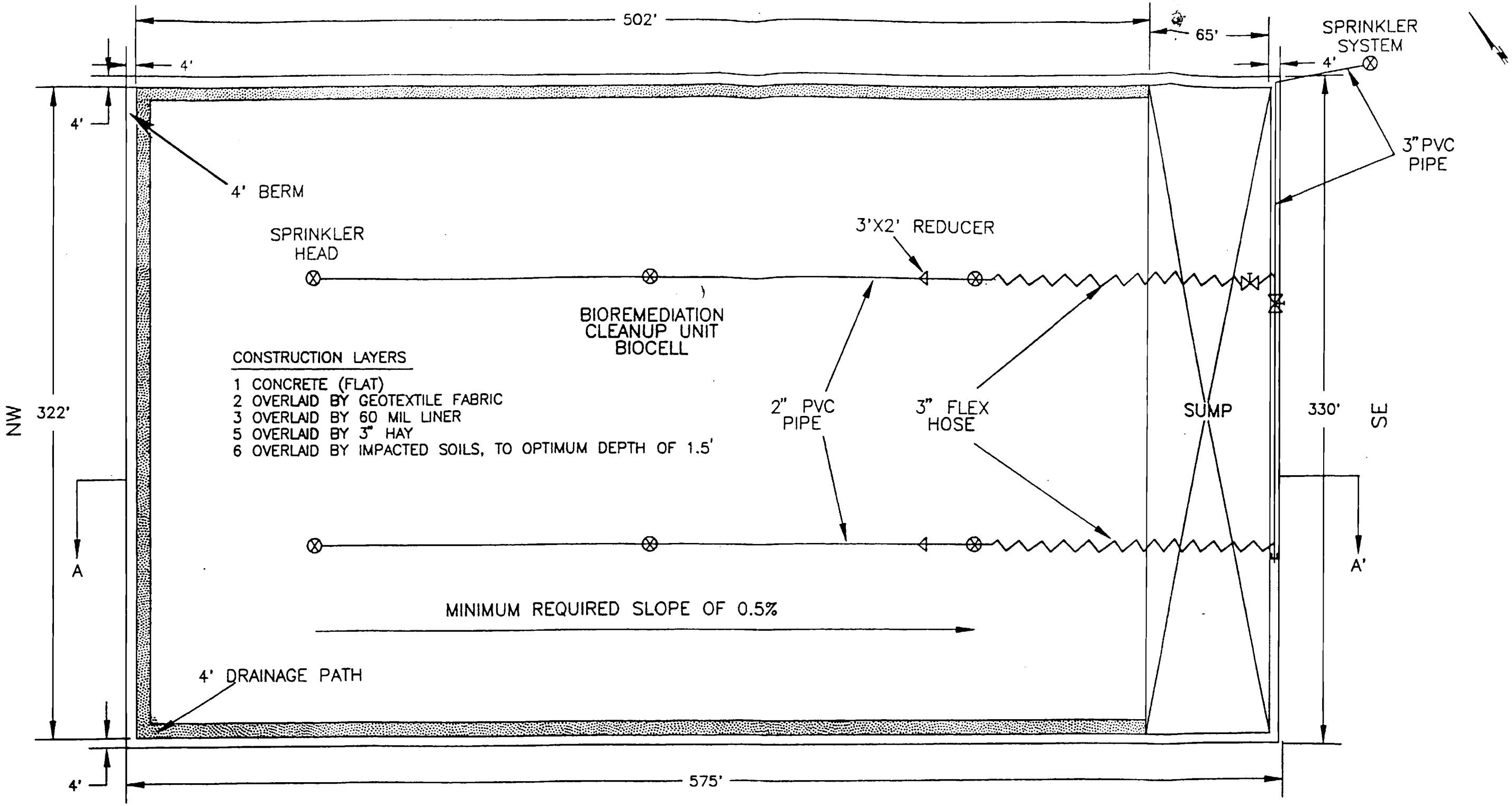

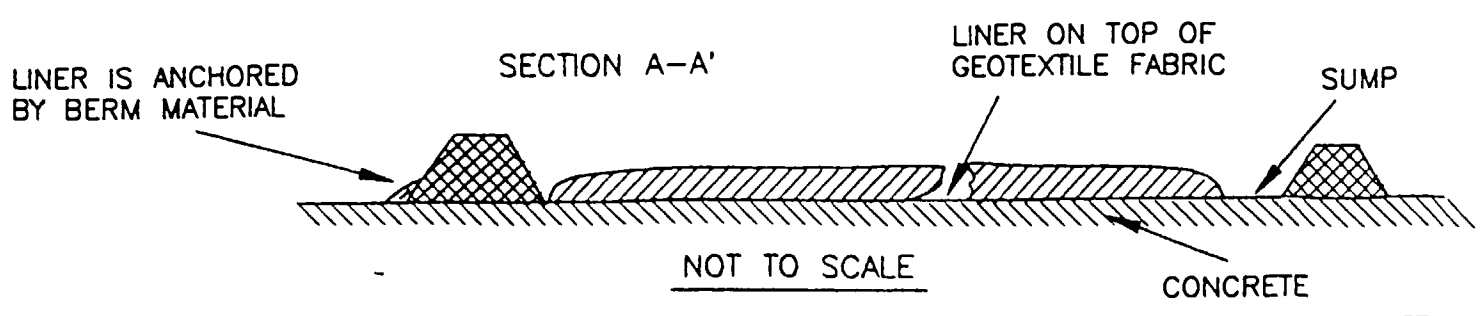

SCALE

0 50 100 FEET

FIGURE 7
APPROXIMATE
LAYOUT OF BIOCELL
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

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335214

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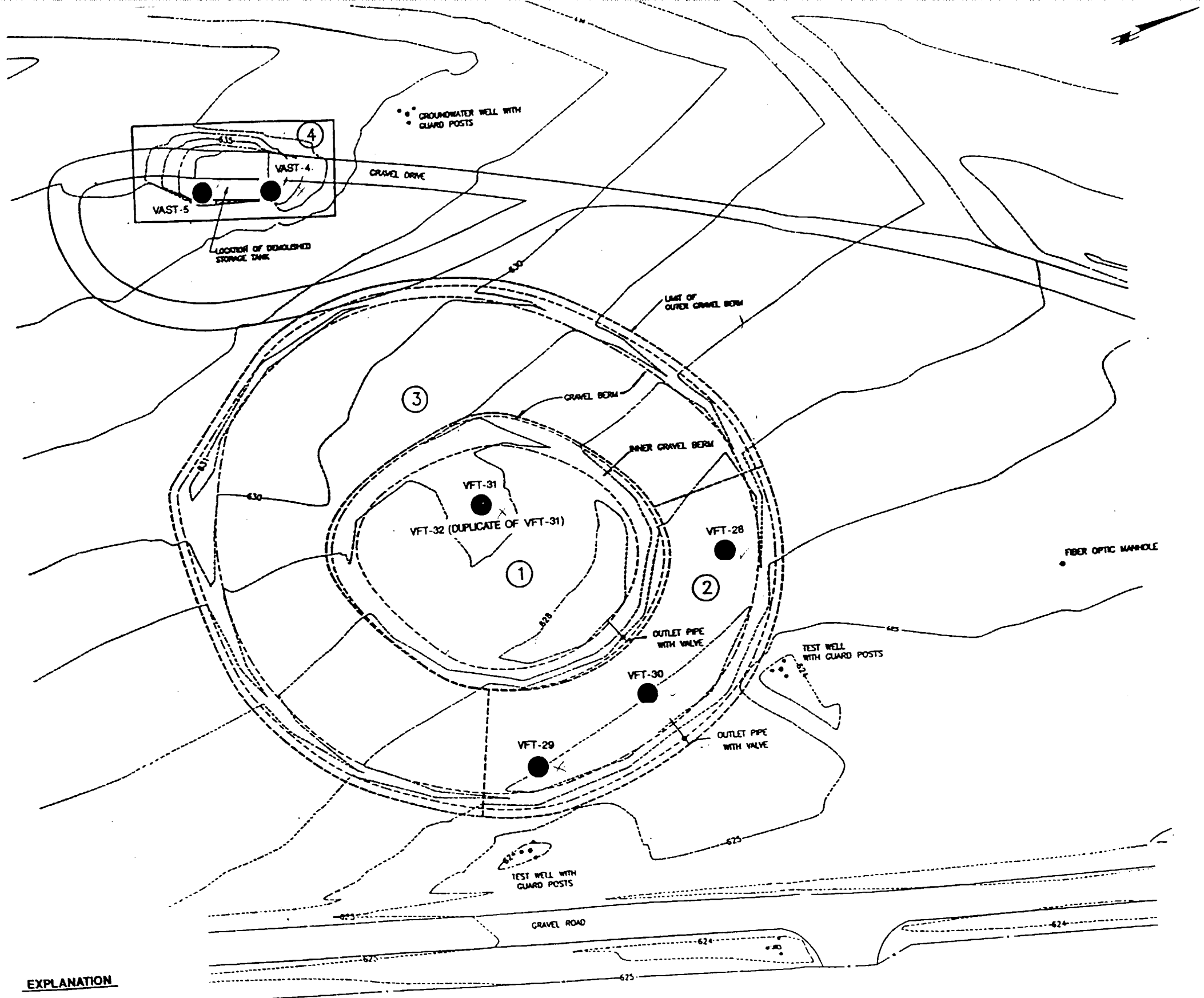


EXPLANATION

VFT-28 (3.5' BELOW ORIGINAL GRADE)

- SOIL SAMPLING LOCATION
- EXISTING CONTOUR LINES
- SECTION 4 BOUNDARY
- 1 SECTION NUMBERS
- SECTION BOUNDARIES

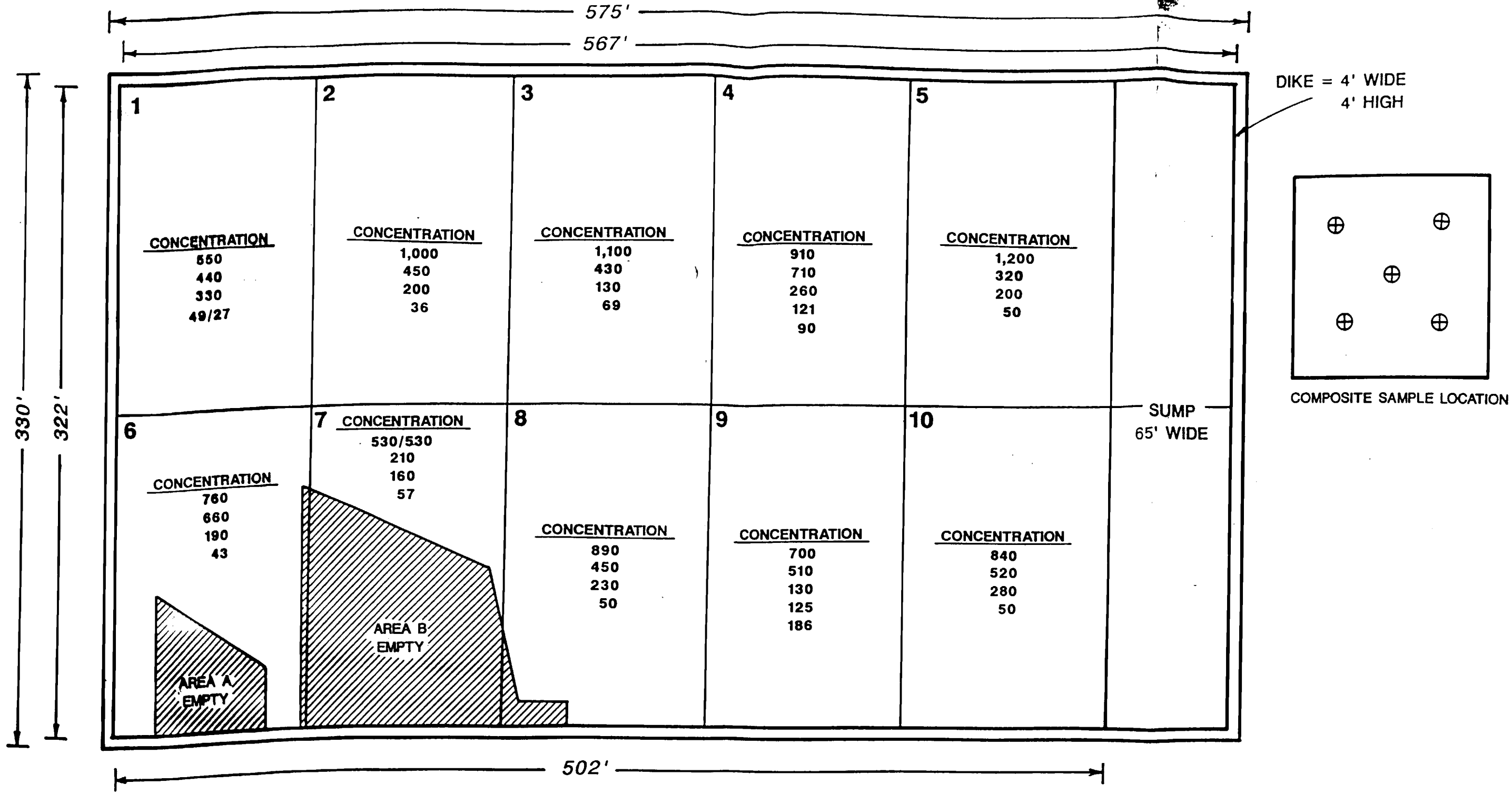
REFERENCE POINTS					
POINT	NORTHING	EASTING	ELEV	BEARING	DISTANCE
#1	2,013,613.39	402,723.76	627.67	N 04°48'34" E	646.85'
#2	2,014,252.96	402,777.99	624.50		

SCALE : 0.45 INCH = 20 FEET

20' 0 20'

FIGURE 8
VERIFICATION
SAMPLING LOCATIONS
FORMER FIRE TRAINING AREA
SWMU'S 19 & 20
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

DAMES & MOORE



	HIGH CONCENTRATION		AVERAGE
BASELINE	1,200	JULY 26, 1993 - SAMPLING	857
1ST EVENT	710	AUGUST 16, 1993 - SAMPLING	470
2ND EVENT	330	SEPTEMBER 17, 1993 - SAMPLING	211
3RD EVENT	125	COTOBER 18, 1993 - SAMPLING	64
4TH EVENT	186	NOVEMBER 4, 1993 - SAMPLING	138

SCALE: 1"=50'
APPROXIMATE

FIGURE 9
INITIAL BASELINE AND PERIODIC
BIOCELL SCREENING SAMPLE GRIDS
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

DAMES & MOORE

335215

FILE NO. 11651-010-138
REVISIONS:
DATE: 2-16-95
APPROVED BY: AEJ
DATE: 2-16-95
CHECKED BY: AEJ
DATE 2-16-95
DRAWN BY

335216

DRAWN BY:	DATE: 2-16-95	CHECKED BY: NEJ	DATE: 2-16-95	APPROVED BY: NEJ	DATE: 2-16-95	REVISIONS:	FILE NO: 11851-010-135

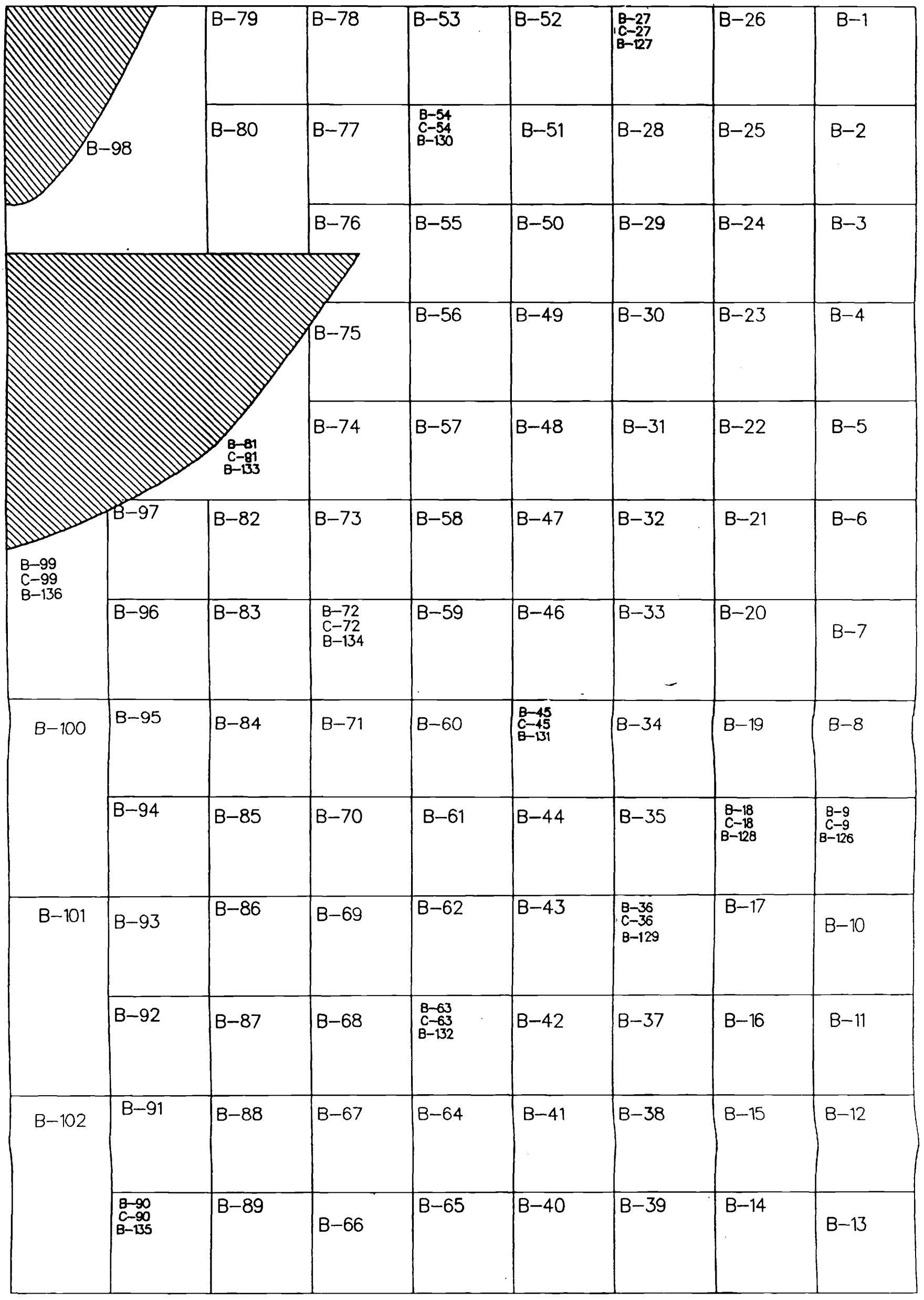


FIGURE 11

SAMPLE LOCATIONS
CARSWELL AIR FORCE BASE
FORT WORTH, TEXAS
for
U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

33521

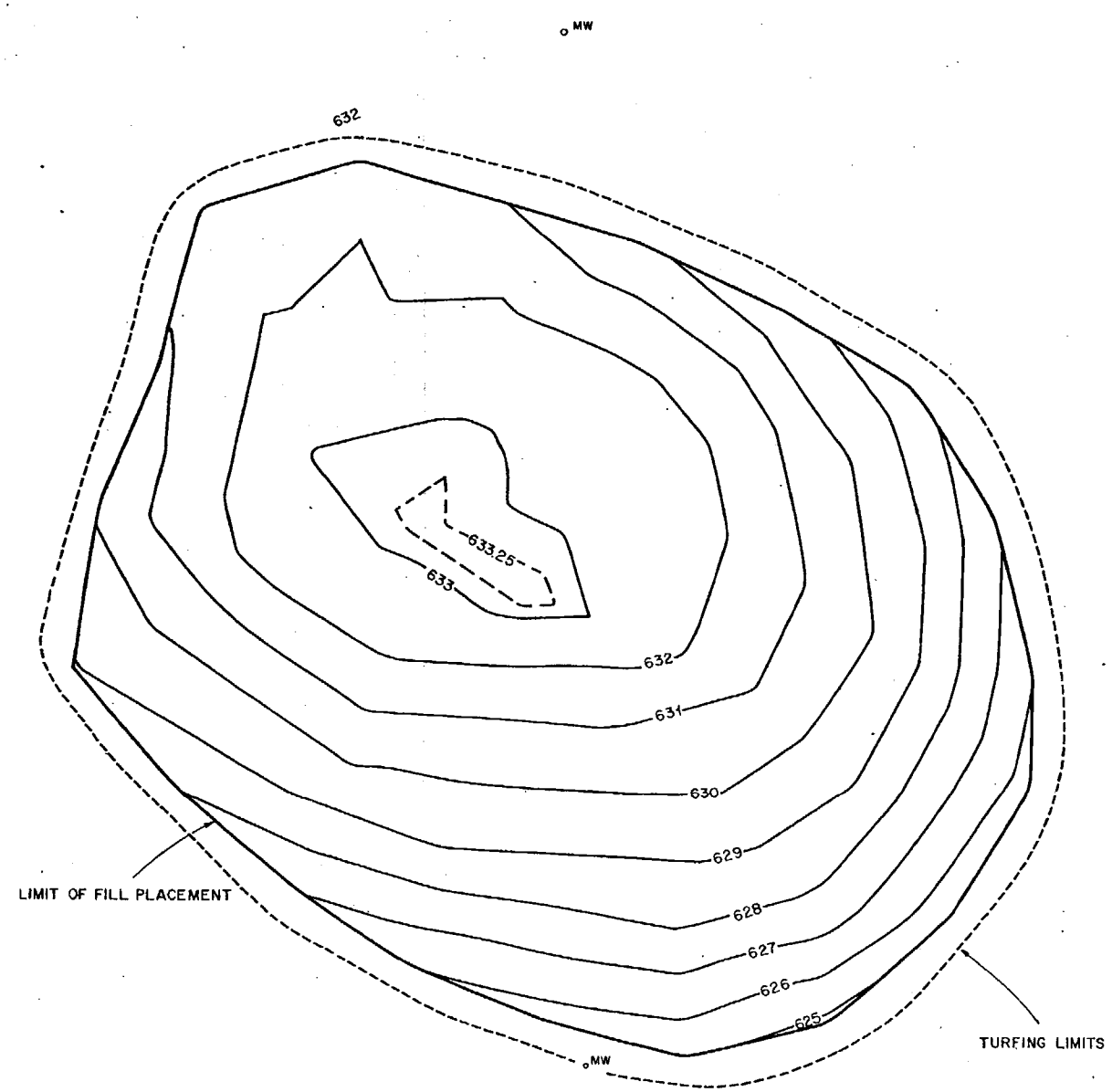
TAB

7

335218

Oversized Map
SWMU 19 & 20
Final Grading Plan

33521



NOTES: UNLESS OTHERWISE SPECIFIED

1. CONTRACTOR SHALL FILL AND COMPACT EXCAVATED AREAS WITH THE LOW-PERMEABILITY MATERIAL SPECIFIED IN SECTION: 02210 LOW PERMEABILITY LINER.
2. FINAL GRADE NOT SPECIFIED
3. TOPSOIL AND SEEDING SHALL BE PLACED IN ALL DISTURBED AREAS. THE EXTENT OF THE DISTURBED AREA MAY DIFFER FROM THAT SHOWN ON PLANS. THE CONTRACTING OFFICERS REPRESENTATIVE SHALL HAVE FINAL AUTHORITY OVER WHICH AREAS SHALL BE SEEDED (SECTION: 02480 SEEDING)
4. THIS PORTION OF GRAVEL DRIVE SHALL BE RESTORED TO THE EXISTING CONDITION OF OTHER SECTIONS OF GRAVEL DRIVE AFTER REMOVAL OF TANK AND SOIL PILE.

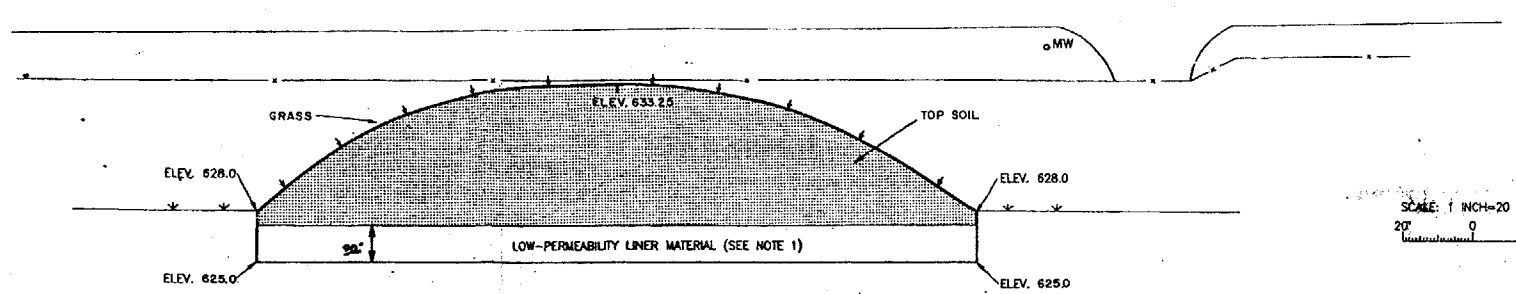
LEGEND

ANTICIPATED LIMITS OF DISTURBED AREAS THAT SHALL BE SEEDED.

FINAL SITE CONTOURS

EXISTING SITE CONTOURS BEFORE REMEDIATION

REFERENCE POINTS					
POINT	NORTHING	EASTING	ELEV	BEARING	DISTANCE
1	2,013,613.39	402,723.76	627.67	N 04°48'34" E	646.85'
2	2,014,257.98	402,777.99	624.50		



SECTION A
NTS

SCALE: 1 INCH=20 FEET
20' 0 20'

CONTRACT No.: DACA63-93-C-0012
SOL. No. DACA63-92-B-0004

$$ – THINK VALUE ENGINEERING – $$

Revisions			
Symbol	Descriptions	Date	Action
	REVISED AS-BUILT	11 NOV 94	
1	REVISED NOTE No. 3	9 DEC 91	

RADIAN CORPORATION
AUSTIN, TEXAS

BASE CIVIL ENGINEER
CARSWELL AFB
FORT WORTH, TEXAS

Designed by: J.P.Y.
Drawn by: M.A.A.
Checked by: S.L.S.
Reviewed by: J.L.M.
Submitted by: Architect-Engineer

SWMU 19 & 20
FINAL GRADING PLAN

Scale: As Shown
Spec. No.:
Contract No.:
Sheet reference number: 4 OF 4
Date: OCT. 1991
Drawing Code:

DRAWING OF WORK AS BUILT

E103770

335220

TAB

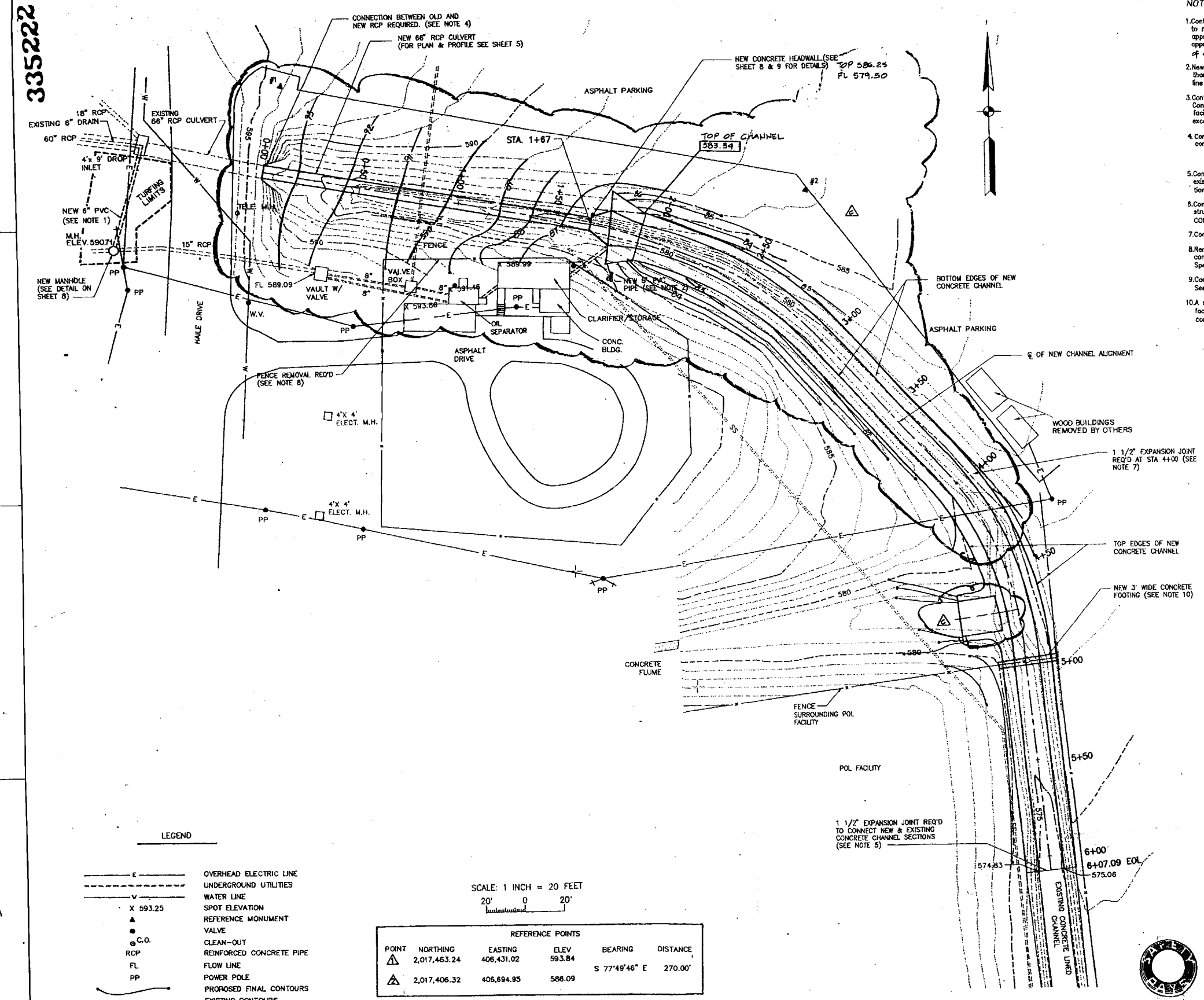
8

335221

Oversized Map
SWMU 53
Layout of New Drainage Structures and Grading Plan

8

335222



NOTES:

1. Contractor shall install new sewer line from existing 4 ft x 9 ft drop inlet to new manhole with drop inlet as shown. The 15-inch RCP line is approximately 8 ft below existing grade. Contractor shall obtain approval from contracting Officer to take the 15" RCP line out of service to install new manhole.
2. New line shall be installed by contractor so that it discharges no less than 8 inches below the top of the concrete wall. The end of this new line shall be integral with the concrete wall.
3. Contractor shall protect all structures that are to remain. The Contractor shall underpin or otherwise support the clarifier/storage facility or any other structure, if needed, to prevent damage during excavation activities.
4. Contractor connected new RCP to old Vic a butt connection and concrete collar per contracting Officer approval.
5. Contractor required to install 1 1/2" expansion joint between new and existing concrete channel sections at station 6 + 07.09. See Specification SECTION: CONCRETE.
6. Contractor required to install 1 1/2" expansion joint between drop structure and new concrete channel section. See Specification SECTION: CONCRETE.
7. Contractor required to install 1 1/2" expansion joint at station 4+00.
8. Removal of fence at drum storage/clarifier facility will be required to complete grading. Contractor will be required to reinstall fence. See Specification SECTION: DEMOLITION.
9. Contraction and construction joints are required for concrete lining. See specification SECTION: CONCRETE.
10. A new concrete footing is required to secure fence surrounding the POL facility to prevent entry and should be of the same dimensions as the concrete footing it is replacing.

LEGEND

—E—	OVERHEAD ELECTRIC LINE
	UNDERGROUND UTILITIES
—W—	WATER LINE
X 593.25	SPOT ELEVATION
▲	REFERENCE MONUMENT
●	VALVE
C.O.	CLEAN-OUT
RCP	REINFORCED CONCRETE PIPE
FL	FLOW LINE
PP	POWER POLE
	PROPOSED FINAL CONTOURS
	EXISTING CONTOURS

SCALE: 1 INCH = 20 FEET
20' 0 20'

REFERENCE POINTS

POINT	NORTHING	EASTING	ELEV	BEARING	DISTANCE
1	2,017,463.24	406,431.02	593.84	S 77°49'46" E	270.00'
2	2,017,406.32	406,694.95	586.09		

CONTRACT No.: DACA63-93-C-0012
~~SOL. No. DACA63-92-B-0004~~

$$ – THINK VALUE ENGINEERING – $$

Revisions

Symbol	Descriptions	Date	Action
	REVISED AS-BUILT	11 NOV 94	
3	REVISED GRADING PLAN	9 DEC 91	AM10003

RADIAN CORPORATION
AUSTIN, TEXAS

BASE CIVIL ENGINEER
CARSWELL AFB
FORT WORTH, TEXAS

Designed by: M.A.R.
Drawn by: R.D.F.
Checked by: S.L.S.
Reviewed by: L.M.D.
Submitted by: Architect-Engineer

SWMU 53
OVERALL LAYOUT OF NEW DRAINAGE STRUCTURES AND GRADING PLAN

Scale: As Shown
Spec. No.:
Contract No.:
Sheet reference number: 4 OF 9
Date: OCT. 1991
Drawing Code:

SEQ. 7

DRAWING OF WORK AS-BUILT

Contract No.: DACA63-93-C-0012

335223

FINAL PAGE

ADMINISTRATIVE RECORD

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ADMINISTRATIVE RECORD

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