

N83447.AR.000479
NAS FORT WORTH
5090.3a

DRAFT CLOSURE REPORT FOR UNNAMED STREAM SITE NAS FORT WORTH TX
9/1/1999
FANNING, PHILLIPS AND MOLNAR



**NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS**

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 506

**RISK-BASED ASSESSMENT, MANAGEMENT, AND CLOSURE
OF SOLID WASTE MANAGEMENT UNITS AND AREAS OF CONCERN
AT NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE,
CARSWELL AIR FORCE BASE, TEXAS**

**DRAFT
CLOSURE REPORT for
UNNAMED STREAM SITE
CDRL A030**



**Contract No. F41624-95-D-8003-0023
Project No. DDPF 98-8125**

September 1999

**RISK-BASED ASSESSMENT, MANAGEMENT, AND CLOSURE
OF SOLID WASTE MANAGEMENT UNITS AND AREAS OF CONCERN
AT NAVAL AIR STATION FORT WORTH, JOINT RESERVE BASE,
CARSWELL AIR FORCE BASE, TEXAS**

**DRAFT
CLOSURE REPORT for
UNNAMED STREAM SITE**

**Contract No. F41624-95-D-8003-0023
Project No. DDPF 98-8125**

**Prepared for:
AFCEE/ERB
3207 North Road
Brooks AFB, TX 78235-5673**

**Prepared by:
Fanning, Phillips and Molnar
9311 San Pedro Avenue, Ste. 700
San Antonio, TX 78216**

September 1999

506 3
d00

**Closure Report
NAS Fort Worth, TX
Risk-Based Assessment, Management, and Closure of Unnamed Stream
Contract #F41624-95-D-8003 / Delivery Order 0023
September 1999
Page i**

This page intentionally left blank.

EXECUTIVE SUMMARY

This closure report presents the findings and data evaluation for the Unnamed Stream Site (UNS) Installation Restoration Program (IRP) site SD-13 at Carswell Air Force Base (AFB), Fort Worth, Texas. The UNS is located behind the Westworth Redevelopment Office, before the main entrance into the Base, off Pumphrey Drive. This area is undeveloped except for an asphalt road that runs through the area. The site is bordered on the north by a fence and parking lot, on the south by open land and on the west by trees and undergrowth. The eastern boundary is the surface water body (stream/river) known as Farmers Branch.

Existing site data from previous investigations performed by various contractors were evaluated and compared against appropriate risk-based closure criteria. Areas where data required for risk-based closure was deficient were identified. The evaluation identified 10 areas of concern and 6 contaminants of potential concern (COPCs) at the site where further evaluation was required to attain closure.

In March-April, 1999, 18 soil samples were collected at the 11 former sampling locations and analyzed for metals, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs). The data collected was evaluated and used to (i) fill data gaps identified in the previous data evaluation mentioned in the previous paragraph, (ii) to delineate horizontal and vertical localized areas that exceeded site-specific target levels for closure based on previous data, and (iii) to verify suitability of closure under Texas Natural Resource Conservation Commission (TNRCC) Risk Reduction Standards (RRS).

Evaluation of the March- April 1999 data indicated that the UNS site meets the RRS 1 closure criteria, closure to background values. No COPC organic constituents were detected at the former sampling locations where they were identified as a concern in the data evaluation. The SVOC analyses had low detections of other SVOCs not identified during the evaluation of previous data that were flagged with a F indicating that the analyte was positively identified but the associated numerical value was below the reporting limit. As such, these detections are considered to be below the Practical Quantitation Limits (PQL). These detections are likely to be anthropogenic since this area has an asphalt road present and receives runoff during heavy rain events from paved areas that have vehicular traffic. VOC analyses were performed along the Unnamed Stream to confirm the previous results and there were no VOCs present with the exception of 1,2,4-trimethylbenzene, m-, p-xylene, and tetrachloroethene. These detections were qualified with a F indicating that the analyte was positively identified but the associated numerical value was below the reporting limit. As such, these detections are considered to be below the PQLs. These detections are likely to be anthropogenic since this area has an asphalt road present and receives runoff during heavy rain events from paved areas that have vehicular traffic. There were no detections of COPC inorganic constituents (arsenic, barium, and cadmium) above background values on the March data with the exception of five locations where

arsenic ranged from 6.0 to 10.2, less than twice the background value of 5.85 mg/kg. These detections are considered to be a natural variation on the background value and not the result of a spill or release. Furthermore, Synthetic Precipitate Leaching Procedure (SPLP) analysis indicated no inorganic constituent that is present above the Groundwater Protection – Residential (GWP-Res) standard is leaching to the groundwater and cross-media contamination is not likely occurring.

The original data evaluation done to guide the March-April 1999 sampling effort presumed closure under RRS2 (health-based values). Therefore, the original metals data was reviewed during the preparation of this report to determine if there were any metals (other than the metals analyzed in March-April 1999) that had values above background but below health based values. This review determined that all of the other metals originally analyzed at various times and locations at the site were below background values with the following exceptions: calcium, copper, and selenium. Calcium was detected at a maximum of 260,000 milligrams per kilogram (mg/kg) (background 167,788 mg/kg), copper was detected at a maximum of 66 mg/kg (background 17.37 mg/kg), and selenium was detected at a maximum of 4.0 mg/kg (background 0.907 mg/kg). It is believed that these individual locations are natural variations on background and not the result of a spill or release.

In preparation for closure, the last portions of appurtenances were removed from the site in June 1999 with the removal of approximately 10 feet of the French Underdrain System. Confirmation sampling of material under the location of the former French Underdrain System was performed. Field observations during the excavation of the French Underdrain System area indicated that the samples were at or in the water table. Low levels of VOCs and SVOCs were present. All detections were either qualified with a F indicating that the analyte was positively identified but the associated numerical value was below the reporting limit or a J indicating that the analyte was positively identified but the quantitation is an estimate. The detections qualified with J's were also below the reporting limits. As such, these detections are considered to be below the Practical Quantitation Limit (PQL). These levels are attributed to the groundwater contamination that extends from the Defense Environmental Restoration Account (DERA) portion of the SD-13 IRP site which is being addressed under a Remedial Action Plan. The metals of concern identified for soils on the Base Realignment and Closure (BRAC) portion of the SD-13 IRP site were also analyzed. Cadmium levels were below background for subsurface soils. At two out of the 11 locations, arsenic and barium were detected above background but were below twice background for subsurface soil. The limited metals detections above background do not appear to be attributable to a release from the French Underdrain System and are considered to be a natural variation on background values.

The results from the investigation indicate that the UNS site does meet the requirements of RRS 1, closure to background values. Any groundwater contamination present is addressed under the Remedial Action Plan for the DERA portion of the SD-13 site. Therefore, it is recommended

Closure Report
NAS Fort Worth, TX
Risk-Based Assessment, Management, and Closure of Unnamed Stream
Contract #F41624-95-D-8003 / Delivery Order 0023
September 1999
Page iv

that the UNS site (Unnamed Stream, former Oil/Water Separator (OWS), and BRAC portion of the French Underdrain System) be closed under RRS1 with no further remedial action required.

TABLE OF CONTENTS

SECTIONS	PAGE
EXECUTIVE SUMMARY	ii
LIST OF TABLES AND FIGURES.....	vi
ACRONYMS AND ABBREVIATIONS.....	vii
1.0 INTRODUCTION.....	1-1
1.1 Project Objectives	1-1
1.2 The U.S. Air Force Installation Restoration Program.....	1-1
1.3 Site Background.....	1-2
2.0 ENVIRONMENTAL SETTING	2-1
2.1 Physical Features	2-1
2.2 Demographics	2-1
2.3 Geology.....	2-2
2.4 Groundwater	2-3
2.5 Surface Water.....	2-4
2.6 Biology.....	2-5
3.0 PREVIOUS INVESTIGATIONS.....	3-1
3.1 Summary of Previous Investigations	3-1
3.2 Characterization of Background Conditions.....	3-1
3.3 Evaluation of Data from Previous Investigations	3-2
4.0 CURRENT SITE INVESTIGATION ACTIVITIES	4-1
4.1 Field Investigation Tasks	4-1
4.1.1 Mobilization	4-2
4.1.2 Sampling and Analysis.....	4-2
4.1.2.1 Order of Analysis.....	4-4
4.1.3 Excavation Activity	4-5
4.1.4 Land Surveys	4-5
4.1.5 Waste Management	4-5
5.0 SITE CLOSURE EVALUATION.....	5-1
5.1 Evaluation of Closure Criteria	5-1
5.1.1 Identification of Chemical of Concerns.....	5-1
5.2 Evaluation of Data	5-1
5.2.1 Comparison of Results to RRS Criteria.....	5-1
5.3 Conclusion of RRS Evaluation.....	5-4

TABLE OF CONTENTS (cont'd.)

SECTIONS	PAGE
REFERENCES	5-6

APPENDICES
(Separate Volume)

APPENDIX A – Chain of Custody Forms
APPENDIX B – Laboratory Analytical Data
APPENDIX C – Quality Assurance / Quality Control Data
APPENDIX D – Soil Boring Logs
APPENDIX E – IDW Manifests
APPENDIX F – French Underdrain System Confirmation Sampling Analytical Data

LIST OF TABLES**TABLE**

3-1	Constituents of Concern Exceeding RRS 2 MSCs at the Unnamed Stream
4-1	Pre/Post Excavation Analytical Summary
5-1	Comparison of Analytical Results with RRSs

LIST OF FIGURES**FIGURE**

1-1	Site Map for Unnamed Stream
1-2	Areas of Investigation at the Unnamed Stream

ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFP-4	Air Force Plant 4
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	contaminant of potential concern
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DERA	Defense Environmental Restoration Account
DO	Delivery Order
DOD	Department of Defense
EPA	Environmental Protection Agency
FPM	Fanning, Phillips and Molnar
FSP	Field Sampling Plan
ft	feet
GW-Res	Groundwater - Residential
GWP-Res	Groundwater Protection - Residential
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
Jacobs	Jacobs Engineering Group Inc.,
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
MSC	Medium Specific Concentration
ND	Non-Detect
NCP	National Contingency Plan

ACRONYMS AND ABBREVIATIONS (Cont'd)

OWS	oil/water separator
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/ Feasibility Study
RRS	Risk Reduction Standard
SAI-Res	Soil/Air and Ingestion - Residential
SARA	Superfund Amendments and Reauthorization Act
SWMU	Solid Waste Management Unit
SPLP	Synthetic Precipitate Leaching Procedure
SVOC	semi-volatile organic compound
TAC	Texas Administrative Code
TNRCC	Texas Natural Resource Conservation Commission
TDPW	Texas Department of Parks and Wildlife
UNS	Unnamed Stream Site
UST	underground storage tank
VOC	volatile organic compound
WSA	Weapons Storage Area

007

506

11

This page intentionally left blank.

1.0 INTRODUCTION

1.1 Project Objectives

The goal of this project is to provide closure documentation for the Unnamed Stream Site (UNS) in accordance with Resource Conservation and Recovery Act (RCRA) Part B permit HW50289. Previous site data was evaluated against appropriate risk-based closure criteria. Areas where data required for risk-based closure was deficient were identified. Additional sampling was performed in March-April, 1999 to address the data needs. Specific tasks required to achieve risk-based closure of the site included:

- Collection of soil samples for Synthetic Precipitate Leaching Procedure (SPLP) analysis to fill data gaps for the protection of the groundwater environment identified in the evaluation of previous data.
- Collection of soil samples for horizontal and vertical delineation of localized areas that exceeded site-specific target levels for closure based on previous data. This included analysis of the levels in the original sampling locations from the previous site work.
- Locating and removing the remaining portions of the French Underdrain System within the Base Realignment and Closure (BRAC) site boundary.
- Preparation of closure documentation in accordance with the Texas Natural Resource Conservation Commission (TNRCC) Risk Reduction Standards (RRS) set forth in the Texas Administrative Code (TAC) Subchapter S.

1.2 The U.S. Air Force Installation Restoration Program

The objective of the U.S. Air Force Installation Restoration Program (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations and to develop remedial actions consistent with the National Contingency Plan (NCP) for sites that pose a threat to human health and welfare or the environment. This section presents information on the program origins, objectives, and organization.

The 1976 Resource Conservation and Recovery Act is one of the primary federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require federal agencies to comply with local and state environmental regulations and provide information to the U.S. Environmental Protection Agency (EPA) concerning past disposal practices at federal sites. RCRA Section 3012 requires state agencies to inventory past hazardous waste disposal sites and provide information to the EPA concerning those sites.

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (i.e., Superfund). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. The CERCLA legislation identifies the USEPA as the primary policy and enforcement agency regarding contaminated sites.

In 1986 Superfund Amendments and Reauthorization Act (SARA) extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the steps that lead to the selection of a remedial process. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action that only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies and extends the USEPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remediation alternatives is recommended at the initiation of a Remedial Investigation/Feasibility Study (RI/FS). SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Executive Order 12580, adopted in 1987, gave various federal agencies, including the Department of Defense (DOD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when the Federal agencies are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with Executive Order 12580, the DOD developed the IRP, under the Defense Environmental Restoration Program, to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated sites. The DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program in June 1980, and implemented the policies outlined in this memorandum in December 1980. The NCP was issued by EPA in 1980 to provide guidance on a process by which (1) contaminant release could be reported, (2) contamination could be identified and quantified, and (3) remedial actions could be selected. The NCP describes the responsibility of federal and state governments and those responsible for contaminant releases.

The DOD formally revised and expanded the existing IRP directives and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by an U.S. Air Force message dated 21 January 1982.

The IRP is the DOD's primary mechanism for response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for a RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial

activities. The program now includes ARAR determinations, identification and screening of remedial technologies, and development of remedial alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure that DOD compliance with federal laws, such as RCRA, NCP, SARA, and CERCLA can be met.

1.3 Site Background

The RCRA Part B Permit for Carswell Air Force Base (AFB) describes IRP site SD-13 (Figure 1-1) as consisting of 4 parts. These are (i) a gas station abandoned in the early 70s, (ii) the French Underdrain System (Solid Waste Management Unit (SWMU) 64)), (iii) the Oil/Water Separator (OWS) (SWMU 67), and (iv) the Unnamed Stream (Area of Concern (AOC 14)).

The Unnamed Stream consisted, in part, of the effluent from the former OWS. Water from the former OWS flowed approximately 200 feet (ft) in the Unnamed Stream to Farmers Branch. The OWS was connected to a French Underdrain System which was constructed to remove fuels from the groundwater flowing either from the tank-farm or from the abandoned gas station upslope and upgradient from the Unnamed Stream area. The OWS and portions of the French Underdrain System were removed in 1996-1997.

The abandoned gas station is currently a paved parking lot. The Underground Storage Tanks (USTs) and underground piping may still be present at the site. Currently, the only visible evidence of the station is the concrete pump-island. The abandoned gas station is part of the Defense Environmental Restoration Account (DERA) program and is not part of this report. For the purposes of this report, the Unnamed Stream Site is defined as the part of SWMU-64 (French Underdrain System) that is located between the former OWS and the BRAC property line, the former OWS (SWMU 67), and the Unnamed Stream (AOC 14). The soil and groundwater impacts within the abandoned gas station area will be addressed as a DERA project. Any groundwater impacts on the BRAC property will be addressed by the Remedial Action Plan for groundwater contamination related to the abandoned gas station.

This page intentionally left blank.

2.0 ENVIRONMENTAL SETTING

2.1 Physical Features

The UNS area is in the east central part of Carswell AFB (Figure 1-1). The area is accessed through a gate adjacent to the Westworth Redevelopment office, 250 Pumphrey Drive, just before the Main entrance onto the Base. This area is undeveloped except for an asphalt road, which transects the project area from south to north on the east side and crosses the UNS near its confluence with Farmers Branch Creek. The east boundary of the site is defined by Farmers Branch. The site consists of an intermittent, unnamed channel that is fed in part by a stormwater discharge culvert and is bordered on the north by a fence and paved parking lot, on the south by open land, and on the east and west by trees and undergrowth.

2.2 Demographics

Land uses immediately surrounding the UNS area are the Grounds Maintenance Yard to the west which is separated from the UNS area by a zone of trees and undergrowth, the abandoned service station and paved parking lots to the northwest and north, and unused open fields with tree and undergrowth areas to the east and south.

Land uses west of Carswell AFB are predominantly residential, commercial, and industrial. These include single-family residences, commercial centers, Air Force Plant-4 (AFP-4), and an industrial complex in White Settlement.

The predominant development south of Carswell AFB is the commercial area located at Interstate 30 and State Highway 183 interchange. This area includes a discount retail center, a regional shopping mall, and a convenience center.

Various types of residential development occur southeast of Carswell AFB, north of Interstate 30. South of River Oaks Boulevard and Roaring Springs Road are country club estates and upscale townhouses. Further south are middle to upper income, single family housing, and multifamily units mixed with commercial office development. Single family housing is also found on the eastern side of Carswell AFB, from the Kings Branch housing tract north to Meandering Road.

Public/recreational land uses occur north of Carswell AFB, surrounding Lake Worth. Public access along the southern shore of Lake Worth is currently restricted due to Carswell AFB activities. A fish hatchery, camp, and private recreational lands are located along the West Fork of the Trinity River, northeast of the Base.

2.3 Geology

Soils were sampled to a depth of eight feet (ft) at the site during previous investigations. Borings and excavations performed as part of this investigation were utilized to provide relevant information on the geologic setting at the site to the depth investigated.

Carswell AFB is built primarily on unconsolidated alluvium, referred to locally as the Terrace Alluvium, which lies unconformably on top of a sequence of lithified Cretaceous formations. These Cretaceous rock units are from youngest to oldest, (1) the Goodland Formation, composed of limestone with a few thin shale beds; (2) the Walnut Formation, a shelly limestone interbedded with thin shale and sandy clay beds; and (3) the Paluxy Formation, a poorly to moderately cemented sandstone with shale interbeds (Jacobs, 1997). The regional dip of the rock units in the vicinity of Carswell AFB ranges from 35 to 40 ft per mile to the east and southeast.

The Terrace Alluvium consists of Quaternary floodplain and fluvial terrace sediments of primarily sand, gravel, clay, and silt deposited by an abandoned meander of the Trinity River. Locally, it has been observed that the Trinity paleochannel and other smaller paleochannels have eroded the Goodland Formation to the extent that Terrace Alluvium sediments were deposited directly on the Walnut Formation. The local thickness of the Terrace Alluvium ranges from 0 to greater than 45 ft (Jacobs, 1997).

Underlying the Quaternary alluvium are the Goodland and Walnut Formations. The Goodland is a white, chalky, fossiliferous, dense limestone, interbedded with clay and marl. The Walnut Formation is a shell-agglomerate limestone with varying amounts of clay and shale. The Goodland is exposed on the southern portion of the base, south of White Settlement Road. The Walnut and Paluxy Formations are exposed in a small area in the northwestern corner of the base along the shores of Lake Worth. The thickness of the Goodland/Walnut formations is approximately 25 ft or greater beneath most of Carswell AFB; however, weathering may have eroded the thickness of the limestone in certain areas (Dames & Moore, 1995). These strata are generally dry, although small amounts of water are occasionally present in the shale and clay units (Radian, 1991).

Underlying the Goodland and Walnut Formations is the Paluxy Formation. Regionally, the Paluxy Formation is divided into upper and lower sand members by a shale unit. The Paluxy Formation thickness ranges from 140 to 190 ft, averaging 160 ft in Tarrant County (Radian, 1991). The Paluxy Formation is exposed along the southern shore of Lake Worth at the northern boundary of the facility and along the erosional channel of the Trinity River. The Paluxy Formation either is aerially exposed or is in contact with the overlying Walnut Formation. It is reported that the Paluxy Formation may be in contact with the overlying Quaternary alluvium at the eastern boundary of AFP-4, where the Goodland and Walnut Formations have been removed by erosion (Dames & Moore, 1995).

2.4 Groundwater

Groundwater has been characterized at the site due to the delineation activities associated with the abandoned gas station under the DERA program. The soil investigation conducted in March-April 1999 described in this report was performed to demonstrate that impacted soils, if any, at the UNS area were not a health concern and constituents will not leach to groundwater. The existing groundwater contamination issues will be addressed as part of the remedial effort for the abandoned gas station groundwater contamination on the DERA and BRAC properties.

Three hydrogeologic units exist beneath Carswell AFB that are relevant to subsurface conditions. From the shallow to the deepest, they are: (1) the Quaternary alluvium aquifer containing unconfined groundwater associated with the Trinity River alluvial terrace deposits; (2) an aquitard of predominantly dry limestone of the Goodland and Walnut Formations; and (3) an aquifer in the Paluxy Formation.

The Quaternary alluvial groundwater is found under unconfined conditions at Carswell AFB. Low permeability is typical of the alluvium because of the large amounts of clay and silt. However, there are zones of greater permeability in the saturated sands and gravels of former channel deposits. Recharge to the water-bearing sediments is local, from rainfall and infiltration from stream channels and drainage ditches. The direction of groundwater flow is generally controlled either by bedrock topography or discharge zones at primary or secondary streams. Previous reports indicate that the groundwater flow in these sediments across the facility is generally toward Farmers Branch Creek or eastward toward the Trinity River at the eastern boundary of the facility. Groundwater leakage may occur to the Paluxy Formation in areas where the Walnut Formation aquitard is significantly thinned by erosion or eroded away.

The unconfined groundwater found in the Quaternary alluvium is generally separated from the underlying Paluxy Aquifer by the low permeability limestones and calcareous shales where the Goodland and Walnut Formations are present. The aquitard is composed of moist clay and shale layers interbedded with dry limestone beds. Hydrographs from paired upper zone Quaternary alluvium and Paluxy Formation monitoring wells indicate there is little flow from the overlying alluvial aquifer to the Paluxy Formation in those areas where the Walnut Formation is not deeply eroded.

The Paluxy Aquifer is the shallowest bedrock aquifer underlying Carswell AFB. In the area, water in the uppermost part of the Paluxy Formation would occur under confined conditions beneath the Goodland and Walnut Formations, except where these units have been eroded away. However, extensive groundwater pumping in the Fort Worth area, including the Cities of White Settlement and Samson Park, has lowered the Paluxy Aquifer potentiometric surface below the top of the formation, resulting in unconfined conditions.

Recharge to the Paluxy Aquifer occurs where the formation crops out. The Paluxy Formation outcrops west of AFP-4 and north of Carswell AFB in the bed of Lake Worth. Lake Worth is a major recharge area for the aquifer and creates a potentiometric high in its vicinity. Regional groundwater flow is southeastward in direction of the regional dip.

2.5 Surface Water

Farmers Branch borders the southeastern extremity of the site. The Unnamed Stream is on the eastern portion of the site. Farmers Branch serves as a drainage conduit for several facilities at Carswell AFB. The Unnamed Stream channel is 6 ft wide and water, when present, flows in an east-southeast direction to Farmers Branch. Farmers Branch at the site location flows north and then changes to an east direction.

Carswell AFB and all of Tarrant County are located within the Trinity River watershed. Surface water resources in the vicinity of Carswell AFB include the West Fork and Kings Branch of the Trinity River, Farmers Branch Creek, Lake Worth, and two ponds in the golf course area.

Lake Worth, a man-made reservoir on the West Fork of the Trinity River, is located north of Carswell AFB and is owned and operated by the City of Fort Worth. These waters are used for public water supply and recreation. Lake Worth covers an area of 3,558 acres and is 12 miles long.

Surface water is the main source of potable water in the vicinity of Carswell AFB. The City of Fort Worth Water Department is the primary supplier to the areas surrounding and including Carswell AFB. Water from Farmers Branch Creek is used to irrigate the on-Base golf course. The nearby communities of White Settlement and Sansom Park obtain water from 12 and 9 groundwater wells, respectively, but when required, they purchase surface water from Fort Worth to supplement their water supplies.

Surface drainage at Carswell AFB is collected by the storm drainage system and routed into the sewer system, or as outfall into Lake Worth. An underground drainage culvert conducts surface runoff generated from areas west of Carswell AFB eastward to Farmers Branch Creek. Storm water runoff from Carswell AFB that is not routed to the Base or city sewer system is discharged into Lake Worth. The outfall is permitted under the National Pollutant Discharge Elimination System.

The potential for contamination of surface water is present at several locations on Carswell AFB. There is potential for migration of hazardous contaminants through the surface water at sites in proximity to the West Fork of the Trinity River, Farmers Branch Creek, and Lake Worth. In

506 20
13 00

addition, shallow groundwater carrying dissolved contaminants may discharge to these surface waters (IT Corp., 1997).

2.6 Biology

Sensitive habitats include those areas that can potentially restrict the use of the land. These include wetlands under the jurisdiction of the Clean Water Act, plant communities that are designated as unusual or of limited distribution, important seasonal use areas for wildlife (e.g., migration routes, breeding areas, or crucial summer/winter habitat that are of agency concern), and areas associated with a protected species or those areas critical for a life need of a species or population.

The shore of Lake Worth is considered sensitive habitat due to its importance to migratory birds, including state- and federal-listed species. The great blue heron rookeries are sensitive nesting areas along the northern banks of Lake Worth. These rookeries are protected as sensitive wildlife areas by the Texas Department of Parks and Wildlife (TDPW).

Carswell AFB has a total of 0.6 acre of jurisdictional wetlands designated by the Corps of Engineers. Jurisdictional wetlands areas on base are found in the natural drainage stream southeast of AFP-4, totaling approximately 0.5 acre, and on the west side of the Off-Site Weapons Storage Area (WSA), totaling approximately 0.1 acre.

The Air Force has conducted informal consultations with the U.S. Fish and Wildlife Service and the TDPW concerning threatened and endangered species potentially occurring in the vicinity of Carswell AFB. No state- or federal-listed threatened or endangered species is known to permanently live on Carswell AFB. None of the federal-listed plant species for Texas are known to occur within 100 miles of Tarrant County. Ten listed bird species occur in Tarrant County and are migrants attracted by Lake Worth. None of these migrants are expected to reside in the vicinity of the main base or at the Off-Site WSA. Two federal-listed candidate reptile species, the Texas horned lizard and the Texas garter snake, may occur in Tarrant County. There is slight potential these reptiles could be present in the horse pasture on the eastern side of the main base.

506 21

**Closure Report
Carswell AFB, TX
Risk-Based Assessment, Management, and Closure of Unnamed Stream
Contract #F41624-95-D-8003 / Delivery Order 0023
September 1999
Page 2-6**

This page intentionally left blank.

3.0 PREVIOUS SITE INVESTIGATIONS

3.1 Summary of Previous Investigations

The previous soil sampling activities conducted at the site are as follows:

- 1984: Four hand-augered borings 16D, 16E, 16G, and 16F were performed at locations along the unnamed stream (see Figure 1-2) and one soil sample was collected from each boring.
- 1991: Four soil samples were collected from each of two borings that were later completed as monitoring wells SD13-MW06 and SD13-MW07 (Figure 1-2).
- 1993: Two soil borings (SD13-SB02 and SD13-SB03) were drilled to the east and west of the oil/water separator and one soil sample was collected from each boring (Figure 1-2).
- June 1996: Excavation activity was undertaken to identify the location and construction of the French Underdrain System. The French Underdrain System was found to be a 6 inch-diameter galvanized, corrugated metal pipe perforated with single rows of 0.25 inch holes drilled along the bottom of the pipe at an approximate spacing of 8 holes per foot. Several sections (a total of 52 ft) of the pipe were removed and several others (a total of 11 ft based on excavation work performed under this investigation) were disconnected and abandoned in place. The excavated areas were back filled with impermeable material to minimize groundwater flow. The OWS area was also excavated, the OWS removed, and confirmation samples were collected. However, data from these samples was not included in the evaluation of previous data because the entire unnamed stream and OWS separator area was over-excavated in 1997 (described below).
- 1997: Remedial actions conducted by Geo-Marine, Inc. included over-excavation of the entire Unnamed Stream channel for a width of six feet and to a depth of no less than one foot, and over-excavation of the west and south walls of the previously removed OWS. Confirmation sampling was performed as part of the project (UN-01, UN-02, UN-03, UN-04, UN-05, WP-2, and OWSS-01 and OWSS-02, see Figure 1-2).

3.2 Characterization of Background Conditions

Jacobs Engineering Group, Inc. (Jacobs) conducted a basewide background study at the Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field, Texas to establish background concentrations of inorganic constituents in various site media. Background concentrations were determined for 24 inorganic constituents in each of the following background populations: surface soil; subsurface soil; groundwater sampled via low-flow sampling techniques;

groundwater sampled with a bailer; surface water; and sediment in the surface water drainages. The results of the study are presented in the *Final NAS Fort Worth, JRB, Texas, Basewide Background Study*, dated September 1998, prepared by Jacobs.

3.3 Evaluation of Data from Previous Investigations

This section provides a summary of the detailed evaluation of the available data prior to the March 1999 investigation against appropriate risk-based closure criteria. The full evaluation can be found in the Final Work Plan Addendum for this current investigation (FPM, 1999). Several metals and organic constituents were detected above their Practical Quantitation Limit (PQLs) and/or background levels. The evaluation process identified 10 areas of concern and 6 contaminants of potential concern (COPCs) within the UNS area that exceeded RRS 2 and required further evaluation to attain closure.

Table 3-1 (from the Work Plan Addendum) compares the maximum concentration of constituents detected with (i) the relevant RRS Medium Specific Concentration (MSC) for protection of groundwater – residential scenario (GWP-Res) or for ingestion and inhalation of vapor and particulates from soil and dermal contact based on residential use (SAI-Res) (ii) PQLs, and (iii) the basewide background levels. Note that the highest of these 3 values is the applicable RRS 2. If the concentration of a constituent of concern exceeded the RRS 2, then all samples with concentrations in exceedence of the RRS 2 were identified. The location of each former sampling site is shown on Figure 1-2. The designations for each location are shown as the former sampling location number cross-referenced with the current investigation sampling location unique identifier. The following summarizes the sample location and the COPC exceedence:

WP2:

Ingestion and Inhalation of Vapors and Particulates: Barium.

Protection of Groundwater: Barium and Arsenic.

OWS01:

Protection of Groundwater: Arsenic.

OWS02:

Protection of Groundwater: Arsenic.

SD1302SB:

Protection of Groundwater: Arsenic and Cadmium.

SD1303SB:

Protection of Groundwater: Cadmium.

SD13MW06:

Protection of Groundwater: Arsenic and Cadmium.

SD13MW07:

Protection of Groundwater: Arsenic and Cadmium.

UN-01:

Ingestion and Inhalation of Vapors and Particulates: Hexachlorobenzene and n-Nitrosodi-n-propylamine.

Protection of Groundwater: Arsenic, Barium, Hexachlorobenzene, and n-Nitrosodi-n-propylamine.

UN-04:

Ingestion and Inhalation of Vapors and Particulates: Hexachlorobenzene and n-Nitrosodi-n-propylamine.

Protection of Groundwater: Arsenic, Hexachlorobenzene, and n-Nitrosodi-n-propylamine.

UN-05:

Ingestion and Inhalation of Vapors and Particulates: Hexachlorobenzene and n-Nitrosodi-n-propylamine.

Protection of Groundwater: Arsenic, Chrysene, Hexachlorobenzene, and n-Nitrosodi-n-propylamine.

The above process identified 10 areas of concern and 6 COPCs within the UNS area that exceeded RRS2 values based on previous data and therefore required further evaluation to attain closure. In

506^{dc}25

addition, samples were taken at former locations UN-02/UN-03 to confirm the previous non-detects for VOCs and SVOCs. VOC analysis was done for the same reason at UN-01 and UN-05.

4.0 CURRENT SITE INVESTIGATION ACTIVITIES

Existing site data (pre-1999) was evaluated against appropriate risk-based closure criteria. Data gaps identified during the data evaluation guided the March-April 1999 field-sampling event for the collection of additional data. Data needed to accomplish closure included:

- *Soil Contamination Data.* Soil contamination data were necessary to delineate localized areas that exceeded site-specific target levels based on previous data and to demonstrate attainment of cleanup levels.
- *Soil and Sediment Characteristics Data.* Soil characteristics data were necessary to understand the geologic conditions at the site. Lithologic data was recorded during all sampling activities.

The focus of the March 1999 field investigation was on the areas identified during the data evaluation as described in the previous section.

4.1 FIELD INVESTIGATION TASKS

The data evaluation and risk-based closure evaluations (based on the provisions of RRS 2) identified the following two types of areas and the field tasks required to achieve closure.

- **Type 1:** Areas that exceed the SAI-Res and the GWP-Res standards for one or more COPC (UN-01, UN-03, UN-04, UN-05, and WP2) based on previous data.
- **Type 2:** Areas that exceed only the GWP-Res standards for one or more COPC (OWS01, OWS02, SD13MW06, SD13MW07, SD1302SB, and SD1303SB) based on previous data.

These areas are shown on Figure 1-2, cross-referenced with the current study unique sampling identifier. Table 3-1 provides the specific COPCs for each of the locations.

To attain target cleanup levels for closure under RRS 2, the following activities were proposed:

- **Type 1 Area:** Based on the exceedence of the SAI soil standards, the horizontal and vertical delineation of the localized areas will be conducted prior to soil excavation to determine the extent of soil excavation and demonstrate attainment of cleanup levels for remaining soils. This approach was based on the previous data indication an exceedence of one or more RRS2 value. A sample was also taken at the original sampling location to confirm the previous data or to determine if the exceedence may have been an anomaly.
- **Type 2 Area:** Performance of Synthetic Precipitation Leaching Procedure (SPLP) analysis at the location of the original soil sample to determine whether the residual soil concentrations

are protective of groundwater. If the SPLP results exceed the RRS standards for groundwater, additional samples will be analyzed at increasing depths.

- **Excavation of French Underdrain:** The portions of the French Underdrain that were present on BRAC property following previous removal exercises were to be located and removed with confirmation samples collected to determine the extent of the impacts, if any.

Specific field investigation tasks required to achieve project objectives are described in the following subsections.

4.1.1 Mobilization

Mobilization activities were coordinated between the Base Point of Contact, Air Force Center for Environmental Excellence (AFCEE) Team Chief, and Fanning Phillips and Molnar (FPM) prior to mobilization. Preparatory steps included obtaining permits for ground penetration, an initial site reconnaissance, briefing personnel on field activities, field equipment procurements, and establishing a temporary field office.

4.1.2 Sampling and Analysis

For details regarding sampling analyses and field activity procedures, refer to the Field Sampling Plan (FSP), Quality Assurance Project Plan, and Health and Safety Plan provided in the *Quality Program Plan*, dated December 1998.

Type 1 Area

For Type 1 areas as described above, a direct-push technology penetration was performed in the area of concern at the previous sampling location. Soil samples were collected from at appropriate depths below ground surface (bgs) based on the original sampling depths.

Initially, the first depth sample collected was analyzed for the analytes of concern (analytes that exceeded SAI-Res). The results were compared to the SAI-Res and also compared to the GWP-Res values. The comparison resulted in one of the following cases (excerpted from the UNS Work Plan Addendum):

Case 1: Csoil > SAI-Res, Csoil > GWP-Res

Since the soil layer is not protective of inhalation, ingestion, and dermal contact, the next deeper sample will be analyzed and the results will be again be compared to the SAI-Res (repeat entire process).

Case 2: $C_{soil} > SAI-Res$, $C_{soil} < GWP-Res$

Since the soil layer is not protective of inhalation, ingestion, and dermal contact, the next deeper sample will be analyzed and the results will be again be compared to the SAI-Res (repeat entire process).

Case 3: $C_{soil} < SAI-Res$, $C_{soil} > GWP-Res$

Since the soil layer is not protective of groundwater, an SPLP analysis will be conducted on the sample and the results will be compared to the Groundwater Standard for Residential use (GW-Res). This will result in one of the following cases:

Case 3(a): $C_{SPLP} < GW-Res$

Since this soil layer is protective of groundwater, the vertical extent has been defined and soil from above this layer will be excavated.

Case 3(b): $C_{SPLP} > GW-Res$

Since the soil layer is not protective of groundwater, the next deeper sample will be analyzed and the results will be again be compared to the RRSs (repeat entire process). The comparison will again result in one of two cases being described.

Case 4: $C_{soil} < SAI-Res$, $C_{soil} < GWP-Res$

Since this soil layer is protective of inhalation, ingestion, and dermal contact as well as groundwater, the vertical extent has been defined and soil from above this layer will be excavated.

The above procedure required the collection of samples at multiple depths from each location, which was done in March-April 1999.

To determine the horizontal radial extent of Type 1 excavation (or to confirm that the previous detection was an anomaly), surface soil samples from 0-2 ft bgs were collected from locations surrounding the original location. The concentrations of relevant COPCs in the samples were analyzed and compared to the RRSs. In cases where the concentrations were below the RRSs, the lateral extent of excavation would extend to the nearest sampling location, provided the original sampling location detection was not an anomaly. In the case where the concentrations were not below the RRSs, the excavation would extend to the locations that met RRSs. If the original and surrounding sampling location analytical results indicated that the former detection was an anomaly, then no excavation would be required for closure. The above procedure required the collection of samples at multiple distances from each location. The purpose of

taking surficial soil samples in all directions from the original location was to determine local extent of contamination around the original sampling location.

Type 2 Area

For Type 2 Areas as described above, a direct-push penetration was performed at the previous sampling location. Soil samples were collected from depths of 0-2 ft, 2-4 ft, 4-6 ft, and 6-8 ft bgs. To satisfy closure criteria, SPLP analysis was conducted on soil samples collected from the original sampling depth at these locations. The SPLP results were compared to the GW-Res standard for the COPCs. One of the following cases resulted from the comparison:

Case 1: $C_{SPLP} < GW-Res$

Since this soil layer is protective of groundwater, no further action is required and the area is considered to meet RRSs.

Case 2: $C_{SPLP} > GW-Res$

Since the soil layer is not protective of groundwater, the next deeper sample will be analyzed and the results will be compared to the GWP-Res RRS 2. This procedure will again result in an area that needs excavation where the extent will be determined as discussed previously.

Analysis and extensive review of past sampling data from the area indicated a trend where concentrations of contaminants are only slightly above RRSs and at shallow depths. Based on this analysis, it was not anticipated that C_{SPLP} would be greater than the GW-Res value at depths greater than 8 feet below ground surface. A 4-foot radius was chosen to define the maximum boundary of horizontal delineation for Type 1 and 2 areas. Evaluation of past data and the localized nature of the units of concern (steam bed and banks and oil/water separator) indicated that this was an appropriate distance.

4.1.2.1 Order of Analysis

As mentioned in the previous paragraph, all initial vertical samples were analyzed and all other samples were extracted and put on hold. Results obtained from the first batch of samples were compared with the RRSs as outlined above. If necessary, the next batch of soil samples from the depth were analyzed and compared with the RRSs. The order in which the contract laboratory performed the analysis depended on the holding times but, in general, the order of analysis will was:

<i>Analysis</i>	<i>Maximum Holding Times (Matrix: Soil)</i>
VOCs	14 days
SVOCs	14 days; 40 days after extraction
Metals	180 days

4.1.3 Excavation Activity

The remaining sections of the French Underdrain System that was partially removed in 1996 by Jacobs were completely removed by FPM in June 1999. Approximately 10 ft of the French Underdrain System that was remaining on the BRAC side of the site was removed. Soil samples were collected and analyzed for VOCs using Method 8260B, SVOCs using Method 8270C, and arsenic, barium, and cadmium using Method 6010B. Figure 1-2 presents the approximate area where the trace of the French Underdrain System was excavated and the limited amount of piping present was removed. The excavated soils were temporarily stockpiled on site. The limited amount of piping that was removed (approximately 10 feet) were properly disposed of in a landfill. Site restoration activities were performed after excavation activities to restore the site. The excavated area was backfilled with the excavated soil and re-graded. The excavated area was re-seeded using hydro-mulch to control or minimize erosion and restore previous site conditions.

Prior to performing excavation activities, soil sampling was performed in the vicinity of the French Underdrain System to characterize the soil. Two soil samples (FUS01 and FUS02) at 6-8 ft were collected and analyzed for COPC metals (method 6010B), SVOCs (method 8270C), and VOCs (method 8260B). It was noted in the logbook that the samples were collected at bedrock adjacent to the French Underdrain System to be removed.

After removal of the French Underdrain System pipe, 9 locations (FUS03-FUS11) from the trace of the former French Underdrain System were sampled at various depths to characterize the soil for COPC metals (method 6010B), SVOCs (method 8270C), and VOCs (method 8260B). Table 4-1 presents the analytes that were detected from the soil samples collected before and after excavation of the French Underdrain System.

4.1.4 Land Surveys

Field activity information was recorded as described in detail in the FSP. For those sites submitted for closure under RRS 2, survey data outlining the property location and boundaries will be obtained after concurrence with state regulators that the site is suitable for closure under RRS2 to fulfill deed certification requirements.

4.1.5 Waste Management

Wastes that may be generated during the project activities included: (1) drill cuttings, (2) expendable personal protective equipment, (3) decontamination water, and (4) general trash.

506 31

Waste disposal activity will be coordinated with Carswell AFB authorities and they were responsible for signing all transportation manifests as the generator. Waste management practices followed the guidelines established by the TNRCC. Philip Services of Dallas, Texas handled IDW. Appendix E contains the manifests for all IDW generated under Delivery Order (DO) 23 for the four sites investigated (Unnamed Stream Site and three other sites).

5.0 SITE CLOSURE EVALUTION

Data from the March 1999 sampling event was evaluated and compared with the TNRCC RRSs for closure/remediation of contaminated sites as set forth in 30 TAC Subchapter S. Sample data collected from the UNS area indicates that case closure under RRS 1 is possible for the soils at the site. Remedial work has been performed at the site which has removed contaminated soil and all appurtenances, and constituents of concern are, in general, below background or PQLs as detailed in Section 5.2.

Analytical and soil lithology data is presented in full in the Appendices. Appendix A contains the Chain of Custody forms for the sampling performed at the UNS. Appendix B contains the laboratory analytical results. Appendix C contains the Quality Assurance /Quality Control (QA/QC) data. Appendix D contains the soil boring logs for all locations sampled. Appendix E contains IDW manifests. Appendix F contains the laboratory analytical results and QA/QC for the French Underdrain System excavation confirmation samples.

5.1 Evaluation of Closure Criteria

The attainment of RRS 1 requires the following criteria to be met:

- The excavation and removal or decontamination of all impacted media and solid waste management units at the site. Additionally, measured concentrations of all chemical of concern should be below their respective PQLs or background concentrations.
- Leachate obtained from soil samples using SPLP Method 1312 should not exceed Maximum Contaminant Level (MCL) or Texas Water Quality Standard, whichever is lower.

5.1.1 Identification of Chemicals of Potential Concern

Existing data was evaluated as described in Section 3.0 for the UNS site. The process identified 10 areas of concern and 6 COPCs within the UNS that exceeded RRS 2 and therefore required further evaluation to attain closure.

5.2 Evaluation of Data

5.2.3 Comparison of Results to RRS 2 Criteria

Table 5-1 summarizes the results of the sample analyses. A summary for each area of concern is provided below. When it became apparent that closure under RRS 1 was possible based on these recent analytical results, the previous metals data was reviewed during the preparation of this report. This was done to determine if there were any metals (other than the metals analyzed in

March-April 1999) that had values above background but below health based values. This review determined that all of the other metals originally analyzed at various times and locations at the site were below background values with the following exceptions: calcium, copper, and selenium. Calcium was detected at a maximum of 260,000 milligrams per kilogram (mg/kg) (background 167,788 mg/kg), copper was detected at a maximum of 66 mg/kg (background 17.37 mg/kg), and selenium was detected at a maximum of 4.0 mg/kg (background 0.907 mg/kg). It is believed that these individual locations are natural variations on background and not the result of a spill or release.

Type 1 Areas – Identified in the evaluation of historical data as areas that exceed SAI-Res or GWP-Res standards.

UN-01:

From the data evaluation outlined in section 3.0, arsenic and barium were the non-organic and n-Nitrosodi-n-propylamine and Hexachlorobenzene were the organic constituents of concern identified at this location. Analytical results indicate arsenic was below background and barium was below background. The organic chemicals n-Nitrosodi-n-propylamine and Hexachlorobenzene were non-detect. The SVOCs benzo (a) anthracene, benzo (b) fluoranthene, benzo (g,h,i) perylene, benzo (k) fluoranthene, chrysene, fluoranthene, indeno (1,2,3-cd) pyrene, phenanthrene, and pyrene were detected and reported with a F qualifier indicating that the analyte was positively identified but the associated numerical value was below the reporting limit. As such, these detections are considered to be below the Practical Quantitation Limit (PQL). These detections are likely to be anthropogenic since this area has an asphalt road present and receives runoff during heavy rain events from paved areas that have vehicular traffic. The VOC analysis done to confirm the previous data indicates that there are no VOCs present except toluene and 1,2,4-trimethylbenzene, which were reported with a F qualifier indicating that the analyte was positively identified but the associated numerical value was below the reporting limit. As such, these detections are considered to be below the PQL. These detections are likely to be anthropogenic since this area has an asphalt road present and receives runoff during heavy rain events from paved areas that have vehicular traffic.

UN-2/UN-03

There were no concerns identified during the data evaluation outlined in section 3.0 for this location. However, VOC and SVOC analyses were performed to confirm previous data. No SVOCs were detected. The VOC analysis done to confirm the previous data indicates that there are no VOCs present except toluene, m-,p-xylene, and 1,2,4-trimethylbenzene, which were reported with a F qualifier indicating that the analyte was positively identified but the associated numerical value was below the reporting limit. As such, these detections are considered to be below the PQL. These detections are likely to be anthropogenic since this area has an asphalt road present and receives runoff during heavy rain events from paved areas that have vehicular traffic.

UN-04:

From the data evaluation outlined in section 3.0, arsenic and barium were the non-organic and n-Nitrosodi-n-propylamine and Hexachlorobenzene were the organic constituents of concern identified at this location. Analytical results indicate arsenic was at background, barium was below background, and SVOCs were non-detect.

UN-05:

From the data evaluation outlined in section 3.0, arsenic and barium were the non-organic and n-Nitrosodi-n-propylamine, Hexachlorobenzene, and Chrysene were the organic constituents of concern identified at this location. Analytical results indicate arsenic was below background but above GWP-Res. A SPLP analysis was performed and the result was below the GW-Res standard. Barium was below background and the GWP-Res value. SVOCs were non-detect. A second sample was also analyzed at this location from the next depth. Arsenic was detected and reported with a F qualifier, indicating that the analyte was positively identified but the associated numerical value was below the reporting limit. As such, this detection is considered to be below the PQL. Barium was below background and the GWP-Res value. SVOCs were non-detect. VOC analysis of the 0 to 2-foot depth at this location was performed to confirm the previous data. The VOCs 1,2,4-trimethylbenzene, tetrachloroethene, and toluene were detected and reported with a F qualifier indicating that the analyte was positively identified but the associated numerical value was below the reporting limit. As such, these detections are considered to be below the PQL.

WP-2:

From the data evaluation outlined in section 3.0, arsenic and barium were the non-organic constituents of concern identified at this location. Arsenic was detected below background but above the GWP-Res standard at the re-sampled location and also at 2 ft and 4 ft from the original location in the North horizontal direction. SPLP analysis confirmed no groundwater protection problem exists at the location. Barium was detected at levels below background and below GWP-Res.

Type 2 Areas – Identified in the evaluation of historical data as area that exceed GWP-Res standard.

OWS01:

From the data evaluation outlined in section 3.0, arsenic was the non-organic constituent of concern identified at this location. Arsenic was detected at approximately twice background (assumed to be a natural variation, which is still below the health-based value) and above the GWP standard at the re-sampled location. SPLP analysis for arsenic confirmed no groundwater protection problem exists at the location.

OWS02:

From the data evaluation outlined in section 3.0, arsenic was the non-organic constituent of concern identified at this location. Arsenic was detected slightly above background (natural variation, not a spill or release) and above the GWP standard at the re-sampled location. SPLP analysis confirmed no groundwater protection problem exists at the location.

SD13MW06:

From the data evaluation outlined in section 3.0, arsenic (2 depths) and cadmium (1 depth) were the non-organic constituents of concern identified at this location. Arsenic was detected at less than twice background (natural variation, not a spill or release) and above the GWP standard at the re-sampled location but SPLP analysis confirmed no groundwater protection problem exists at the location. Cadmium was detected below background and below GWP-Res.

SD13MW07:

From the data evaluation outlined in section 3.0, arsenic and cadmium were the non-organic constituents of concern identified at this location (two depths). Arsenic was detected below background but above the GWP standard at the re-sampled location but SPLP analysis confirmed no groundwater protection problem exists at the location. Cadmium was detected below background and below GWP-Res.

SD1302SB:

From the data evaluation outlined in section 3.0, arsenic and cadmium were the non-organic constituents of concern identified at this location. Arsenic was detected at less than twice background (natural variation, not a spill or release) and above the GWP standard at the re-sampled location. SPLP analysis confirmed no groundwater protection problem exists at the location. Cadmium was detected below background and below GWP-Res.

SD1303SB:

From the data evaluation outlined in section 3.0, arsenic (one depth) and cadmium (two depths) were the non-organic constituents of concern identified at this location. Arsenic was detected at less than twice background (natural variation, not a spill or release) and above the GWP standard at the re-sampled location. SPLP analysis confirmed no groundwater protection problem exists at the location. Cadmium was detected below background and below GWP-Res.

5.3 Conclusion of RRS Evaluation

A total of 18 soil samples were taken at 11 locations at the UNS. These samples were taken to verify previous analytical data or delineate the horizontal and vertical extent of contamination, if present, and to verify that the site is suitable for closure under the Risk Reduction Standards. The samples were analyzed for the COPCs identified in the evaluation of previous investigative data as described in section 3.0

In areas where it was identified that there was a potential SAI-Res and GWP-Res exceedence (Type I areas), the current investigative results indicate that organic constituents are non-detect or are below PQLs. The detections that are below PQLs are likely anthropogenic and are not believed to be the result of a spill or release. Inorganic constituents are below background values. SPLP analysis, where necessary, was performed and shows that the detected levels of inorganic constituents will not leach to groundwater at levels that will exceed groundwater standards. No cross-media contamination is occurring.

In Type II areas where it was identified that there was a potential GWP-Res exceedence (inorganic constituents only), current investigative results indicate cadmium does not exceed the GWP-Res standard. The arsenic results indicated that some locations were above background but were at twice or less the background value and the levels are considered variations on background, not indicative of a spill or release. These samples had SPLP analysis performed, which showed that the detected levels of arsenic will not leach to groundwater at levels that will exceed groundwater standards. No cross-media contamination is occurring.

In preparation for closure, the last portions of appurtenances were removed from the site in June 1999 with the removal of approximately 10 feet of the French Underdrain System. Confirmation sampling of material under the trace of the former French Underdrain System was performed. Field observations during the excavation of the trace of the French Underdrain System indicate that the samples were at or in the water table. Low levels of VOCs and SVOCs were present. All detections were either qualified with a F indicating that the analyte was positively identified but the associated numerical value was below the reporting limit or a J indicating that the analyte was positively identified but the quantitation is an estimate. The detections qualified with J's were also below the reporting limits. As such, these detections are considered to be below the Practical Quantitation Limit (PQL). These levels are attributed to the groundwater contamination that extends from the Defense Environmental Restoration Account (DERA) portion of the SD-13 IRP site which is being addressed under a Remedial Action Plan. The metals of concern identified for soils on the Base Realignment and Closure (BRAC) portion of the SD-13 IRP site were also analyzed. Cadmium levels were below background for subsurface soils. At two out of the 11 locations, arsenic and barium were detected above background but were below twice background for subsurface soil. The limited metals detections above background do not appear to be attributable to a release from the French Underdrain System and are considered to be a natural variation on background values.

Based on the analytical results and the above discussion, it is proposed that the UNS site meets the closure requirements for RRS 1 closure. It is recommended that closure of the Unnamed Stream Site (Unnamed Stream, former Oil/Water Separator, and the BRAC portion of the French Underdrain System) be considered with no further remedial action required with respect to the soils.

REFERENCES

- Dames & Moore, 1995, *Final Summary Report Remediation Project, SWMUs 19, 20, and 53, Carswell AFB, Fort Worth, Texas.*
- FPM, 1998, *Final Quality Program Plan.*
- FPM, 1999, *Revised Final Work Plan Addendum – Unnamed Stream.*
- Geo-Marine, Inc., 1998, *Soil Removal and Site Restoration via Soil Replacement for the Unnamed Stream, Carswell Air Force Base.*
- Jacobs, 1997, *Draft Basewide Background Study.*
- Jacobs, 1998, *Final Basewide Background Study.*
- IT Corp., 1997, *Final Work Plan Site Characterization of the Sanitary Sewer System.*
- LAW Environmental, Inc., 1994, *Analytical Informal Technical Information Report for Oil/Water Separator Assessment.*
- LAW Environmental, Inc., 1995, *Installation Restoration Program – Oil/Water Separator Assessment Report.*
- LAW Environmental, Inc., 1995, *Installation Restoration Program – RCRA Facility Investigation Report.*
- Parsons Engineering Science, Inc., 1996, *Field Activity Report (TNRCC Form 0017) – Implementation of Remedial Actions at Site ST14 and Site SD13.*
- Parsons Engineering Science, Inc., 1997, *Final Remedial Action Plan for the Risk-Based Remediation of Site ST14 (SWMU 68) LPSTID 104819; the Former Base Refueling Area (AOC7); the French Underdrain System (SWMU 64); and the North Oil/Water Separator (SWMU 67).*
- Radian, 1991, *Remedial Investigation for the East Area, Draft Report for Carswell AFB, TX.*
- Texas Natural Resource Conservation Commission, 1993, *Texas Administrative Code, Chapter 336 Industrial Solid Waste and Municipal Hazardous Waste, Risk Reduction Standards, Subchapters A and S.*
- Texas Natural Resource Conservation Commission, 1995, *Letter limited RFI approval Notice to Proceed.*
- Texas Natural Resource Conservation Commission, 1998, *Memorandum, Subject: Implementation of the Existing Risk Reduction Rules.*

Closure Report
Carswell AFB, TX
Risk-Based Assessment, Management, and Closure of Unnamed Stream
Contract #F41624-95-D-8003 / Delivery Order 0023
September 1999
Page 5-7

United States Environmental Protection Agency, 1994, *Letter comments form EPA on the Work Plan and Sampling and Analyses Addendum for the proposed oil/water separator assessment.*

United States Air Force Center for Environmental Excellence, 1994, *Letter to Mr. Gary Baumgarten, EPA Region VI.*

United States Air Force Center for Environmental Excellence, 1997, *Memorandum for TNRCC on Collection of Free Product from AOC7.*

United States Air Force Center for Environmental Excellence, 1995, *Memorandum for TNRCC, Subject: Response to 26 Jul 95 TNRCC letter to Unnamed Stream Draft RFI Report, December 1994.*

61. 688

506 39

**Closure Report
Carswell AFB, TX
Risk-Based Assessment, Management, and Closure of Unnamed Stream
Contract #F41624-95-D-8003 / Delivery Order 0023
September 1999
Page 5-8**

This page intentionally left blank.

TABLES

**TABLE 3-1
CONSTITUENTS OF CONCERN EXCEEDING RRS 2 MSCs AT UNNAMED STREAM**

Chemical	Sample	Depth [ft]	Date	Concentration [mg/kg]	PQL [mg/kg]	RR2 MSCs [mg/kg]	Basewide Background
<u>Ingestion and Inhalation of Vapors and Dermal Contact</u>							
<u>Metals</u>							
Barium	WP2	-	10/30/97	9801	2	9100	233
<u>SVOCs</u>							
Hexachlorobenzene	UN-01p	-	11/6/97	0.398	0.333	0.26	-
	UN-04p	-	11/6/97	0.398	0.333	0.26	-
	UN-05p	-	11/6/97	0.398	0.333	0.26	-
n-Nitrosodi-n-propylamine	UN-01p	-	10/30/97	0.398	0.333	0.045	-
	UN-04p	-	10/30/97	0.398	0.333	0.045	-
	UN-05p	-	10/30/97	0.398	0.333	0.045	-
<u>Protection of Groundwater</u>							
Arsenic	OWS01	-	10/30/97	10	0.5	5	5.85
	OWS02	-	10/30/97	10	0.5	5	5.85
	WP2	-	10/30/97	9.9	0.5	5	5.85
	UN-01	-	10/30/97	10	0.5	5	5.85
	UN-04	-	10/30/97	10	0.5	5	5.85
	UN-05	-	10/30/97	10	0.5	5	5.85
	SD13MW06D	6-8	3/2/94	12	0.5	5	5.85
	SD13MW07E	8-10	3/2/94	12	0.5	5	5.85
	SD1302SBA	0-2	4/2/94	18	0.5	5	5.85
	Barium	WP2	-	10/30/97	9801	2	200
UN-01		-	10/30/97	727	2	200	233
Cadmium	SD13MW06A	0-2	3/24/94	1.2	1	0.5	0.556
	SD13MW06D	6-8	3/24/94	1.2	1	0.5	0.556
	SD13MW07B	2-4	3/24/94	1.3	1	0.5	0.556
	SD13MW07E	8-10	3/24/94	1	1	0.5	0.556
	SD1302SBA	0-2	4/24/94	1.8	1	0.5	0.556
	SD1303SBB	4-6	4/24/94	3.9	1	0.5	0.556
	SD1303SBC	2-4	4/24/94	2.1	1	0.5	0.556
<u>SVOCs</u>							
Chrysene	UN-05	-	10/30/97	2.52	0.333	1.2	-
Hexachlorobenzene	UN-05p	-	10/30/97	0.398	0.333	0.1	-
	UN-01p	-	10/30/97	0.398	0.333	0.1	-
	UN-04p	-	10/30/97	0.398	0.333	0.1	-
n-Nitrosodi-n-propylamine	UN-01p	-	10/30/97	0.398	0.333	0.0012	-
	UN-04p	-	10/30/97	0.398	0.333	0.0012	-
	UN-05p	-	10/30/97	0.398	0.333	0.0012	-

p indicates proxy value assigned in accordance with TNRCC memo dated July 23, 1998

TABLE 4-1
PRE/POST EXCAVATION ANALYTICAL SUMMARY

Analytes	Method	Backgd.	Pre/Post Excavation												
			FUS01	FUS02	FUS03	FUS04	FUS05	FUS06		FUS07	FUS08	FUS09	FUS10	FUS11	
			S13SFU0108AA	S13SFU0208AA	S13FU0300BA	S13SFU0410BA	S13SFU0508BA	S13SFU0608BA	S13SFU0610BA	S13SFU0708BA	S13SFU0810BA	S13SFU0910BA	S13SFU1010BA	S13SFU1110BA	
		(mg/kg)	8 ft	8 ft	0 ft	10 ft	6 ft	6 ft	10 ft	6 ft	10 ft	10 ft	10 ft	10 ft	
Arsenic	6010B	6.58	3.6	4.4	5	5.9	4.6	7.8	5.1	2.5	5.5	4.4	4.5	11	
Barium		128.1	87	110	82.8	198	70.1	82.7	229	83.9	113	83.3	77.8	27	
Cadmium		0.59	0.26	0.14	0.2	0.37	0.26	0.24	0.27	0.1	0.29	0.14	0.32	0.11	
Benzo(a)anthracene	8270C	--	0.302	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.17E-02	ND	
Benzo(a)pyrene		--	0.302	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Benzo(b)fluoranthene		--	0.299R	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.66E-02	ND	
Benzo(g,h,i)Perylene		--	0.128	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Benzo(k)fluoranthene		--	0.413	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Chrysene		--	0.267	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fluoranthene		--	0.488	ND	ND	0.111	ND	ND	ND	ND	ND	6.84E-02	1.38E-01	ND	
Indeno(1,2,3-cd)pyrene		--	0.144	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Phenanthrene		--	0.179	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
bis (2-ethylhexyl) phthl.		--	ND	ND	ND	ND	0.0447M	ND	0.036M	0.0398M	ND	ND	ND	ND	
Pyrene		--	0.421	ND	ND	0.0744	ND	ND	ND	ND	ND	4.53E-02	ND	ND	
1,2,4-Trimethylbenzene	8260B	--	ND	ND	2.13E-04	5.56E-04	1.88E-04	ND	1.95E-04	2.29E-04	ND	2.53E-04	4.39E-04	1.70E-04	
1,3,5-Trimethylbenzene		--	ND	ND	ND	1.85E-04	1.53E-04	ND	ND	ND	ND	1.72E-04	ND	ND	
Chlorobenzene		--	5.56E-04	2.96E-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Isopropylbenzene		--	ND	ND	4.27E-04	2.38E-03	ND	ND	1.83E-04	ND	5.11E-03	ND	2.46E-03	ND	
Methylene Chloride		--	0.00216	0.00132	ND	ND	ND	0.312J	ND	ND	ND	ND	ND	ND	
Tetrachloroethene		--	ND	ND	7.98E-04	ND									
Ethylbenzene		--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.55E-04	
Toluene		--	9.33E-04	5.19E-04	5.17E-04	8.52E-04	8.94E-04	4.14E-03	8.54E-04	8.92E-04	7.84E-04	7.01E-04	5.49E-04	9.20E-04	
m-,p-Xylene		--	ND	ND	2.47E-04	4.57E-04	ND	ND	ND	2.65E-04	ND	ND	4.88E-04	6.14E-04	
o-Xylene		--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.70E-04	
n-Butylbenzene		--	ND	ND	2.25E-04	1.15E-03	ND	ND	4.15E-04	ND	ND	ND	ND	ND	
n-Propylbenzene		--	ND	ND	2.58E-04	2.01E-03	ND								
p-Isopropyltoluene		--	ND	ND	ND	ND	ND	ND	ND	ND	7.49E-03	ND	ND	ND	
sec-Butylbenzene		--	ND	ND	6.97E-04	ND	ND	1.43E-02	1.01E-03	ND	0.0117J	ND	2.56E-03	ND	
tert-Butylbenzene		--	ND	ND	5.73E-04	ND	ND	0.0842J	4.87E-03	ND	0.0123J	ND	2.01E-03	ND	

Note: All organic data (Methods 8260B and 8270C) was qualified as F - the analyte was positively identified but the associated numerical value is below the reporting limit, except those detections with J, M, or R flags.

M - A matrix effect was present

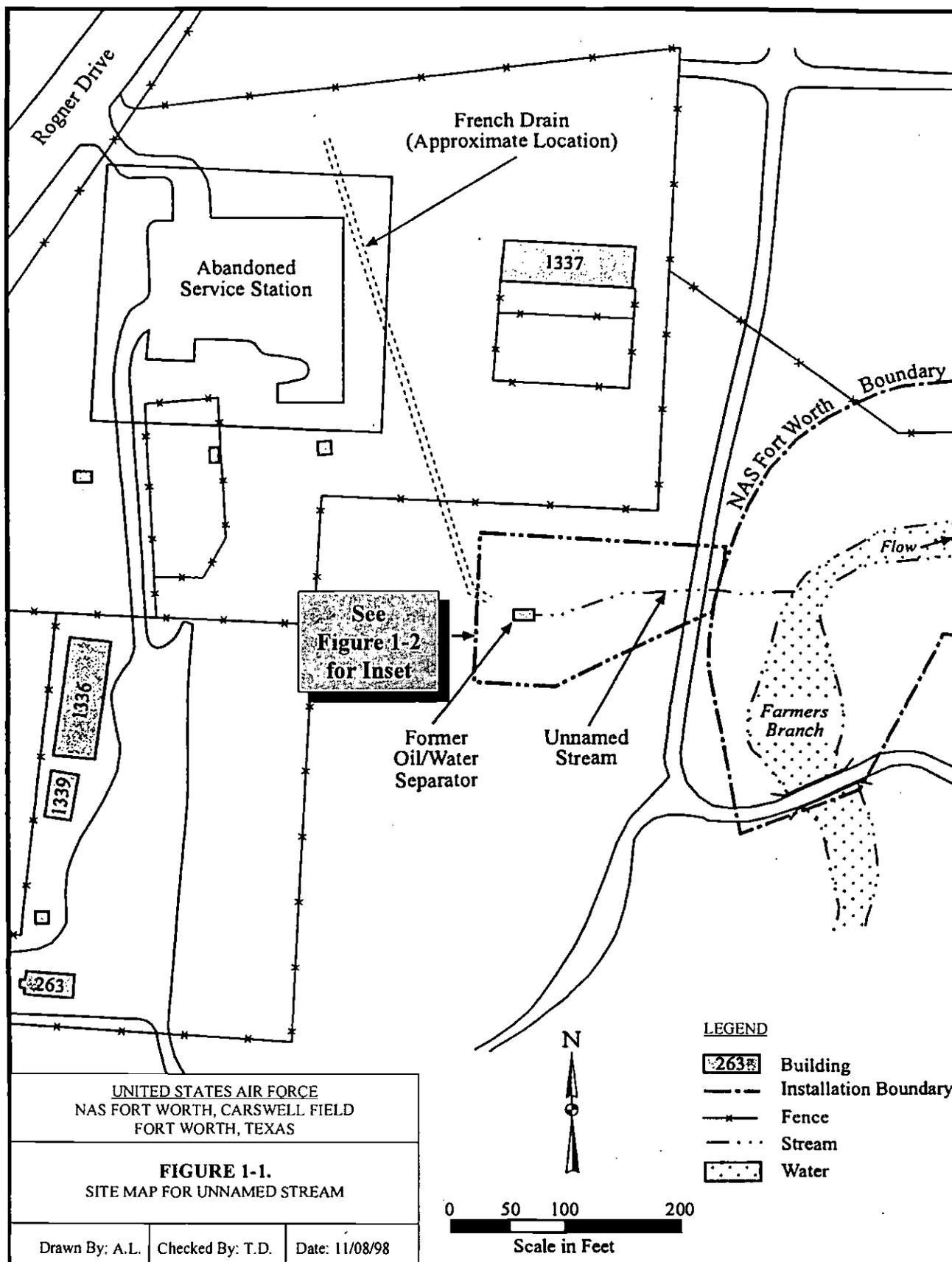
R - The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria

J - The analyte was positively identified, the quantitation is an estimation

Backgd. - Background for Subsurface Soils as determined by the Jacobs Engineering Basewide Background Study

-- : Assumed Non-Detect

FIGURES



UNITED STATES AIR FORCE
 NAS FORT WORTH, CARSWELL FIELD
 FORT WORTH, TEXAS

FIGURE 1-1.
 SITE MAP FOR UNNAMED STREAM

Drawn By: A.L. Checked By: T.D. Date: 11/08/98

LEGEND

-  Building
-  Installation Boundary
-  Fence
-  Stream
-  Water

0 50 100 200
 Scale in Feet

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE