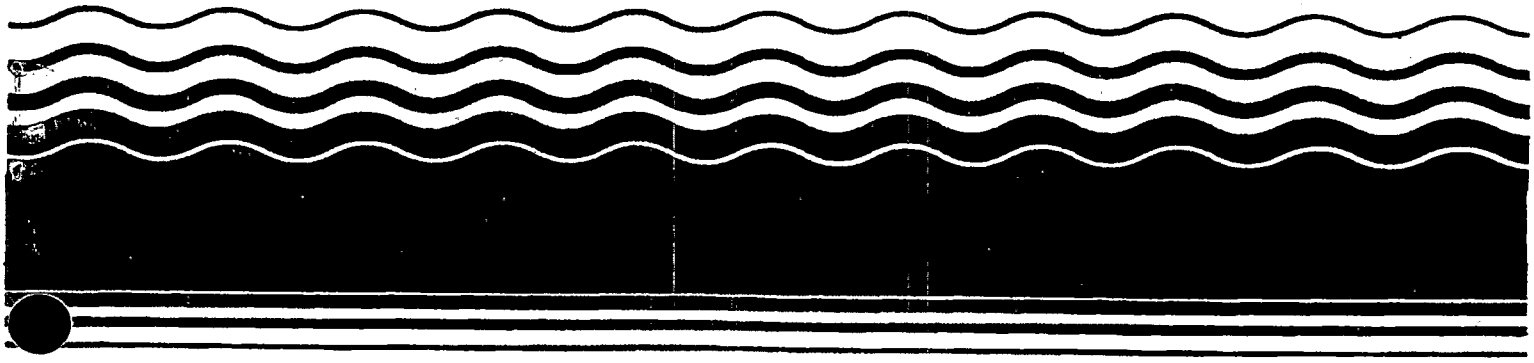
PB99-964001
EPA541-R99-019
1999

EPA Superfund
Record of Decision:

Homestead Air Force Base
OUs 18, 26, 28, & 29
Homestead, FL
3/15/1999



Homestead Air Force Base, Florida

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

Preliminary Assessment/Remedial Design Contract

Final
Record of Decision
OU 18, OU 26, OU 28, and OU 29

Contract F41624-97-D-8017

October 1998

MONTGOMERY WATSON

FINAL

RECORD OF DECISION

FOR

OU 18, OU 26, OU 28, and OU 29

Homestead Air Force Base, Florida

October 1998

Prepared for:

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

Contract F41624-97-D-8017
Delivery Order 010

Prepared by:

Montgomery Watson
3501 N. Causeway Blvd., Suite 400
Metairie, Louisiana 70002

MAR 15 199

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

4WD-FFB

Albert Lowas
Director of Air Force Base Conversion Agency
1400 North Moore Street, Suite 2300
Arlington, VA 22209-2802

SUBJ: Record Of Decision - Operable Units 18, 26, 28, and 29; Homestead Air Force Base NPL Site; Homestead, Florida

Dear Mr. Lowas:

The U.S. Environmental Protection Agency (EPA) Region IV has reviewed the subject decision document and concurs with the selected remedies for the remedial actions at Operable Units (OU) 18, 26, 28, and 29 at the former Homestead Air Force Base (HAFB). These remedies are supported by the previously completed Remedial Investigation, Feasibility Study, and Baseline Risk Assessment Reports. The selected remedies consist of:

OU-18
Remove existing asphalt-containing sediments and some above grade fill along the Boundary Canal, place them on top of OU-18, regrade the site, and install a vegetated cover over the site. Install fence and warning signs. Restrict land access and use. Long-term management and groundwater monitoring.

OU-26
Remove contaminated soils. Dispose in RCRA Subtitle D landfill. Backfill excavated area. Regrade and revegetate.

OU-28
Remove contaminated soils. Dispose in RCRA Subtitle D landfill. Backfill excavated area. Regrade and revegetate.

OU-29
Remove contaminated soils. Dispose in RCRA Subtitle D landfill. Backfill excavated area. Regrade and revegetate.

The determination to implement these courses of action at these sites are consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) and the National Contingency Plan (40 CFR 300).

One point on OU-18 merits clarification. On April 21, 1998, EPA Region IV issued a Memorandum titled "Assuring Land Use Controls at Federal Facilities." The content of that memorandum deals with land use controls for properties which are not imminently being transferred to a non-federal entity. To date, our focus in implementing this policy at Homestead Air Force Base has been on that part which will remain as Homestead Air Reserve Station. However, because of the indefinite length of time before OU-18 and other similar areas outside of the cantonment area that rely on land use controls are transferred by deed to a non-federal entity, EPA believes that our April 21, 1998, policy on land use controls should apply until such transfer occurs. Therefore, we are concurring with the subject OU-18 Record Of Decision (ROD) conditioned upon the development of a Land Use Control Assurance Plan (LUCAP) for the non-cantonment portion of Homestead Air Force Base and a Land Use Control Implementation Plan (LUCIP) for OU-18. To expedite this process, we suggest development of a LUCAP similar to the one which has been negotiated between the Homestead Air Reserve Station, Florida Department of Environmental Protection, and EPA.

Thus, EPA's concurrence with the Record of Decision (ROD) for OU-18 is conditioned on the express understanding that the Air Force is committed to reaching an agreement with EPA Region IV and the Florida Department of Environmental Protection (FDEP) that complies with EPA's April 21, 1998 Memorandum titled "Assuring Land Use Controls at Federal Facilities." We reiterate, as we advised Air Force Regional Environmental Office representatives in our meeting on May 21, 1998, our concurrence with this particular ROD is based on the understanding that the Air Force is committed to entering a Memorandum of Agreement (MOA) consistent with the above-referenced Land Use Control (LUC) Policy. Furthermore, once such an MOA is in place, the Homestead Air Force Base BRAC Cleanup Team (BCT) will be expected to craft specific provisions for Land Use Controls as part of the resulting Land Use Control Implementation Plan for OU- 18, that will prohibit unrestricted property reuse.

As agreed upon at the May 21, 1998, meeting with the Homestead Air Reserve Station, we continue to hold the expectation that final details will be worked out within 90 days after the date of this concurrence, resulting in an MOA that fully complies with the LUC policy. As emphasized at that meeting, and counter to the statement in the Air Force Regional Environmental Office's letter dated June 1, 1998, we remain steadfast in our position that in the event an MOA is not reached within 90 days, we reserve the right to reconsider this remedy, and will not be willing to concur on future Homestead RODs that rely in whole or in part on Land Use Controls unless and until an agreement is in effect.

EPA appreciates the level of effort that was put forth in the documents leading to this decision. EPA looks forward to working with HAFB as we move towards final cleanup of the National Priorities List (NPL) site.

If you have any questions, please call me at (404) 562-8651, or Doyle T. Brittain at (404) 562-8549.

Sincerely,

Richard D. Green, Director
Waste Management Division

cc: Thomas J. Bartol, HAFB/AFBCA
John Mitchell, HAFB/AFRES
Jim Woolford, EPA/FFRO
Jorge Caspary, FDEP
Hugh Vick, Gannett Fleming

D.Brittain/dtb:4WD-FFB:28549:02-11-99:HAFB991-OU18ETAL.ROD

D.BRITTAIN DODRS 2/11/99 E.BOZEMAN DODRS 2/11/99 J.JOHNSTON FFB R.GREEN WD 2/11/99

12-10-98

DEPARTMENT OF THE AIR FORCE
AIR FORCE BASE CONVERSION AGENCY

December 8, 1998

AFBCA/DD Homestead
29050 Coral Sea Blvd., Box 36
Homestead ARB, Florida 33039-1299

US EPA, Region 4, 4WD-FFB
Atlanta Federal Center
61 Forsyth St
Atlanta, GA 30303-8960
ATTN: Mr. Doyle Brittain

Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400
ATTN: Mr. Jorge Caspary

Dade County Department of Environmental Resources Management
Industrial Waste Section
33 SW 2nd Avenue, Suite 800
Miami, Florida 33130-1540
ATTN: Mr. James Carter

RE: Final Record of Decision (ROD) signature page, Operable Units 18, 26, 28, and 29, Former Homestead AFB, Florida

Attached for insertion into the final referenced ROD is a signature page signed by our director. Please process the final document for your agency's concurrence/approval. If you need new documents, please let me know and I will send them. The final document we sent on October 22, 1998 is valid except for the signature page that goes before page 1-1. If possible, your expedited processing will be appreciated. As you know, we want to begin the remedial action as soon as possible. I will be forwarding a remedial action work plan for this work soon. We greatly appreciate all the hard work that has gone into making this four site ROD a reality. Your concurrence is requested by January 13, 1999. If you have any questions, please contact me at (305) 224-7233.

THOMAS J. BARTOL
BRAC Environmental Coordinator
Homestead Operating Location

Attachment:
Signature page for OU 18,26,28,29 ROD

cc:
AFBCA/DD, Andrew Mendoza
HQ AFRC/CEVV, Carlton Crenshaw
HQ AFCEE/ERB, Greg Keefe
Gannett Fleming, Hugh Vick (2)
482 SPTG/CEV, John Mitchell
BAH, Phil Lee

U.S. Environmental Protection Agency Date

Florida Department of Environmental Protection Date

Albert F. Lowe, Jr. December 3, 1998

Director, Air Force Base Conversion Agency Date

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACC	Air Combat Command
AFB	Air Force Base
AFRC	Air Force Reserve Command
AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
ARB	Air Reserve Base
AST	Aboveground Storage Tank
BCT	BRAC Cleanup Team
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COI	Chemical of Interest
COPC	Chemicals of Potential Concern
COPEC	Chemical of Potential Ecological Concern
DCAD	Dade County Aviation Department
DCB	Dichlorobenzene
DCE	Dichloroethene
DDD	Dichloro-Diphenyl-Dichloroethane
DDE	Dichloro-Diphenyl-Dichloroethylene
DDT	Dichloro-Diphenyl-Trichloroethane
DERM	Metropolitan Dade County Department of Environmental Resources Management
DERP	Defense Environmental Restoration Program
DOD	Department of Defense
EPA	U.S. Environmental Protection Agency
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FFA	Federal Facilities Agreement
FS	Feasibility Study
HI	Hazard Index
HQ	Hazard Quotient
HRS	Hazard Ranking System
IF	Intake Factor
IRA	Interim Removal Action
IRP	Installation Restoration Program
LTTD	Low Temperature Thermal Desorption
MCL	Maximum Contaminant Level
mg/kg	milligrams/kilogram

mg/l	milligrams/liter
NCP	National Oil and Substances Pollution Contingency Plan
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	Operable Unit
OHM	OH Materials
OWS	Oil/Water Separator
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
ppb	parts per billion
ppm	parts per million
PRG	Preliminary Remedial Goal
PSC	Potential Source of Contamination
RAB	Restoration Advisory Board
RAO	Remedial Action Objectives
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RfD	Reference Dose
RL	Reporting Limit
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SAC	Strategic Air Command
SARA	Superfund Amendments and Reauthorization Act
SF	Slope Factor
SI	Site Inspection
SVOC	Semivolatile Organic Compound
TAC	Tactical Air Command
TCE	Trichloroethene
TEFs	Toxicity Equivalency Factors
TFW	Tactical Training Wing
TMV	Toxicity, Mobility, and Volume
TRPH	Total Recoverable Petroleum Hydrocarbon
TTW	Tactical Training Wing
UCL	Upper Confidence Limit
µg/kg	micrograms/kilogram
µg/L	micrograms/liter
USACE	U.S. Army Corps of Engineers

USAF	United States Air Force
UST	Underground Storage Tank
VOC	Volatile Organic Compound
W-C	Woodward-Clyde

DECLARATION STATEMENT
FOR THE RECORD OF DECISION
FOR OPERABLE UNIT NOs. 18, 26, 28 AND 29

SITE NAME AND LOCATION

Operable Unit Nos. 18, 26, 28, and 29

Homestead Air Force Base, Florida

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial actions for the Operable Units (OUs) 18, 26, 28, and 29 at Homestead Air Force Base (AFB), Florida. The remedial actions were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site. The State of Florida, the U.S. Environmental Protection Agency (EPA), and the U.S. Air Force (USAF) concur with the selected remedy presented in this Record of Decision (ROD).

ASSESSMENT OF SITES

Actual or threatened releases of hazardous substances from the OU sites, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. The risks identified in the Remedial Investigation (RI) for OUs 18, 26, 28, and 29 are presented below:

Operable Unit	Human Risk	Environmental Risk
OU 18	EF	E
OU 26	EF	--
OU 28	F	E
OU 29	F	--

-- = Risk values did not exceed EPA criteria
E = Risk values exceed EPA criteria
F = Contaminant concentrations exceeded risk-based Florida Department of Environmental Protection (FDEP) industrial soil cleanup goals.

DESCRIPTION OF SELECTED REMEDIES

Remedies have been selected which address the principal risks identified at each OU site. The selected remedies will allow for Homestead AFB to meet its overall objective of protecting human health and the environment through the process of identifying, investigating, cleaning up, and closing contaminated sites.

The remedial alternatives selected for each site are summarized below:

Operable Unit	Media	Remedial Alternative
OU18	Soil/Sediment	OU18-3: Soil Cover
OU26	Soil	OU26-4S: Remove and Landfill
	Groundwater	OU26-3G: Intrinsic Remediation
OU28	Soil	OU28-4: Remove and Landfill
OU29	Soil	OU29-4: Remove and Landfill

The selected alternative to address soil risks at OUs 26, 28 and 29 is to "remove and landfill" the contamination. This alternative includes:

- Excavation and removal of contaminated soils
- Backfilling excavated areas with uncontaminated fill
- Transporting contaminated soils to a solid waste landfill for disposal
- Lead-contaminated soils at site OU28 that are determined to be characteristically hazardous will be encapsulated/stabilized prior to disposal in a solid waste landfill

At OU18, the "soil cover" alternative has been selected to address risks associated with soil and sediment contamination. This alternative includes:

- Removing existing asphaltic sediments and the site fill material along the canal
- Placing removed sediments and fill material on top of the site
- Re-grading the site
- Placing a vegetated soil cover over the site

The "intrinsic remediation" alternative has been selected to address risks associated with groundwater contamination at OU26. Intrinsic remediation includes:

- Evaluation of biodegradation/reduction of contaminants over time
- Long-term groundwater monitoring for chemicals of concern
- Restriction of groundwater use at the site
- Long-term management and health and safety oversight for construction projects in the area

STATUTORY DETERMINATIONS

The selected remedies are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost effective. These remedies utilize permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable. However, because treatment of the principal threats at the OUs was not found to be practicable, these remedies do not satisfy the statutory preference for treatment as a principal element.

Because the remedies for OUs 18 soils/sediments and 26 groundwater will result in hazardous substances remaining on site above health-based levels, a review will be conducted within five years of commencement of remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

Because the selected remedy for soil at OUs 26, 28 and 29 will not result in hazardous substances remaining on site above health-based levels, the five-year review will not apply to these actions for OUs 26, 28, and 29.

1.0
SITE NAME, LOCATION, AND DESCRIPTION

The following sections provide descriptions of OUs 18, 26, 28, and 29.

1.1 SITE NAMES

This ROD is for the following Homestead AFB OUs:

- OU18 - Old Contractor Storage Area and Former Construction Debris Landfill
- OU26 - Building 745, Aircraft Fabrication Facility
- OU28 - Building 750, Propulsion (Engine) Maintenance Facility
- OU29 - Building 760, Avionics Aerospace Ground Equipment Shop and Tactical Electronic Warfare System Shop

Section 1.3 provides site specific descriptions of the OUs.

1.2 LOCATION AND GENERAL DESCRIPTION

The four OUs are located at Homestead AFB, which is located in southern Dade County, Florida, approximately 25 miles southwest of Miami and 7 miles east of the town of Homestead (Figure 1-1). The main Base covers approximately 2,916 acres. There are approximately 700 personnel currently working at the Base; about half are military personnel and half are civilian employees. An Additional 200 to 300 Reservists are at the Base for training, but are not full-time employees. The nearby city of Homestead has an approximate population of 18,700. Florida City is home to approximately 5,500 residents (Homestead Chamber of Commerce 1994). The population for the greater Miami area is reported to be 1.9 million (Miami Chamber of Commerce 1994).

The topography at Homestead AFB and associated OUs is relatively flat. Many of the trees and buildings previously on the Base were destroyed in 1992 by Hurricane Andrew. The

flightline, support buildings and hangars, and several office-type buildings have been repaired or rebuilt since the hurricane. The Base is surrounded by a security fence.

A series of canals form the Boundary Canal system that drains most of the Base. The Boundary Canal empties into the storm water reservoir at the southeast corner of the Base. Water in the Boundary Canal and reservoir consists of storm water and is not used as a potable water source. The Boundary Canal has essentially two major elements, the West-South and North-East segments. A dike is present along the outside bank of the Boundary Canal to minimize off-Base runoff from entering the canal.

The Outfall Canal flows straight east from the storm water reservoir and empties into Biscayne Bay. The total length of the Outfall Canal is approximately 10,400 feet (2.0 miles). In addition to the excavated canal, an earthen bank is constructed on both sides. Control structure S20G is located along Outfall Canal, approximately 1.4 miles east of the reservoir. According to the South Florida Water Management District (SFWMD), this structure controls the flow of the Outfall Canal to minimize salt water intrusion from Biscayne Bay. Water movement through the structure is controlled by a vertical lift gate. The gate is 25 feet wide and can be lifted to provide a maximum opening of at least 10 feet in height (USACE 1963). The width of the Outfall Canal ranges from approximately 35 to 50 feet. The total depth of the canal including the bank ranges from 10 to 20 feet.

The Base is surrounded by residential areas to the north and southwest, and farmland and plant nurseries on the other boundaries. Figure 1-2 shows Homestead AFB and surrounding area.

1.3 SITE DESCRIPTIONS

The following sections provide site specific descriptions for the four OUs discussed in this ROD. Figure 1-3 shows the locations of the OUs within Homestead AFB.

1.3.1 OU18 - Old Contractor Storage Area and Former Construction Debris Landfill

OU18 consists of the former Old Contractor Storage Area and Former Construction Debris Landfill. OU18 occupies an area of approximately 2.5 acres near the corner of Bikini Boulevard and Schweinfurt Road at the northeastern edge of the Base (Figure 1-4). According to Homestead personnel, OU18 had been used by contractors since the early 1980s for storage of various materials (including pipes, equipment, paint cans, and tools) and for the disposal of crushed asphalt. The surface consists of crushed asphalt with some sand and gravel.

Surface drainage flows to a swale located along the site's southeast edge. The swale drains to the southwest. The southern and southwest edge of the OU is bounded by grass, brush, and small trees, while the north and west sides are bounded by canals. The west edge is bounded by a canal between the site and the former Family Camp Grounds access road. The north edge of the site runs up against the Boundary Canal.

Although there have been no reported spills for this area, housekeeping had been poor, and contractors appeared to have routinely left unusable debris when leaving the site. Areas of oil staining and paint spillage were noted throughout the area during a June 1993 visual inspection. Beginning in 1995, piles of excavation material have been placed onto the site by Base contractors.

1.3.2 OU26 - Building 745, Aircraft Fabrication Facility

OU26, which includes Building 745 - Aircraft Fabrication Facility, occupies about 1.5 acres in the east-central portion of the Base (Figure 1-5). According to Homestead AFB personnel, the building had been used for maintenance of aircraft skin and hydraulics. Building 745 has been partially repaired since Hurricane Andrew. The building is unoccupied and will likely be demolished as part of reuse activities. There are currently no plans to occupy the facility. Asphalt parking and driveways are located to the northwest, southwest, and southeast. Grassy areas and a drainage canal are located to the northeast. Three transformers were

reportedly stored in a fenced area on the east side of Building 745. No leaks were reported around the transformers.

A covered concrete slab labeled Building 746 is located southeast of Building 745. Building 746 was used to store contained gas cylinders. Two flammable materials storage cabinets were located south of Building 746 and contained paints, solvents, and driveway sealer during a 1993 visual inspection.

1.3.3 OU28 - Building 750, Propulsion (Engine) Maintenance Facility

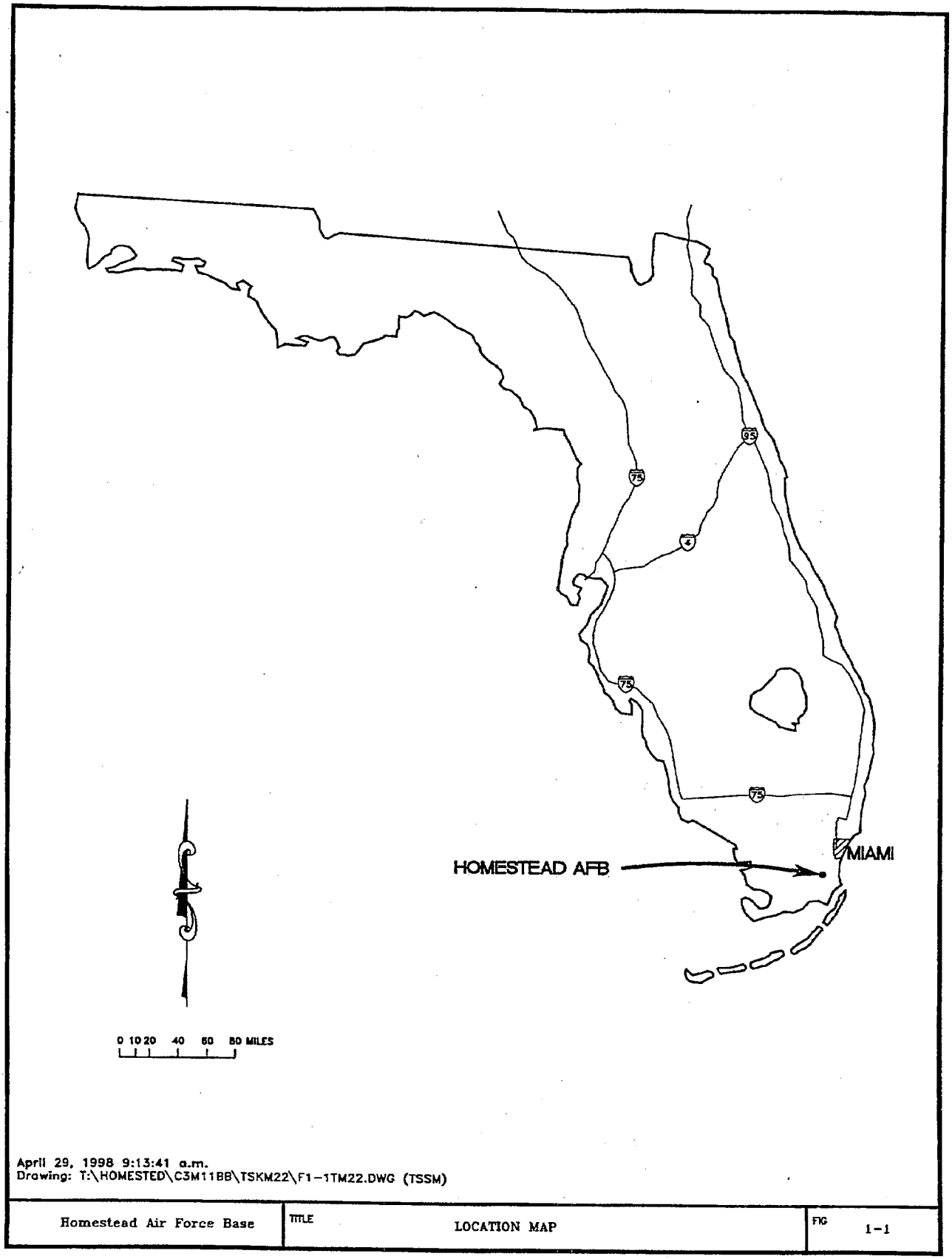
OU28, which includes Building 750 - Propulsion (Engine) Maintenance Facility, occupies approximately 4 acres immediately northeast of OU26 (Figure 1-6). OU28 had been used for jet engine tear-down, rebuilding, inspection and repair since approximately 1950. The site topography gently slopes to the north to a drainage swale at the northwest portion of the site and to the southeast towards a drainage swale at the southeast portion of the building. The site driveways and parking areas are covered with asphalt. Small areas to the sides and rear of the building are grass covered.

An oil water separator (OWS) and sump were located in the southwest portion of the site, and five underground storage tanks (USTs) associated with electroplating operations at the facility were located at the northwest corner of the building by Bikini Boulevard. Building 744, an aboveground storage tank (AST), and Building 743, an emergency electrical generation building, are located at the south side of the site.

1.3.4 OU29 - Building 760, Avionics Aerospace Ground Equipment Shop and Tactical Electronic Warfare System Shop

OU29, which consists of former Building 760 and surrounding area, is located northeast of the intersection of Bikini and St. Nazaire Boulevards (Figure 1-7). Building 760 was demolished due to damage from Hurricane Andrew. The site currently consists of a mixture of asphalt or concrete paved areas and a grassy area covering the former building footprint. Nearby OU28 is located southwest and across St. Nazaire Blvd. from OU29.

Building 760 was used as an Avionics Aerospace Ground Equipment shop, a Tactical Electronic Warfare System shop, and housed various associated testing shops based on available records. An OWS had been located at the southeast corner of Building 760. Effluent from the OWS discharged to the north into the sanitary sewer that runs along Bikini Boulevard. A 2,000-gallon steel UST was also located adjacent to the southwest side of Building 760. The tank was reportedly used to store diesel fuel used to power a generator or boiler that was located inside Building 760.



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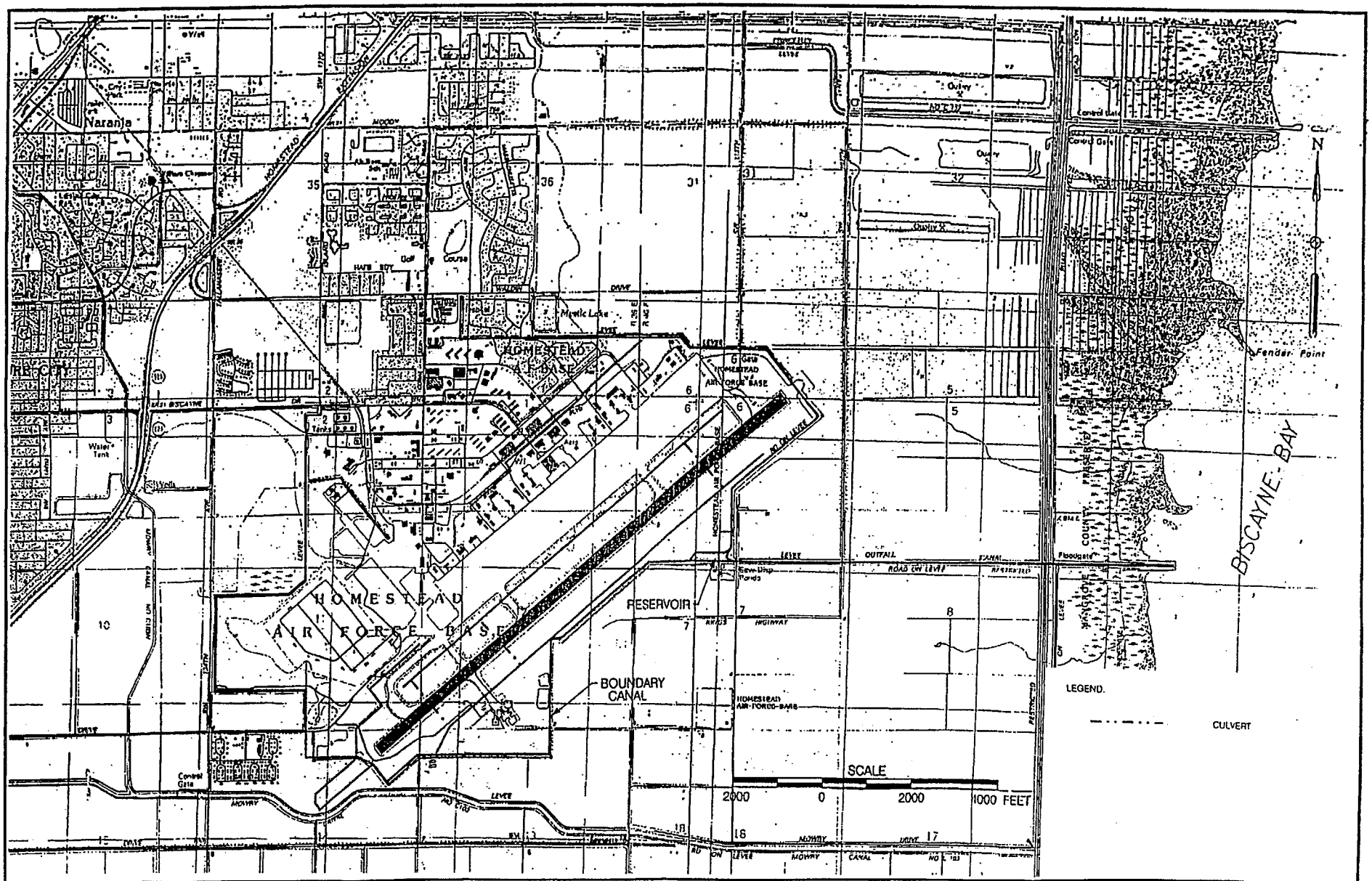
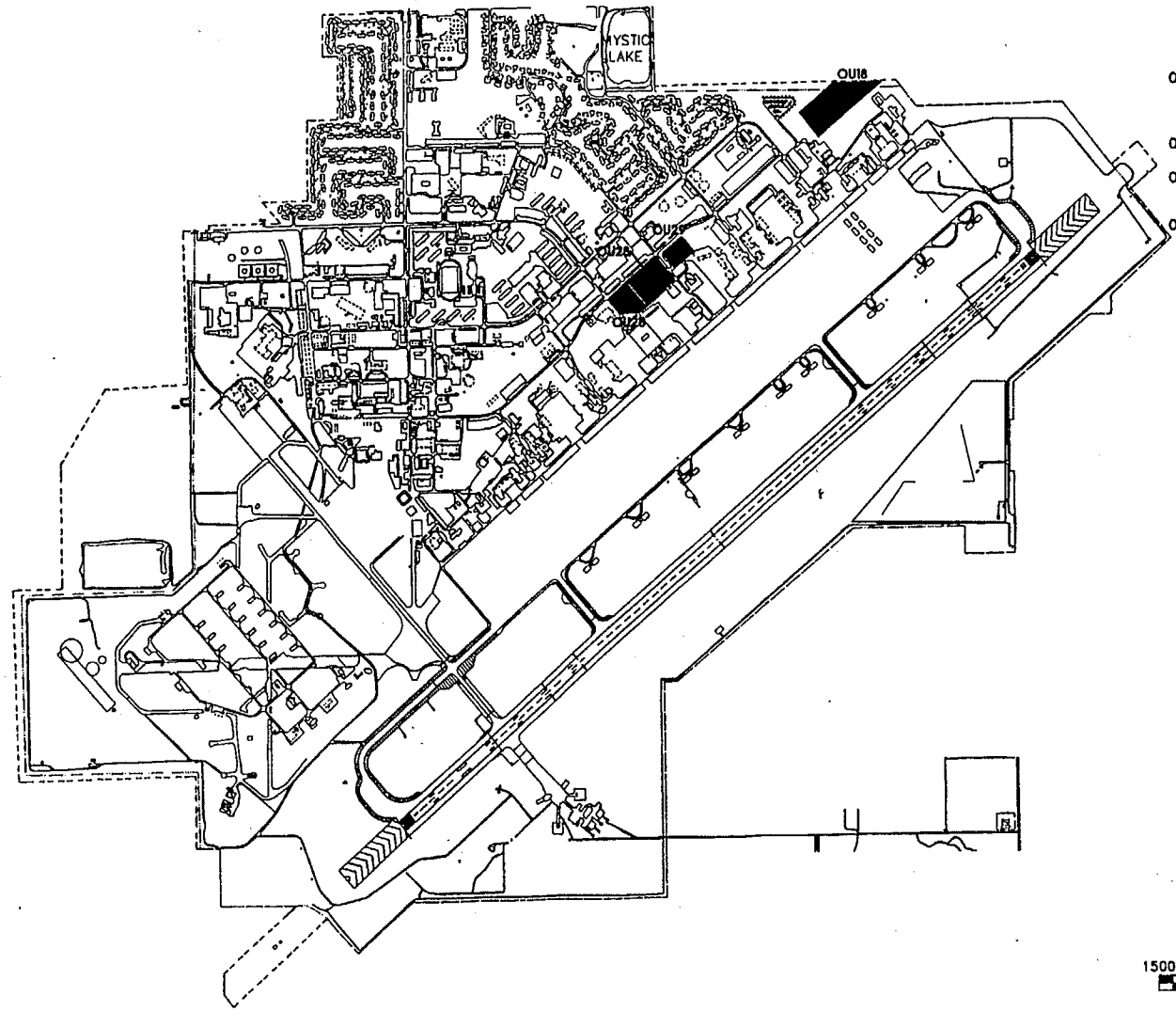
Homestead Air Force Base	TITLE	LOCATION MAP	FIG 1-1



Homestead Air Force Base	mz	TOPOGRAPHIC MAP OF HOMESTEAD AFB AND SURROUNDING AREA	no 1-2



LEGEND

OU SITES

OU18 = Old Contractor Storage Area and Former Construction Debris Landfill

OU26 = Bldg. 745, Aircraft Fabrication

OU28 = Bldg. 750, Propulsion (Engine) Maintenance Facility

OU29 = Bldg. 760, Avionics Aerospace Ground Equipment Shop, Tactical Electronic Warfare System Shop

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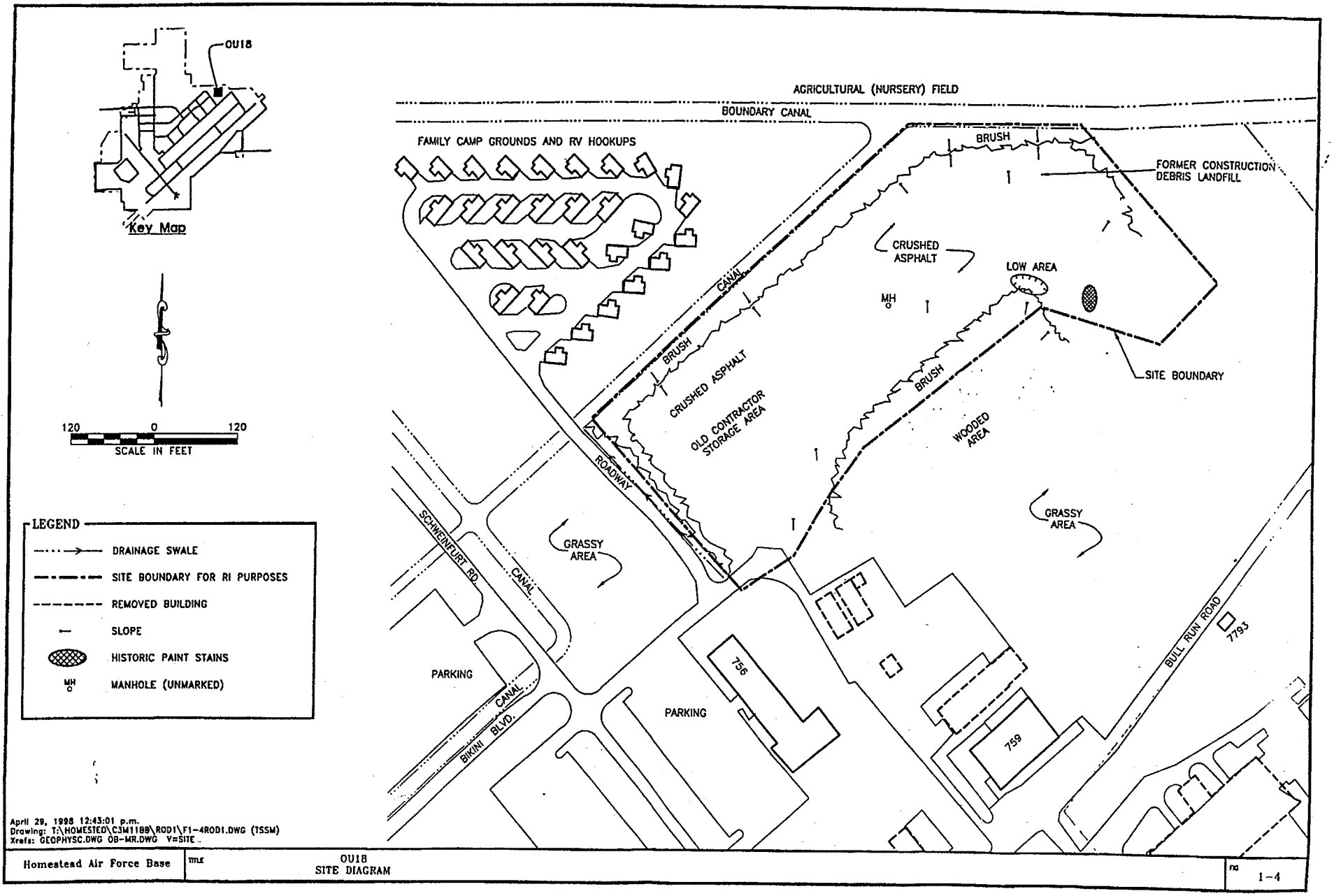
Homestead Air Force Base	TITLE	LOCATIONS OF OU SITES	NO 1-3


OU18
Key Map
120 0 120
SCALE IN FEET
LEGEND
DRAINAGE SWALE
SITE BOUNDARY FOR RI PURPOSES
REMOVED BUILDING
SLOPE
HISTORIC PAINT STAINS
MH MANHOLE (UNMARKED)
AGRICULTURAL (NURSERY) FIELD
BOUNDARY CANAL
FAMILY CAMP GROUNDS AND RV HOOKUPS
BRUSH
FORMER CONSTRUCTION DEBRIS LANDFILL
CRUSHED ASPHALT
LOW AREA
MH
CANAL
BRUSH
CRUSHED ASPHALT
OLD CONTRACTOR STORAGE AREA
BRUSH
SITE BOUNDARY
WOODED AREA
ROADWAY
GRASSY AREA
GRASSY AREA
SCHWEINFURT RD.
CANAL
PARKING
CANAL
BIKINI BLVD.
PARKING
756
759
BULL RUN ROAD
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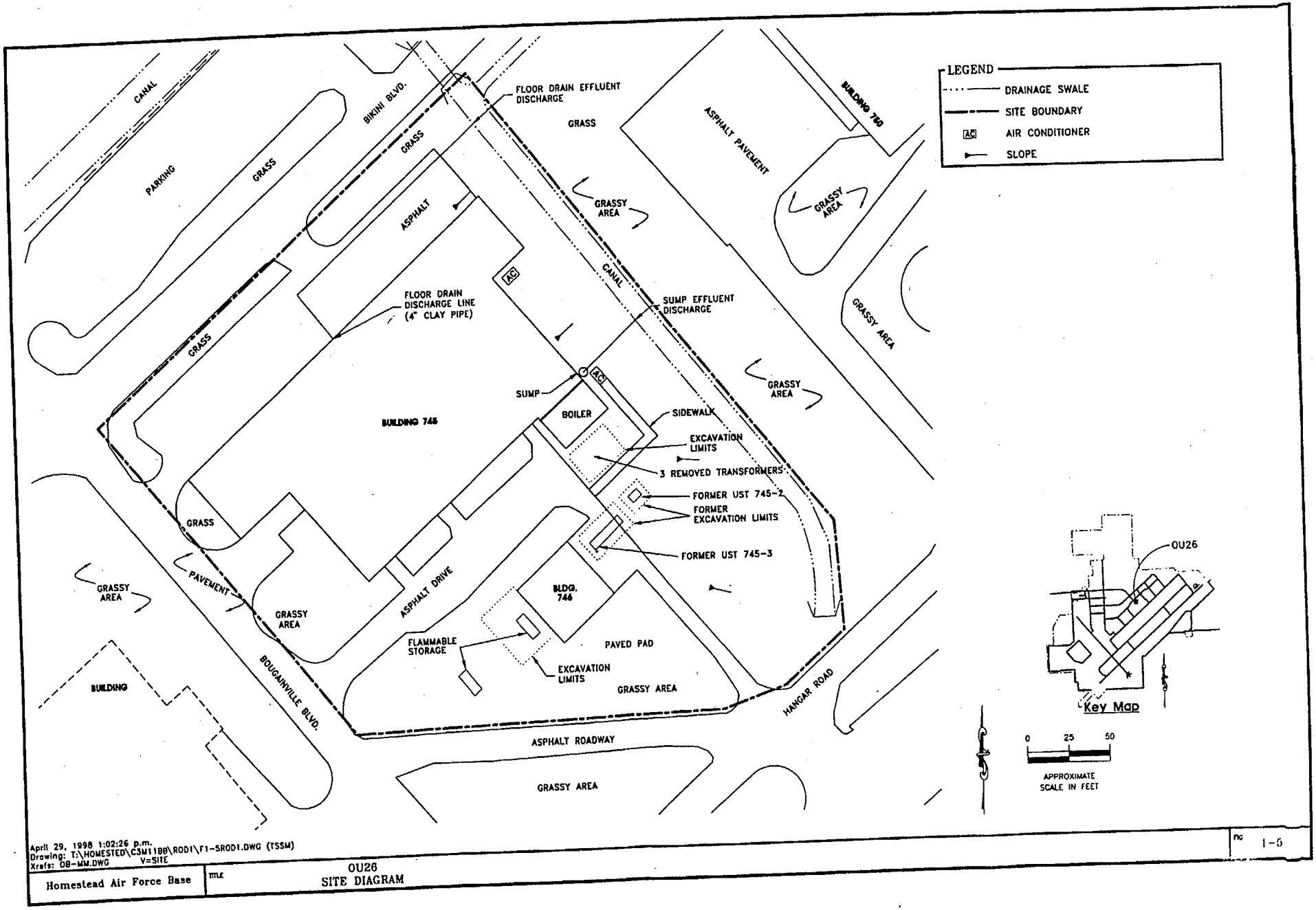
Homestead Air Force Base
OU18
SITE DIAGRAM
1-4



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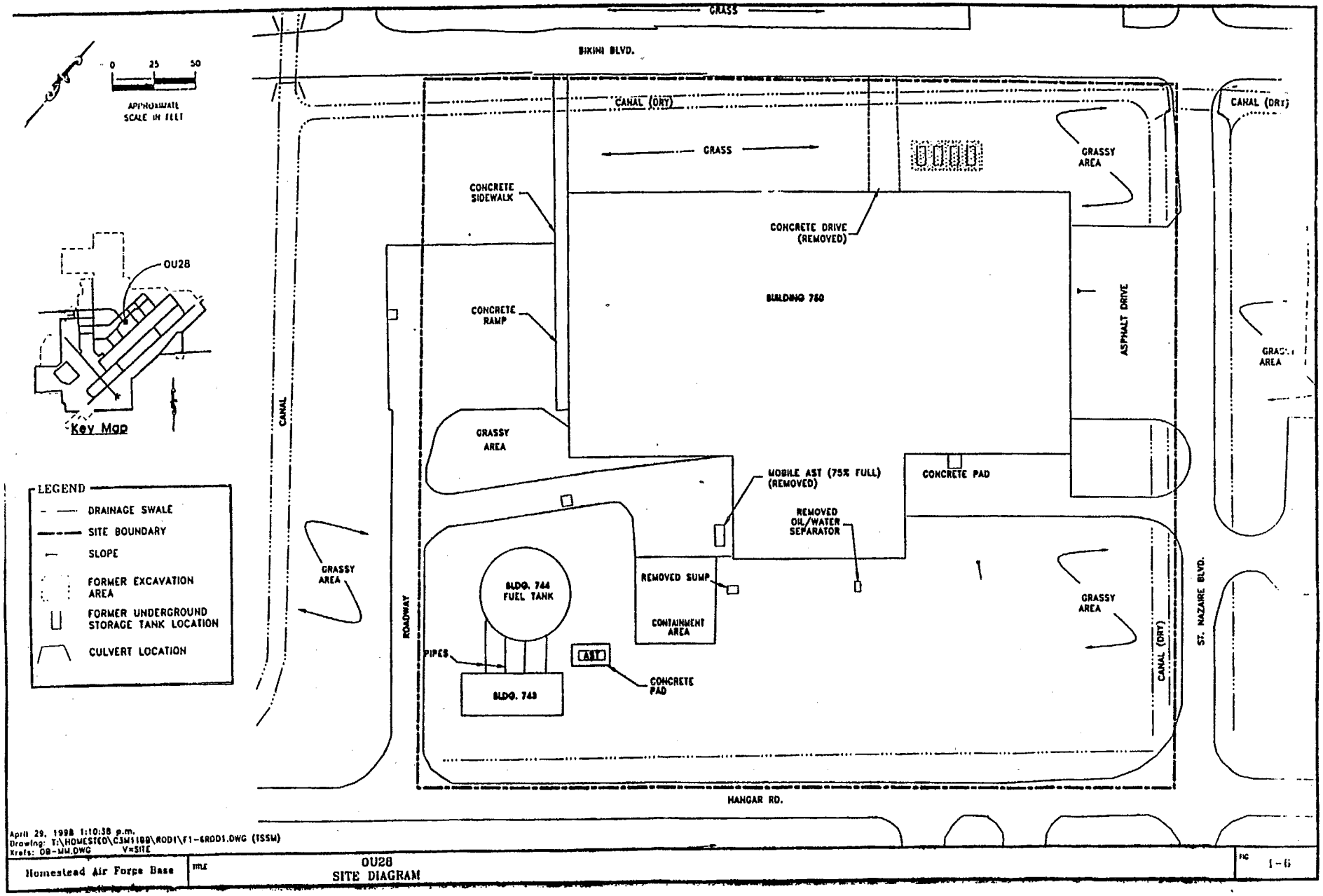
Homestead Air Force Base	title	OU26 SITE DIAGRAM	fig 1-5


0 25 50
APPROXIMATE SCALE IN FEET
Key Map
OU28
LEGEND
DRAINAGE SWALE
SITE BOUNDARY
SLOPE
FORMER EXCAVATION AREA
FORMER UNDERGROUND STORAGE TANK LOCATION
CULVERT LOCATION
BISCAYNE BLVD.
GRASS
CANAL (DRY)
CONCRETE SIDEWALK
CONCRETE DRIVE (REMOVED)
GRASSY AREA
BUILDING 760
ASPHALT DRIVE
CONCRETE RAMP
CANAL
GRASSY AREA
MOBILE AST (75% FULL) (REMOVED)
CONCRETE PAD
REMOVED OIL/WATER SEPARATOR
ROADWAY
BLDG. 744 FUEL TANK
REMOVED SUMP
CONTAINMENT AREA
PIPES
AST
CONCRETE PAD
BLDG. 743
ST. NAZAIRE BLVD.
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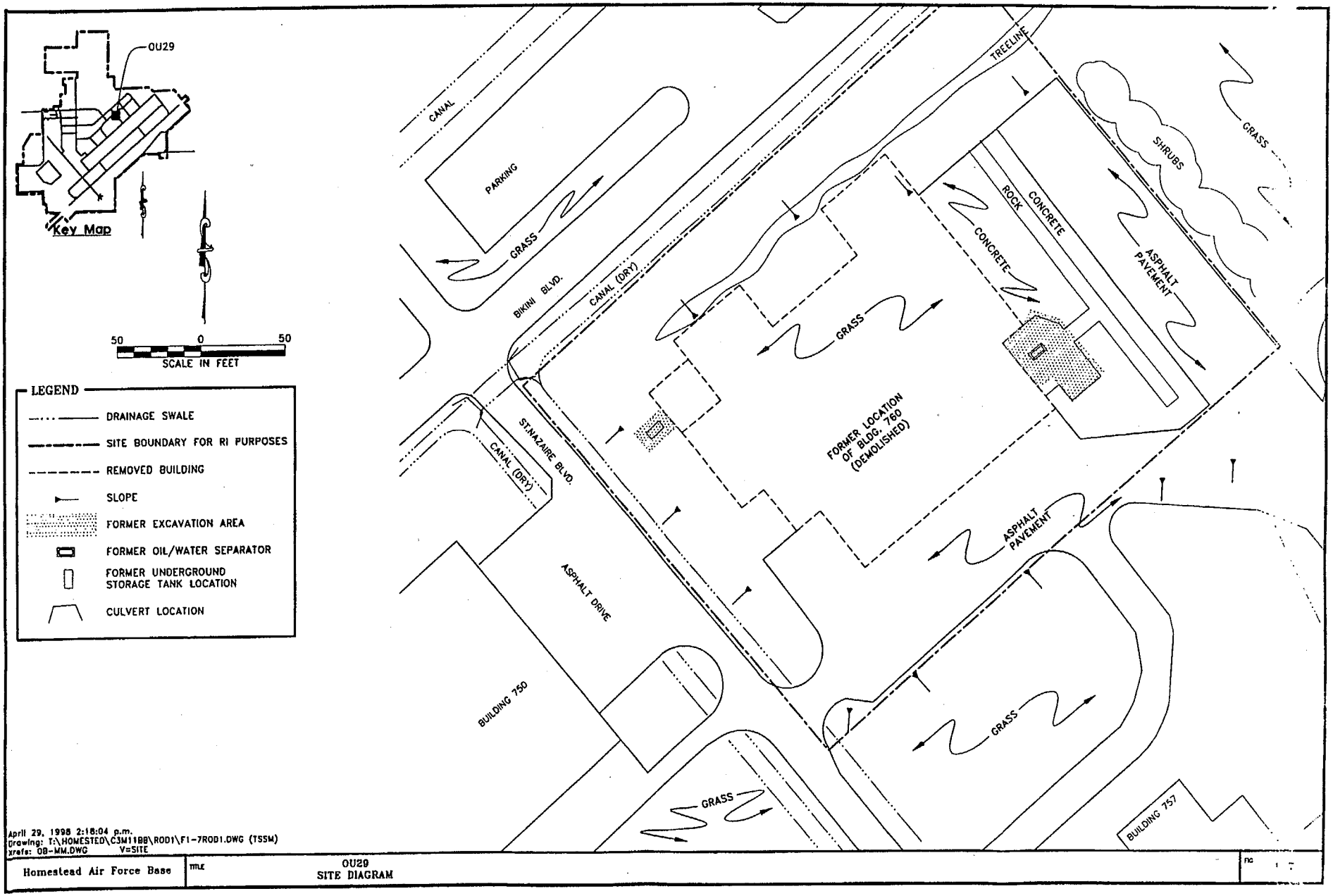
Homestead Air Force Base
OU28
SITE DIAGRAM
FIG 1-6


OU29
Key Map
50 0 50
SCALE IN FEET
LEGEND
DRAINAGE SWALE
SITE BOUNDARY FOR RI PURPOSES
REMOVED BUILDING
SLOPE
FORMER EXCAVATION AREA
FORMER OIL/WATER SEPARATOR
FORMER UNDERGROUND STORAGE TANK LOCATION
CULVERT LOCATION
CANAL
PARKING
GRASS
BIKINI BLVD.
CANAL (DRY)
TREELINE
SHRUBS
GRASS
ROCK
CONCRETE
CONCRETE
ASPHALT PAVEMENT
GRASS
FORMER LOCATION OF BLDG. 760 (DEMOLISHED)
ST. NAZAIRE BLVD.
CANAL (DRY)
ASPHALT PAVEMENT
ASPHALT DRIVE
BUILDING 750
GRASS
GRASS
BUILDING 757
April 29, 1998 2:18:04 p.m.
Drawing: T:\HOMESTED\C3M1188\ROD1\F1-7ROD1.DWG (TSSM)
Xrefs: OB-MM.DWG V=SITE
Homestead Air Force Base
TITLE
OU29
SITE DIAGRAM
NO

2.0 SITE AND REGULATORY HISTORY

The following sections describe the regulatory and site history related to Homestead AFB and associated OUs.

2.1 REGULATORY HISTORY

The Installation Restoration Program (IRP) is the USAF's vehicle for implementing the Defense Environmental Restoration Program (DERP). The DERP was developed by the Department of Defense (DOD) to meet the requirements of CERCLA in accordance with the NCP. In 1986, DERP was expanded to incorporate the requirements of SARA. The program goals of the IRP are consistent with the program goals of DERP: to identify, investigate, clean up and close contaminated sites.

In 1987, Executive Order 12580 delegated the lead agency responsibilities for CERCLA/SARA to the Secretary of Defense to carry out environment restoration at military facilities. Under DERP, the activities are carried out consistent with CERCLA §120 and in consultation with the EPA. DERP also gives DOD the authority to enter into agreements with federal and state agencies and local governments for assistance in carrying out environmental restoration programs.

The IRP was initiated at Homestead AFB in 1983 and a Records Search was completed for the Base. Beginning in 1986, a series of more detailed investigations were completed at various locations on the Base. In accordance with SARA, the EPA prepared a final Hazard Ranking System (HRS) scoring package for Homestead AFB. This led to the final listing of Homestead AFB on the National Priorities List (NPL) on August 30, 1990.

As a result of the NPL listing, the USAF entered into a Federal Facilities Agreement (FFA) with the EPA and the Florida Department of Environmental Protection (FDEP, formerly the Florida Department of Environmental Regulation, or FDER) on May 25, 1990. The FFA required the identified OUs to be investigated under the FFA. OUs 18, 26, 28 and 29 were identified as potential sources of contamination (PSC) and are included in this ROD.

In 1992, due to damage caused by Hurricane Andrew, sixty-two (62) on-Base sites and four (4) off-Base sites were designated as units/areas of concern (AOCs) by the USAF, the EPA, the FDER (now the FDEP), and the U.S. Army Corps of Engineers (USACE). Subsequent to this listing, two more on-Base units (Munitions Storage Area and Jet Engine Test Cell) were added. These units were identified to be evaluated for the potential of a release that would have resulted from Hurricane Andrew or specific waste handling activities at the sites. In July 1993, a Resources Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was conducted by W-C at the 68 sites/AOCs (W-C 1994). The RFA included record searches, personal interviews, and site inspections. As a result of the RFA and transference of certain sites to the Base UST/OWS Program, 31 sites were eliminated from further consideration. The remaining 37 units were recommended for Confirmation Sampling due to their potential for a release of hazardous constituents to the environment identified in the RFA.

Sampling for the 37 units was conducted from April 1994 through July 1994, which included the sampling of the surface soil, subsurface limestone, and groundwater. As a result of Confirmation Sampling and agreements reached during subsequent Base Realignment and Closure (BRAC) Cleanup Team (BCT) meetings, of the 37 sites, 15 sites required no further action, 10 sites were reassigned to be addressed in other programs, 6 sites were recommended for an RI, and 6 were recommended for further investigation as expanded Site Investigation (SI) sites in accordance with CERCLA/SARA.

Concurrent to the Confirmation Sampling Program, investigations in conjunction with the Base UST/OWS Remediation Program were completed at Building 750 and Building 760, and at OWS 206 (near Building 200). As a result of the presence of chlorinated Volatile Organic Compounds (VOCs) detected during the investigations at Buildings 750 and 760, these sites were designated as OU28 and OU29, respectively, to be investigated under CERCLA. OWS 206 was designated to be addressed as an expanded SI specific to the OWS effluent.

The RI sites addressed in this ROD have had work completed in conjunction with the Base UST/OWS Remediation program. As a result of data generated from the Confirmation

Sampling Program, Interim Removal Actions (IRAs) were planned and executed for OU22, OU26, and OU27 in conjunction with the RI.

2.2 SITE HISTORY

The land now occupied by Homestead AFB was originally developed by Pan American Air Ferries, Inc., and used for pilot training. In September 1942, the Caribbean Wing Headquarters took over the air field, and Homestead Air Field was activated. Homestead Army Air Field was initially used by the Army Transport Command for dispatching aircraft overseas. However, in 1943, the Second Operational Training Unit began using the airfield to train the transport pilots and crews.

In October 1945, the base was placed on inactive status due to extensive damage caused by a hurricane in the previous month and anticipated post-war reductions in military activities. The Base property was turned over to Dade County. Crop dusters used the runways and a few small industrial and commercial industries used the buildings. The Dade County Port Authority managed the Base until 1953, when the federal government reacquired it along with the surrounding property.

By 1955, the Homestead facility had been rebuilt as a Strategic Air Command (SAC) Base, Homestead AFB, and in February, the first operational squadron arrived. The Base was formally reactivated in November of the same year. During 1960, modifications were made to the facility to accommodate B-52 aircraft.

A Base command change from SAC to the Tactical Air Command (TAC) occurred in July 1968. The 4351st Tactical Fighter Wing (TFW), which flew F-100s, was the new host unit until October 1970. In October 1970, the 31st TFW, which flew F-4s, returned from Southeast Asia became the host unit for Homestead AFB. In 1981, the 31st TFW was renamed the 31st Tactical Training Wing (TTW), but was changed back to the 31st TFW in October 1984. The 31st TFW was re-designated again in 1991 to the 31st Fighter Wing. In 1993, Homestead AFB was reassigned under the newly formed Air Combat Command (ACC).

On August 24, 1992, Homestead AFB was struck by Hurricane Andrew. Approximately 97 percent of the Base facilities were rendered unusable. As a result of the hurricane, most of the previous 33 tenants vacated the Base, and many of the damaged buildings were demolished and removed. Following Hurricane Andrew, the Base was operated by a small contingent of Base personnel from September 1992 until April 1994. During this period, the administration of environmental programs at Homestead AFB changed to reflect a change in Base command structure from ACC to the Air Force Base Conversion Agency (AFBCA). On April 1, 1994, approximately one-third of the Base officially became Homestead Air Reserve Base (ARB). Currently, the 482nd Fighter Wing of the AFRC utilizes approximately this portion of the Base for daily operations and training. Most of the remainder of the Base is currently under an interim short-term lease to Dade County and is being considered for property transfer to the Metropolitan Dade County Aviation Department (DCAD) in accordance with the USAF BRAC program. Some parcels have been transferred to governmental and private agencies, such as the U.S. Department of Labor for a job training program, Dade County for a homeless assistance shelter, Florida Power and Light, a credit union, and a bank. Sites OU18, OU26, OU28, and OU29 are intended to be transferred to Dade County for industrial/commercial use.

3.0
COMMUNITY PARTICIPATION HISTORY

The Air Force has a public participation program at Homestead AFB to promote public understanding of the cleanup process and its results, and ensure that the community's concerns are solicited, considered, and thoroughly addressed. The backbone of this program is the Community Relations Plan which assessed the public's level of knowledge, interest, and information needs by conducting community interviews and researching of the local social, demographic, economic, and political information. The Community Relations Plan recommended compatible public involvement strategies that include a Restoration Advisory Board (RAB), newsletters and fact sheets, Information Repositories, and public meetings at project milestones.

RABs are a joint creation of the DOD and the EPA and are a vehicle for community input during environmental restoration. A RAB was formed for the Homestead AFB in October 1993 and meets routinely. Community members of the RAB exchange information and discuss restoration issues with the BCT which includes representatives from the USAF, EPA, and the FDEP. Currently, there are seven community members on the Homestead AFB RAB.

RAB meetings provide opportunities for direct public participation. Presentation topics include current investigations, results, plans for the environmental restoration program, and the current issues and decisions facing the BCT. All RAB meetings are open to the public and include a public comment period for the audience members to ask questions and express opinions and concerns.

Newsletters and Fact sheets update the community members on the current issues and environmental investigation and/or remediation activities. Newsletters are published four times a year, and fact sheets are published when needed to provide more detail on specific activities and at major milestones in the environmental restoration process at Homestead AFB.

The public has access to current and historical information about environmental restoration activities at Homestead AFB through the Information Repository located at Homestead AFB. Included in the repository are technical documents such as investigation and remedial action reports, work plans, and RAB meeting minutes and handouts.

The USAF has kept the public informed of and involved in the decision-making process for environmental restoration activities at OUs 18, 26, 28, and 29 through the RAB, newsletters, and fact sheets. Additionally, a Proposed Plan was distributed in (***to be completed***) that detailed site investigations and the preferred remedial alternatives for the OUs. There was a thirty-day public comment period during which the public had the opportunity to review the decisions and submit comments and concerns. A public meeting was also held on (***to be completed***) to present the site investigation and preferred remedial alternatives. Submitted comments from the Proposed Plan public comment period and public meeting are addressed in the Responsiveness Summary, Section 7.0 of this ROD.

4.0 SCOPE AND ROLES OF THE RESPONSE ACTION

An RFA was completed in 1994 which identified the four sites discussed in this ROD for investigation either as part of the Confirmation Sampling Program and/or Base UST/OWS Remediation Program. Based on the initial investigation, these sites were designated as OUs, and an RI and Feasibility Study (FS) was completed for OU18, OU26, OU28, and OU29 under CERCLA. To date, 31 OUs and 2 areas of concern have been designated as PSCs to be investigated. In general, the investigation of the sites have been conducted independently of each other.

This ROD addresses remedial actions for four OUs:

- OU 18 - (Soil/Sediment Contamination)
- OU 26 - (Groundwater and Soil Contamination)
- OU 28 - (Soil Contamination)
- OU 29 - (Soil Contamination)

Contaminated soils at OUs 18, 26, 28 and 29 pose the principal threat to human health and the environment due to potential risks from ingestion or dermal contact with contaminants in the soils. In addition, there is a potential threat of soil contamination migrating into the underlying groundwater.

Contaminated groundwater at OU26 also poses a principal threat to human health. The identified potential risk is associated with construction worker dermal contact with trichloroethene (TCE) in groundwater.

The purpose of this response (e.g., the proposed remedial actions described in Section 6.0) is to prevent risks associated with current or future exposure to the contaminated soils and groundwater, and to be protective of human health and the environment.

5.0 SUMMARY OF SITE CHARACTERISTICS

The following sections describe known or suspected contamination, location(s) of potential contamination, and potential routes of contaminant migration for OUs 18, 26, 28, and 29.

5.1 INVESTIGATION SUMMARY

5.1.1 OU18 - Old Contractor Storage Area and Former Construction Debris Landfill

Confirmation Sampling and an RI were completed at OU18. The following sections summarize the results of each activity.

5.1.1.1 Confirmation Sampling

A preliminary investigation was completed at OU18 as part of the Confirmation Sampling Program in 1994 (W-C 1996a). Investigative activities included collection of surface soil samples, subsurface soil samples, and groundwater samples (Figure 5-1).

Sampling at OU18 indicated no significant VOC contamination in the groundwater, surface soil or subsurface. Polynuclear aromatic hydrocarbons (PAHs) were, however, detected at significant levels in the surface soils, and at less significant concentrations in the subsurface and groundwater. Total PAH concentrations ranged from 1,074 mg/kg to 2,291 mg/kg in the surface soil, with detections in the subsurface samples generally being one to two orders of magnitude lower. Total PAHs concentrations in the groundwater were reported at 17 µg/L and 42 µg/L. Pesticides and various inorganic compounds (including cyanide and metals) were also detected in the surface soil, subsurface and groundwater samples. In particular, arsenic was detected above the FDEP industrial soil cleanup goal (10 mg/kg) in the subsurface at a concentration of 26 mg/kg.

5.1.1.2 Remedial Investigation

Surface soil samples collected during the RI confirmed that relatively high concentrations of total PAHs (up to 567.2 mg/kg) are present in areas most likely to receive site runoff. Subsurface soil samples collected during the Confirmation Sampling indicated that relatively high concentrations of total PAHs and individual pesticides are present in the site subsurface, mainly in the northeastern portion of the site where the thickness of crushed asphalt, mixed with fill soils, was observed to be greatest. Subsurface samples from RI soil borings showed relatively low concentrations of VOCs, total PAHs, individual semivolatile organic compounds (SVOCs) and pesticides in subsurface throughout the site (see Figures 5-2 and 5-3). Sixteen metals were detected above the background concentrations.

Groundwater sampling from wells installed during Confirmation Sampling and the RI indicated that relatively low concentrations of total PAHs, individual SVOCs, and pesticides are present in site groundwater. Benzo(a)pyrene was detected above the FDEP groundwater guidance criteria in one RI groundwater sample. All other analytes were reported below FDEP groundwater guidance criteria.

RI surface water and sediment sampling upstream, adjacent to, and downstream of the site in the Boundary Canal indicated no contamination above the FDEP Class III freshwater guidance criteria for the surface water. In sediment, PAHs, SVOCs, and pesticides were detected with the highest concentrations in samples adjacent to the site. The detections of PAHs in the sediment adjacent to the site are expected since crushed asphalt from the site surface was observed to be sloughing into the canal along the western portion of the site. Relatively high concentrations of arsenic, up to 21.4 mg/kg, were also reported in sediment samples.

5.1.1.3 Contamination Summary

The following discussion summarizes media impacted by contaminants potentially associated with OU18:

- **Surface Soils** - Surface soils, primarily along the southern edge of the site, contain concentrations of several individual PAH compounds that exceed the FDEP industrial soil cleanup goals. These samples are located in areas most likely to receive runoff from the site and are considered to be accumulation areas. Two pesticides, aldrin and heptachlor epoxide, exceeded their respective FDEP industrial soil cleanup goals in four surface soil samples.

- **Subsurface Samples** - Subsurface samples had reported concentrations of PAH compounds that exceeded their respective FDEP industrial soil cleanup goals. The PAH detections at depth are consistent with the presence of crushed asphalt, mixed with sand and gravel, observed to a depth of 11-feet in this area of the site. Beryllium marginally exceeded its FDEP industrial soil cleanup goal in one of the subsurface samples.

- **Groundwater** - Benzo(a)pyrene was detected above the FDEP groundwater criteria in one RI sample. All other detected analytes were reported at concentrations below the groundwater guidance criteria.

- **Sediment** - PAHs and arsenic were detected in sediment. The PAHs are likely due to crushed asphalt, a source of PAHs, observed in the sediment. Sediment samples collected downgradient of the site had reported concentrations of contaminants that were one to two orders of magnitude lower than samples adjacent to the site.

- **Surface Water** - Contaminants detected in surface water did not exceed the FDEP Class III freshwater guidance criteria.

5.1.2 OU26 - Building 745, Aircraft Fabrication

Confirmation Sampling, a UST investigation, Interim Removal Actions (IRAs), and an RI were completed at OU26. The following sections summarize the results of each activity.

5.1.2.1 Confirmation Sampling

Confirmation Sampling groundwater and subsurface samples (W-C 1996a) indicated the presence of significant levels of halogenated VOCs (cis-DCE, 1,2-DCE, PCE, TCE, and vinyl chloride) as shown on Figure 5-4. In surface soil samples, PAHs, pesticides, and polychlorinated biphenyls (PCBs) were detected. The total PAH concentrations ranged from 2.02 mg/kg to 24.62 mg/kg. Aroclor-1254 was detected at 1,400 µg/kg, and 4,4′-DDD, 4,4′-DDE, 4,4′-DDT, aldrin, endrin ketone, and heptachlor epoxide were detected at concentrations ranging from 0.5 µg/kg to 25 µg/kg. Eleven metals were detected above background concentrations including: arsenic at 123 mg/kg, chromium at 86 mg/kg, and lead at 506 mg/kg.

5.1.2.2 UST Investigation

The two steel USTs northeast of Building 746 were removed by OHM Corp. in 1994. The soils were excavated, with sidewall samples being field-screened for organic vapors, until all field-screening results were below 10 parts per million (ppm). Five monitoring wells sampled in the area showed low concentrations of cis/trans-1,2-DCE and TCE.

5.1.2.3 Interim Removal Action Activities

IRAs were completed concurrently with the RI activities to remove arsenic and PCB surface soil contamination detected at the southeast corner of Building 745, and at the location of the flammable locker immediately southwest of Building 746. Concentrations of arsenic which exceed the FDEP industrial soil cleanup goal were left in the excavation sidewalls due to the inability to excavate under the building foundation. Monitoring wells were also installed and sampled in the center of the excavations. PCBs were nondetect in the groundwater. For the monitoring well installed in the excavation area near the corner of Building 745, arsenic was detected at a concentration of 190 µg/L. OHM reported that the IRAs were complete and no further action was required.

Tracer studies were also done to determine the discharge points of floor drains located within Building 745. The tracer study indicated that pipes within the building were discharging

directly to the canal northeast of Building 745, and also indicated the location of a sump discharge at the southeast corner of the building. Sediment and soil samples (collected above the water line) in the canal were collected at each discharge point, and the contents of the sump were sampled. Relatively high levels of VOCs were detected in the canal sediments collected where the floor drains discharged to the canal. Additionally, PAHs were detected in the sediment at the discharge points and in the sample of sludge collected from the sump within the piping system. The floor drain system was subsequently plugged and is no longer in use.

5.1.2.4 Remedial Investigation

Surface soil samples collected from RI soil borings showed low concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds in some samples, in addition to total PAHs, individual SVOCs, and individual pesticides. Fourteen metals were detected above background concentrations in the RI surface soil samples. Mercury and lead were detected above FDEP industrial soil cleanup goals in an isolated area south of Building 745 near the former lead-acid battery storage room (Figures 5-5 and 5-6).

Subsurface samples from RI soil borings west of Building 745 showed low concentrations of the same chlorinated VOCs which were detected in the same area during Confirmation Sampling. Nine metals were detected above background concentrations in the RI subsurface samples. However, all detections from the subsurface samples were below FDEP industrial soil cleanup goals.

Groundwater screening throughout the site during Confirmation Sampling and the RI indicated that significant concentrations of chlorinated VOCs are present in site groundwater, particularly west of Building 745. Groundwater sampling from monitoring wells in this area indicated that relatively high maximum concentrations of TCE (1,600 µg/L), PCE (3 µg/L), 1,2-DCE (470 µg/L), and vinyl chloride (7 µg/L) are present in the area of maximum detections from the groundwater screening. These maximum concentrations occur in shallow well SM60-MW1. The most likely source of the VOCs is historic leakage from the underground pipe connected to the floor drain system. The groundwater screening results indicated that the VOC plume does not extend to the canal adjacent to the site.

A deep monitoring well was installed adjacent to the shallow well with the highest chlorinated VOC concentrations. This deep well was sampled during the RI and showed a reported TCE concentration of 5 µg/L. The groundwater contaminants that were reported above the FDEP groundwater guidance criteria are shown on Figure 5-6.

Surface water and sediment samples were collected in the adjacent canal upstream, adjacent to, and downstream of the floor drain and sump discharge points. The highest concentrations of contaminants were in sediment and surface water at the industrial floor drain discharge point. Elevated concentrations of chlorobenzene and BTEX were the primary contaminants found in sediment at this location. Low concentrations of these compounds were detected in surface water at this location and the sampling location immediately downstream. Elevated concentrations of SVOCs were also detected in this sample and in upstream and downstream sediment samples. Several pesticides were detected in all sediment samples at relatively high concentrations. Several metals were detected above background concentrations in sediment and surface water samples. However, all contaminants reported in surface water were below the FDEP Class III freshwater guidance criteria.

5.1.2.5 Contamination Summary

The following discussion summarizes media impacted by contaminant releases associated with OU 26:

- **Surface Soils** - Surface soils near the southwestern and eastern portions of Building 745, and at the southern corner of Building 746, contain concentrations of one PAH and three metals that exceed the FDEP industrial soil cleanup goals. One sample had reported concentrations of lead and mercury that exceeded their respective FDEP industrial soil cleanup goals. This area is located adjacent to a part of Building 745 that was used for lead-acid battery storage, which may explain the presence of these metals. Concentrations of arsenic from two soil boring surface soil samples exceeded the 10 mg/kg FDEP industrial soil cleanup goal. These samples were located in the area where the IRA was completed to remove arsenic reported during

Confirmation Sampling. Benzo(a)pyrene marginally exceeded the FDEP industrial soil cleanup goal in two surface soil samples.

- **Subsurface** - No contaminants were detected in subsurface samples above respective FDEP industrial soil cleanup goals.

- **Groundwater** - Chlorinated VOCs were reported at concentrations exceeding FDEP groundwater guidance criteria and/or federal maximum contaminant limits (MCLs) in three of the site monitoring wells sampled during the RI. TCE, 1,2-DCE, and PCE were reported in monitoring wells SM60-MW1 and OU26-MW1D at elevated concentrations. Vinyl chloride was also detected in monitoring well SM60-MW1. The high concentrations of chlorinated VOCs reported in shallow monitoring well SM60-MW1 are consistent with leakage from the floor drain discharge line which exits Building 745 near the monitoring well location.

- **Sediment** - Contaminants in sediment included: 1,4-dichlorobenzene, PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3)pyrene), arsenic, and lead. 1,4-Dichlorobenzene was reported only in the sediment sample at the discharge point for the floor drain discharge line (SD-04). The highest concentration of arsenic was reported at the furthest downgradient location (SD-01). Lead was reported at relatively high concentrations in three of six samples. All three samples are located adjacent to Building 745 in the area where the floor drain and sump discharged to the canal.

- **Surface Water** - Lead was reported at a maximum concentration of 44.7 µg/L in the surface water at the site. None of the contaminants reported in surface water exceeded the FDEP Class III freshwater guidance criteria.

5.1.3 OU28 - Building 750, Propulsion (Engine) Maintenance Facility

An OWS and sump investigation, UST investigation, and an RI were completed at OU28. The following sections summarize the results of each activity.

5.1.3.1 UST/OWS Investigations

Preliminary investigations at OU28 were completed as part of the Base UST/OWS Remediation Program. The five electroplating USTs northwest of Building 750 and the OWS and sump southeast of Building 750 were removed.

OWS and Sump Investigation

The OWS and sump were removed in 1994. At this time the floor drains in the building and on the concrete pad were grouted. The sump and separator were removed and were found to be constructed of concrete. A groundwater and subsurface investigation was completed at the sump/separator area in 1994 based on the results of the excavation work. PCE, TCE, PAHs, and metals were detected in the groundwater during the investigation.

Additionally, an effluent discharge investigation was completed to confirm the separator and sump discharge points. The results of the investigation confirmed that the buried pipe between the separator and sump did discharge to a drainage swale to the southeast. Sampling at the discharge point showed detections of PAHs, TRPH, arsenic, and cadmium.

Underground Storage Tanks 750-1, 2, 3, and 4 Investigation

Four concrete USTs formerly located at the northwest corner of Building 750 were removed in 1994. Influent piping was grouted in-place at the excavation boundary. Excavation sidewall and soil boring samples were collected for analysis. No VOCs were detected and metals concentrations were below the established cleanup standard. The borings were completed as shallow monitoring wells.

Sampling of the monitoring wells indicated no VOC or cyanide contamination in groundwater. Additionally, detected metals, except for lead. were below their respective

maximum contaminant levels (MCLs). From the investigation it was concluded that there was no evidence of a discharge from the USTs to surrounding site media.

5.1.3.2 Remedial Investigation

In the southern, eastern, and northern portions of Site OU28, PAHs, pesticides, and metals (lead and arsenic) were reported as concentrations that exceed the FDEP industrial soil cleanup goals (Figures 5-7 and 5-8). PAH exceedances were reported primarily in surface soil samples near the eastern and northern portions of Building 750. However, some marginal exceedances of benzo(a)pyrene and benzo(a) anthracene were reported in surface soil samples south of Building 750 near the AST (Building 744). Lead and arsenic were detected above FDEP soil cleanup goals in surface soil surrounding the AST (Building 744). Maximum concentrations detected were 20,200 mg/kg and 23.6 mg/kg, respectively. A possible explanation for the high lead concentrations is lead-based paint flaking from the AST. Lead also exceeded the FDEP industrial soil cleanup goal in one surface soil sample near the eastern corner of Building 750. One pesticide, heptachlor epoxide, was reported at a concentration marginally exceeding the FDEP industrial soil cleanup goal in a surface soil sample collected east of Building 750.

Subsurface sampling indicated low levels of VOCs, PAHs, and metals. However, reported concentrations were below the FDEP soil cleanup goals.

Groundwater sampling indicated chlorinated VOCs (TCE, PCE, and 1,2-DCE) are present above FDEP groundwater guidance criteria and/or federal MCLs. The groundwater sampling indicates that the extent of contamination is confined to the former OWS area. Additionally, metals were detected below FDEP groundwater guidance criteria and federal MCLs. Iron did, however, exceed the FDEP secondary water quality standard.

5.1.3.3 Contamination Summary

The following discussion summarizes media impacted by contaminant releases associated with OU 28:

- **Surface Soils** - PAHs exceeded FDEP industrial soil cleanup goals near the southern, eastern and northern portions of Building 750. Additionally, lead and arsenic exceeded the FDEP industrial soil cleanup goals in the surface soils surrounding the large upright AST. Lead also exceeded the FDEP industrial soil cleanup goals in surface soil near the eastern corner of Building 750.

- **Subsurface Samples** - Subsurface sampling indicated low levels of VOCs, PAHs, and metals. Concentrations of the contaminants were below FDEP industrial soil cleanup goals.

- **Groundwater** - Chlorinated VOCs (including TCE) were reported at concentrations exceeding the FDEP groundwater guidance criteria and/or federal MCLs. Groundwater samples with VOC concentrations that exceeded applicable criteria were located in the area of the removed OWS.

5.1.4 OU29 - Building 760, Avionics Aerospace Ground Equipment Shop and Tactical Electronic Warfare System Shop

An OWS removal and investigation, UST investigation, and an RI were completed at OU29. The following sections summarize the results of each activity.

5.1.4.1 UST/OWS Investigations

Preliminary investigations at site OU29 included investigation and removal of the USTs and OWSs at the site.

OWS Removal and Investigation

The OWS was removed in 1994, and the influent and effluent piping were sealed at the excavation boundaries. Subsurface samples of target compounds were reported as either nondetect or below FDEP industrial soil cleanup goals. Groundwater sampling indicated contamination with TCE, PCE, and vinyl chloride.

UST No. 760-1 Investigation

In 1994, the UST was excavated and removed. Subsurface investigation of the UST area showed detections of total recoverable petroleum hydrocarbons (TRPH) and lead. TRPH was reported at concentrations below the acceptable FDEP clean soil criteria. Results of the subsequent groundwater investigation indicated the presence of chlorobenzene, benzene, 1,4-dichlorobenzene, and naphthalenes. Concentrations of benzene and chlorobenzene exceeded the FDEP groundwater guidance criteria and/or the federal MCL. Resampling in 1996 indicated that these contaminants no longer exceeded the stated criteria.

5.1.4.2 Remedial Investigation

Surface soils near the southern, eastern, and northern portions of former Building 760 contained concentrations of PAHs and one pesticide (heptachlor epoxide) that exceeded the FDEP industrial soil cleanup goals (Figures 5-9 and 5-10). Additionally, a marginal exceedance of benzo(a)pyrene was reported in the surface soil sample north of former Building 760. The locations of the surface soils with PAH concentrations that exceeded cleanup goals are consistent with areas that would have received runoff from the site.

Subsurface samples collected from borings near the former OWS excavation indicated that relatively low concentrations of BTEX, PAHs, and pesticides are present. Thirteen metals were reported above background concentrations in the subsurface samples. However, detected analytes were reported below the FDEP industrial soil cleanup goals.

The groundwater screening indicated that significant concentrations of BTEX and chlorinated VOCs were present in the area of the former OWS. Groundwater samples from existing monitoring wells near the center of the former OWS excavation area contained concentrations of TCE, 1,2-DCE, and vinyl chloride which exceeded the FDEP groundwater guidance criteria and/or federal MCLs.

5.1.4.3 Contamination Summary

The following discussion summarizes media impacted by contaminant releases associated with OU29:

- **Surface Soils** - PAHs and heptachlor epoxide exceeded FDEP industrial soil cleanup goals near the eastern, southern, and northern portions of former Building 760. The locations of the surface soil with PAH concentrations exceeding FDEP industrial soil cleanup goals are consistent with areas that would have received runoff from the site.

- **Subsurface Samples** - Contaminants detected in the subsurface were reported below the FDEP industrial soil cleanup goals.

- **Groundwater** - Chlorinated VOCs (including TCE) were reported at concentrations exceeding the FDEP groundwater guidance criteria and/or federal MCLs. Groundwater sampling results indicated that contamination is concentrated in the area of the removed OWS and has not migrated from this area.

5.2 CONTAMINANT FATE AND TRANSPORT

Contaminant fate and transport modeling was completed as part of the RI to evaluate the potential for site-related COPCs in groundwater to be transported to nearby surface water in the Base canal system. This activity included evaluating contaminant migration mechanisms; characteristics of the contaminant; and the relationship between groundwater and surface water in the canal system.

Volatilization to the atmosphere and adsorption to soil are the dominant fate processes for organic compounds detected in soils. VOCs are highly volatile, while PAHs and pesticides are moderately mobile. Metals are not volatile and are expected to remain absorbed to soil. Volatile organic compounds detected in groundwater are generally considered mobile and are susceptible to movement through the groundwater. PAHs and pesticides are generally not mobile in groundwater. Additionally, metals are not considered to be mobile in groundwater.

Modeling of fate and transport of contaminants in the groundwater indicated that contaminants will not travel the estimated 30 to 1,000 feet to the nearest canals at

concentrations above the EPA Region III Risk-Based Concentrations (RBCs) or FDEP groundwater guidance concentrations at any of the sites (W-C 1997a).

5.3 BASELINE RISK ASSESSMENT(BRA)

A BRA was completed to assess the potential impacts to human health and the environment associated with current or future exposures to chemicals of potential concern (COPCs) present at the sites. The results of the risk assessment were used to:

- Estimate the magnitude of potential human health and environmental risk associated with site-related chemicals
- Identify the primary contaminants contributing to the risk
- Assess whether corrective action was warranted at the site
- Help support the decision whether to remediate and, if necessary, select a remedial alternative

5.3.1 Human Health

The steps in the BRA process are:

1. Selection of COPCs
2. Exposure assessment
3. Calculation of exposure point concentrations
4. Estimating chemical intakes
5. Toxicity assessment
6. Risk characterization

5.3.1.1 Selection of Contaminants of Potential Concern (COPCs)

COPCs considered for the OUs were chemicals that may have been released from waste sources at the site; were detected in surface soil, subsurface rock/fill, sediment, surface water, and/or groundwater at the sites; and may be significant contributors to human health risks.

COPCs for each site were selected using the following screening criteria:

- Chemical data evaluation: Data were considered usable for risk assessment purposes if the data were unqualified or were estimated ("J" qualifier). Rejected data were not used in the risk assessment. Chemicals that can be attributed to laboratory or field contamination were not considered COPCs.

- Detection frequency: Chemicals that were detected infrequently (e.g., approximately 5 percent or less) and did not exceed human health screening values were not considered COPCs.

- Essential nutrients: Essential nutrients (i.e., calcium, iron, magnesium, potassium, and sodium) which did not exceed recommended daily allowances (RDAs) were not considered COPCs.

- Background: Chemicals that were detected at concentrations within background levels were not considered COPCs. Site chemicals (i.e., inorganic chemicals in all media and PAHs and pesticides in surface soil and surface water) were considered to be significantly above background if the maximum concentration detected at the site exceeded two times the mean of the background concentrations.

- Comparison to human health screening values: Chemicals that were detected at concentrations below human health-based screening levels for residential exposures at target risk levels of 1×10^{-6} for carcinogens and 0.1 for noncarcinogens were not considered COPCs in accordance with EPA Region IV guidance (EPA 1995b). Maximum detected concentrations at a site were compared to EPA RBCs (EPA 1995a), FDEP cleanup goals (FDEP 1994,

1995), and DERM cleanup goals (DERM 1995), where available. If the maximum detected concentration exceeded the lowest (i.e., most conservative) screening value, the chemical was considered to be a COPC.

- Other considerations: According to EPA Region IV guidance (EPA 1995b), any chemical eliminated as a COPC by any of the above criteria should be included in the BRA if it is a parent compound or transformation product of any other chemical that was retained as a COPC. Any chemicals with detection limits above RBCs should be retained as COPCs. Also, any member of a chemical class (e.g., carcinogenic PAHs) that has other members selected as COPCs should be retained in the BRA.

- Availability of EPA toxicity criteria: Chemicals that do not have EPA-established toxicity factors, but that could potentially contribute to risks (e.g., lead) were considered COPCs. These chemicals could not be evaluated quantitatively in the risk assessment; however, their potential impacts to site risks were evaluated qualitatively.

The COPCs identified in the human health risk assessment for OUs 18, 26, 28, and 29 are summarized in Table 5-1. It should be noted that in previous sections of this ROD, site media have been referred to as surface soil and subsurface soil and subsurface limestone rock. In the human health BRA, exposure media were surface soil and total soils (which includes surface soil and subsurface limestone rock). The total soils designation is applicable for potential exposure patterns of construction workers, who are assumed to come in contact with the entire soil column during excavation activities. Therefore, the term total soils was used for the selection of COPCs and the human health BRA.

5.3.1.2 Exposure Assessment

For this risk assessment, the exposure assessment involved determining intake factors for each respective receptor which resulted in estimates of both average and the reasonable maximum exposure (RME). Average exposure variables represent the most likely estimates

of exposure for an individual with normal activity patterns. RME exposure variables represent the highest exposure that would reasonably be expected to occur at a site.

Potentially Exposed Populations

Potential health risks were evaluated for all present and potential future on-site receptors based on present and reasonable future land uses. Receptors evaluated for each site included occupational workers, nonresident recreational adults/trespassers, and hypothetical future construction workers.

Potential receptors for site-related chemicals and the potentially complete pathways through which they might be exposed are summarized below:

Occupational Receptors

- Incidental ingestion of surface soil and surface water
- Dermal contact with surface soil and surface water
- Inhalation of airborne particulate matter from surface soil and volatile emissions from surface water

Hypothetical Future Construction Workers

- Incidental ingestion of total soil, sediment, groundwater, and surface water
- Dermal contact with total soil, sediment, groundwater, and surface water
- Inhalation of airborne particulate matter from total soil and sediments; inhalation of volatile emissions from sediments, groundwater, and surface water

Nonresident Adult Recreational Receptor/Trespasser

- Incidental ingestion of surface soil and surface water
- Dermal contact with surface soil and surface water
- Inhalation of airborne particulate matter from surface soil and volatile emissions from surface water

5.3.1.3 Exposure Point Concentrations

Soil, Sediment, Surface Water, and Groundwater

For each COPC detected in surface soil, total soil, sediment, surface water, and groundwater samples, the arithmetic mean and 95 percent upper confidence limit (UCL) of the mean concentrations (based on assumed lognormal distribution) were calculated using analytical results. In accordance with EPA guidance (EPA 1989), the RME concentration is either the 95 percent upper confidence limit on the mean or the maximum detected concentration, whichever is lower. If the data set was composed of six or fewer samples, the maximum detected concentration was used as the RME value.

In calculating exposure point concentrations in the risk assessment, one-half the sample reporting limits (RLs) were used to represent the concentration of COPCs that were not detected (ND) in a particular sample, but that were detected in at least one other sample in the set. However, according to EPA guidance (EPA 1989), one-half the RL for a given nondetect sample was not used if it caused the calculated average concentration to exceed the maximum detected concentration in that sample set.

In accordance with EPA Region IV guidance (EPA, 1995b), the exposure point concentrations of carcinogenic PAHs in each medium were adjusted by their respective toxicity equivalency factors (TEFs) relative to benzo(a)pyrene. Calculated average and RME concentrations of the carcinogenic PAHs were converted to equivalent concentrations of benzo(a)pyrene by multiplying by the appropriate TEFs.

Exposure point concentrations used to evaluate dermal soil, sediment, surface water, and groundwater contact were adjusted to account for the percentage of dermal absorption. The dermal adjusted concentrations were calculated by multiplying the average and RME concentrations by the absorbed fraction (surface soil, total soils, and sediments) or the permeability coefficient (surface water and groundwater).

Air

Screening-level air emissions and dispersion models recommended in EPA's Soil Screening Guidance (EPA 1996) were used to estimate concentrations of airborne volatile and particulate emissions of COPCs from surface soil, total soil, and sediments. The modeled air concentrations were used to estimate occupational worker, construction worker, and recreational/trespasser exposures to these media via inhalation.

An EPA box model (EPA 1988) was used to estimate volatile emissions from groundwater to evaluate construction worker exposures to shallow groundwater (in excavation trenches) if hypothetical future excavations intercept the water table. Volatile emissions from surface water were also estimated, using the same model, for occupational worker, construction worker, and recreational/trespasser exposures.

5.3.1.4 Estimating Chemical Intakes

Using the exposure point concentrations of COPCs in soils, sediment, surface water, and groundwater, the potential human intake of those chemicals via each exposure pathway was estimated. Intakes are expressed in terms of milligrams of chemical per kilogram of body weight per day (mg/kg-day). Intakes were estimated using reasonable estimates of body size, inhalation rates, ingestion rates, dermal absorption rates, soil matrix effects, and frequency and duration of exposure. Intakes were estimated for both average and RME conditions.

The general equation for calculating intake in terms of mg/(kg-day) is (EPA 1989):

$$intake = \frac{chemical\ conc. * contact\ rate * exposure\ frequency * exposure\ duration}{body\ weight * averaging\ time}$$

Omitting chemical concentrations from the intake equation yields a pathway-specific "intake factor (in mg/kg-day per unit media concentrations)". Since the exposure pattern resulting in exposure to various COPCs is the same, the intake factor (IF) can be calculated by multiplying it by the concentration of each chemical to obtain the pathway-specific intake of that chemical. Intake factors were calculated separately for each receptor and exposure pathway.

5.3.1.5 Toxicity Assessment

EPA toxicity factors were used to assess potential health risks resulting from the estimated chemical intakes. Toxicity factors are expressed either as a reference dose (RfD) or a slope factor (SF). The RfD is the daily dose of a noncarcinogen that is unlikely to result in toxic effects to humans over a lifetime of exposure. SFs and the EPA weight-of-evidence classification are used to estimate potential carcinogenic risks. The SF is used to estimate the upper-bound probability of an individual developing cancer as a result of exposure to a potential carcinogen. The weight-of-evidence classification is an evaluation of the quality and quantity of carcinogenic potency data for a given chemical.

5.3.1.6 Risk Characterization

Risk characterization combines the outputs of the exposure and toxicity assessments to develop quantitative estimates of risks associated with assumed exposures to noncarcinogenic and carcinogenic COPCs released from the site. Both average and RME risks were calculated for each site.

Noncarcinogenic Risks

The potential for noncarcinogenic effects was characterized by comparing estimated chemical intakes with chemical-specific RfDs. Chemical intake is the chemical concentration in the exposure medium multiplied by the pathway-specific intake factor. The ratio of the estimated intake to the RfD is called a hazard quotient (HQ), which was calculated as follows (EPA 1989):

$$Noncancer\ Hazard\ Quotient = \frac{Chemical\ Intake\ (mg\ /\ kg - day)}{RfD\ (mg\ /\ kg - day)}$$

For each receptor category (i.e., occupational workers, future construction workers, and recreational receptors/trespasser), HQs were summed for all chemical intakes and all relevant exposure pathways to yield a total hazard index (HI). An HI equal to or less than 1 indicates that adverse noncarcinogenic health effects are not expected to occur even to sensitive individuals over a lifetime of exposure. An HI above 1 indicates a potential cause for concern for noncarcinogenic health effects and the need for further evaluation of assumptions about exposure and toxicity (for example, effects of several different chemicals are not necessarily additive, although the HI approach assumes additivity).

The HI provides a rough measure of potential toxicity, but it is conservative and dependent on the quality of the experimental evidence. Since the HI does not define dose-response relationships, its numerical value cannot be construed as a direct estimate of the magnitude of risk (EPA 1986a). The HIs calculated for receptors at sites OU18 through OU29 are summarized in Table 5-2.

Carcinogenic Risks

Potential carcinogenic effects are characterized in terms of the excess probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. Excess probability means the increased probability over and above the normal probability of getting cancer (i.e., background risk), which in the United States is 1 in 3 (American Cancer Society 1990). Excess lifetime cancer risks were calculated by multiplying the average daily chemical intake by the cancer SF (EPA 1989), which is the risk per unit chemical intake:

$$Risk = chemical\ intake\ (mg\ /\ kg\ -\ day)\ x\ SF\ (mg\ /\ kg\ -\ day)^{-1}$$

For each receptor category at each site, cancer risks were calculated separately for each carcinogen and each exposure pathway, and the resulting risks were summed to yield a total upper-bound estimate of cancer risk due to multiple exposures. This is a conservative

approach that can result in an artificially elevated estimate of cancer risk, especially if several carcinogens are present (EPA 1986b).

The following guidance was considered in order to interpret the significance of the cancer risk estimates. In the NCP (EPA 1990), EPA states that: "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 1×10^{-4} and 1×10^{-6}." These values are equivalent to a 1 in 10,000 to 1 in 1,000,000 chance of getting cancer from the exposure. DERM however strives to attain risk levels at or below the 10^{-6} level. These risk levels are extremely low and would not be measurable or discernible (compared to the background cancer risk of 1 in 3) in individuals or even in a large population. For example, a risk level of 1 in 10,000 (1×10^{-4}) would increase an individual's chance of getting cancer from the background risk of 1 in 3 to 1.0001 in 3. The excess cancer risks (average and RME) for the various receptors at OU18 through OU29 are summarized in Table 5-2.

Qualitative Assessment of Exposures to Lead

Lead exposures were not addressed in the quantitative risk assessment because EPA withdrew the RfD for lead in 1989, primarily due to the lack of a discernible threshold dose and the numerous sources of lead in the environment. Current EPA guidance (EPA, 1994b) recommends an interim soil lead concentration of 400 mg/kg for sites characterized as residential. Additionally, FDEP has a soil cleanup goal of 1,000 mg/kg for industrial sites (FDEP 1995).

Lead was detected at OU26 and OU28 at concentrations that exceeded the FDEP cleanup goal of 1,000 mg/kg for industrial exposures. At OU26, lead was detected in the surface soil hot spot sample at a concentration of 2,210 mg/kg. At OU28, lead was detected in five surface soil concentrations ranging from 1,230 mg/kg to 20, 200 mg/kg.

5.3.2 Ecological Risk Assessment

The objective of the ecological risk assessment component of the BRA is to estimate the potential ecological risk associated with the exposure of identified receptor populations and

communities to COPCs. Procedures and the methods used for the performance of the ecological evaluation of the OUs are provided in the Final RI Report (W-C 1997a). The focus for the evaluations is on those ecological receptors identified as potentially utilizing the unit (transients) and not necessarily those restricted to the unit (residents).

The scope of the ecological risk assessment included:

- Evaluation of the ecological habitat and identification of receptor species including any rare, threatened or endangered species or critical habitats
- Identification of the chemicals of potential ecological concern and existing exposure pathways
- Estimation of the ecological effects (i.e., toxicity) of the COPCs and qualitative characterization of the nature and extent of ecological risk or threat

5.3.2.1 Ecological Habitat Review

OU18

Thick stands of cane-elephant grass and silk reed canes (*Pennisetum purpureum* and *Neyraudia reynaudiana*) cover the perimeter of the site and heavy infestations of Brazilian Pepper (*Schinus terebinthifolius*) are located along the northeast perimeter. The interior of the site contains a mixed pattern of cane, overgrown weedy areas, and barren, crushed asphalt areas. This unit has been characterized as Cane Brake/Thicket based on the vegetative cover present and appears to be capable of supporting a viable ecological community (i.e., the unit contains exploitable habitat). Both aquatic and terrestrial communities were identified for OU18.

OU26

This unit has been characterized as Urban Grassland based on the vegetative cover present and appears to be incapable of supporting even a small viable terrestrial community. Although OU26 contains no exploitable terrestrial habitat, the small drainage canal (a

100-foot length within OU26) may provide forage for ecological receptors. Wading birds were observed as were small fish within the canal. Thus, semi-aquatic and aquatic ecological communities are identified as potentially present within OU26. Potential ecological receptors were identified based on the character of the canal community and on the potential trophic relationship among those organisms either predicted or observed within the OU26 drainage canal

Except for birds (loggerhead shrikes, mockingbirds, and doves) roosting on powerlines at the site and insects, no other animal groups were observed in the unit during the activities in January and February, 1996. However, wading birds (great blue heron, little blue heron, and yellow-crowned night heron), turtles (unidentified), and small fish (unidentified) were observed in the drainage canal along the northeast edge of OU26.

OU28

This unit has been characterized as Urban Grassland based on the vegetative cover present and appears to be capable of supporting a small but viable ecological community; i.e., contains exploitable habitat. Although OU28 is in close proximity to Boundary Canal, there is no waterway for access to the terrestrial grassland sections, and overland migrations are highly unlikely due to the barrier Bikini Boulevard presents. Thus, only a terrestrial ecological community was identified as being present within OU28. Potential terrestrial ecological receptors were identified based on the character of the vegetative community, the unavailability of water, and the potential trophic relationship among those organisms either predicted or observed within the unit. Fauna observed at OU28 during RI/SI activities in January and February 1996 were limited to birds (doves, loggerhead shrikes, kestrels, and meadowlarks), anoles (lizards), and insects.

OU29

OU29 is classified as an Urban Grassland, but it differs from the other Urban Grassland units by containing ornamental trees and shrubs and not having an abandoned building. Given the presence of trees and shrubbery, arboreal community components (e.g., the tree frogs, exotic anoles, squirrels, birds) could be found within the tree line less than 50 feet from the canal.

OU29 appears to be capable of supporting a small but viable ecological community; i.e., contains exploitable habitat.

Only a terrestrial ecological community was identified as being present within OU29. Potential terrestrial ecological receptors were identified based on the character of the vegetative community, the availability of water, and on the potential trophic relationship among those organisms either predicted or observed within the unit.

Summary of Ecological Habitats

In the ecological risk assessment, habitats at each site were observed to determine potential receptors that could be exposed to site contaminants. The table below summarizes the habitat and ecological receptors identified at each site which could potentially be impacted directly through inhalation, ingestion, skin contact, or directly through ingestion of contaminants in the food chain.

Ecological Habitat

Operable Unit	Characterization	Receptors
OU18	Cane Brake/Thicket with a viable ecological community	Terrestrial and Aquatic (e.g. alligators, coot, marsh wren, small fish, turtles, raccoon)
OU 26	Urban Grassland incapable of supporting a viable terrestrial community. Able though to support an aquatic community based on the location of canals at the site	Aquatic (e.g. marsh wren, small fish, turtles, raccoon)
OU28	Urban Grassland capable of supporting a small but viable terrestrial community	Terrestrial (e.g. American robin, dove, mouse, shrew, opossum)
OU29	Urban Grassland with ornamental trees capable of supporting a small but viable terrestrial community	Terrestrial (e.g. American robin, dove, mouse, shrew, opossum)

5.3.2.2 Chemicals of Potential Ecological Concern (COPECs)

Chemicals of interest (COI) were identified based on consideration of unit-specific analytical data, analytical data from adjacent areas and background for the chemicals, unit-specific waste management activity information, and waste management activity information from

adjacent areas. Chemicals detected in surface soil, surface water, and sediments were screened against ecotoxicological benchmarks.

If a COI exceeded both the background concentration and the applicable screening criteria, it was classified as a chemical of potential ecological concern (COPEC). If no screening criteria was identified and its concentration exceeds 2 times background, it was considered a COPEC but evaluated in qualitative terms.

An additional screening of the chemicals was performed considering the ingestion exposure pathway. This involved an evaluation of potential consequences of vertebrates ingesting contaminated media (soil, sediment, or water) to determine if chemical concentrations warrant inclusion as ingestion pathway COPECs. Furthermore, chemicals whose concentrations increase along the food chain, or more concisely, with increasing trophic levels of the foodweb were also selected as COPECs.

Table 5-3 summarizes the COPECs selected.

5.3.2.3 Exposure Assessment

Exposure assessment consists of defining exposure factors and assumptions used to estimate the potential ecological risks. Two exposure scenarios were considered, direct and indirect. Direct exposure consists of contact between the contaminated media and an organism (e.g., dermal, respiratory, and/or ingestion of the contaminated media) while indirect exposure results from the ingestion of contaminant that has accumulated in biological tissues of the receptor's forage (e.g., plants, fish, insects, or small mammals). Exposure scenarios to ecologically relevant receptors of concern were developed based on the receptor's potential for exposure and its relevance within the ecological community.

5.3.2.4 Risk Evaluation

Based on the ecological evaluation, the following conclusions were made:

OU18

- A potential risk due to direct exposure of high molecular weight PAHs was identified for sensitive, rare, or endangered species of plants within OU18. No other significant ecologically relevant direct exposure risks were identified within the soils or sediments of OU18.

- Soil concentrations of the chemicals of potential ecological concern were not found to pose any unacceptable risks to the ecological receptors of concern.

- Sediment concentrations of the chemicals of potential ecological concern were not found to pose any unacceptable risks to the relevant ecological receptors of concern.

- Groundwater transport of the chemicals of interest within OU18 is predicted to have no significant ecologically relevant effects on the canal system biota or ecology as none of the concentrations exceed ecotoxicological screening concentrations.

- While there is insufficient ecotoxicological data available for a quantitative assessment of the potential risk to the ecologically relevant amphibians and reptilian receptors of concern utilizing OU18, there does not appear to be any observable impact on these populations, based on site-specific observations.

OU26

- Potential direct exposure risks are identified for strictly aquatic receptors. These risks are not considered ecologically relevant due to limited utilization of the drainage canal by Base-wide biota.

- No indirect exposure risks were identified for ecologically relevant receptors of concern utilizing the drainage canal within OU26.

- Groundwater transport of the chemicals of interest within OU26 is predicted to have no significant ecologically relevant effects on the canal system biota or ecology as none of the concentrations exceed ecotoxicological screening concentrations.

- While there is insufficient ecotoxicological data available for a quantitative assessment of the potential risk to the ecologically relevant amphibians and reptilian receptors of concern utilizing OU26, there does not appear to be any observable impact on these populations, based on site-specific observations.

OU28

- No direct-exposure ecologically relevant risks were identified for chemicals detected within surface soil of OU28.

- Elevated soil concentrations of cadmium may pose an ecologically relevant risk to transient omnivorous mammals. This risk, however, is present under background conditions and, therefore, is considered to be overestimated.

- Soil concentrations of lead may pose an ecologically relevant risk to transient herbivorous birds. The lead is highly localized in extent.

- Groundwater transport of the chemicals of interest within OU28 is predicted to have no significant ecologically relevant effects on the canal system biota or ecology as none of the concentrations exceed ecotoxicological screening concentrations.

- While there is insufficient ecotoxicological data available for a quantitative assessment of the potential risk to the ecologically relevant amphibians and reptilian receptors of concern utilizing OU28, there does not appear to be any observable impact on these populations, based on site-specific observations.

OU29

- No direct-exposure ecologically relevant risks were identified for chemicals detected within surface soil of OU29.

- Elevated soil concentrations of cadmium may pose an ecologically relevant risk to transient omnivorous mammals. This risk, however, is present under background conditions and, therefore, is considered to be overestimated.

- Groundwater transport of the chemicals of interest within OU29 is predicted to have no significant ecologically relevant effects on the canal system biota or ecology as none of the concentrations exceed ecotoxicological screening concentrations.

- While there is insufficient ecotoxicological data available for a quantitative assessment of the potential risk to the ecologically relevant amphibians and reptilian receptors of concern utilizing OU29, there does not appear to be any observable impact on these populations, based on site-specific observations.

5.3.3 Summary of Human Health and Ecological Risks

The results of the human health risk assessment indicate that there are potential unacceptable risks at three of the OU sites. The following table and Table 5-2 summarize the results of the BRA for human health. For OU18, potential unacceptable human health risk was identified due to ingestion and dermal contact with PAHs detected in the surface soil. The PAHs were also identified as a potential ecological risk to sensitive plants. Site OU26 showed a potential for unacceptable human health effects due to construction worker dermal exposure to TCE in groundwater and construction worker ingestion of lead and mercury in surface soil. OU28 showed a potential unacceptable ecological risk due to high concentrations of lead in surface soil. At site OU29, although no potential unacceptable human health or ecological risks were identified, several PAHs were detected in surface soil samples of concentrations above the FDEP industrial soil cleanup goals. Additionally, concentrations of PAHs, lead, and arsenic that also exceeded the FDEP industrial soil cleanup goals were detected in surface soils at

sites OU26 and OU28, although no unacceptable human or ecological risks were associated with these detections. Since FDEP considers the industrial soil cleanup goals as risk based (1×10^{-6} excess cancer risk), all areas at the sites with FDEP industrial soil cleanup goal exceedances were included in the FS for consideration of remedial alternatives.

SUMMARY OF HUMAN HEALTH RISKS

Site	Risk Type	Occupational Worker	Construction Worker	Recreational User/ Trespasser
OU18	Hazard Index[1]	0.3	**2.1**	0.1
	Cancer Risk[2]	**4×10^{-4}**	4×10^{-5}	**2×10^{-4}**
OU26	Hazard Index	0.1	**3.8**	0.04
	Cancer Risk	2×10^{-5}	2×10^{-6}	6×10^{-6}
OU26[3] Hot-Spot	Hazard Index	**1.3**	**3.4**	0.5
	Cancer Risk	1×10^{-6}	2×10^{-8}	5×10^{-7}
OU28	Hazard Index	0.2	0.4	0.09
	Cancer Risk	2×10^{-5}	3×10^{-7}	1×10^{-5}
OU29	Hazard Index	0.1	0.3	0.04
	Cancer Risk	5×10^{-5}	8×10^{-7}	2×10^{-5}

[1]The acceptable EPA hazard index is less than 1.0
[2]The acceptable EPA risk range is 1×10^{-4} (1 in 10,000) to 1×10^{-6} (1 in 1,000,000)
[3]Risk calculated for a "hot-spot" of mercury in surface soils at site OU26.
Numbers in bold exceed the acceptable hazard index or carcinogenic risk range.

Actual or threatened releases of hazardous substances from the OUs, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

5.4 PRELIMINARY REMEDIATION GOALS

Preliminary remediation goals (PRGs) are recommended concentrations of individual chemicals for specific medium and land use combinations at CERCLA sites. There are two primary sources of chemical-specific PRGs:

- Concentrations based on chemical-specific ARARs
- Concentrations based on risk assessment

Risk-based PRGs are concentration limits that are calculated using carcinogenic and/or noncarcinogenic toxicity values under specific exposure conditions. PRGs provide long-term targets to use during development, evaluation, and selection of remedial action alternatives. The methodology used to derive risk-based PRGs is taken from EPA's Risk Assessment Guidance for Superfund, Part B (EPA 1991).

5.4.1 Human Health and Environmental Risks Identified by BRA

The BRA identified potential risks to human health or the environment from specific contaminants and exposure scenarios. The identified potential risks at the four OUs are summarized below:

- **Site OU18**

  - Hypothetical occupational worker exposure through ingestion or dermal contact with surface soils containing PAHs (Excess Lifetime Cancer Risk [ELCR] = 4×10^{-4}).

  - Hypothetical adult recreational receptor/trespasser exposure through ingestion or dermal contact with surface soils containing PAHs (ELCR = 2×10^{-4}).

  - Hypothetical construction worker exposure through dermal contact with groundwater containing pesticides and metals (Hazard Index [HI] = 2.1). However, the highest concentrations of the respective contaminants of concern are at different monitoring wells, resulting in an unlikely exposure scenario.

  - Potential environmental risk to sensitive plant species due to PAHs in surface soils, and potential risk to avian and mammalian receptors due to lead and arsenic in sediments. However, the bioavailability of the metals is uncertain and the potential for risk is likely overstated.

- **Site OU26**

  - Hypothetical occupational worker exposure through ingestion of surface soils containing lead and mercury (HI = 1.3).

  - Hypothetical construction worker exposure through dermal contact with groundwater containing TCE (HI = 3.8).

  - Although no unacceptable human health or environmental risks were identified for PAHs or arsenic in surface soils, these chemicals were detected in surface soils at concentrations that exceed FDEP industrial soil cleanup goals (FDEP 1995).

- **Site OU28**

  - No unacceptable human health risks were identified at OU28. However, PAHs and lead were detected in surface soils at concentrations that exceed FDEP industrial soil cleanup goals (FDEP 1995).

  - There is a potential ecological risk to herbivorous birds due to lead in surface soils found near the large upright storage tank.

- **Site OU29**

  - No unacceptable human health or environmental risks were identified at OU29. However, PAHs were detected in surface soils at concentrations that exceed FDEP industrial soil cleanup goals (FDEP 1995).

5.4.2 PRGs Based on FDEP Cleanup Goals

Potential unacceptable human carcinogenic and ecological risks were identified at OU18 under hypothetical occupational worker or recreational receptor/trespasser exposures to

PAHs in surface soils. A potential but unlikely ecological risk was identified for avian and mammalian receptors due to lead and arsenic in sediments at OU18.

Potential unacceptable human health risks were identified at OU26 under hypothetical occupational worker exposures to lead and mercury in surface soils. PAHs and arsenic were detected in OU26 surface soils at levels that exceed FDEP industrial soil cleanup levels (FDEP 1995).

Although the BRA did not identify potential unacceptable human risks at OU28 and OU29, a potential ecological risk to herbivorous birds was identified under potential exposures to lead in surface soils at OU28. Further, individual concentrations of lead, arsenic, and PAHs (at OU28) and PAHs (at OU29) were detected in surface soils at levels that exceed FDEP industrial soil cleanup goals (FDEP 1995).

The FDEP industrial soil cleanup goals are based on achieving an ELCR of 1×10^{-6} for carcinogens, or achieving an HI equal to or less than 1.0 for noncarcinogens (FDEP 1995). For certain PAHs (i.e., benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene) and arsenic, the general FDEP industrial soil cleanup goals (FDEP 1995) have been adjusted to be site-specific goals that the BCT developed by considering the unique local conditions existing at Homestead AFB. These site-specific goals are considered to be protective of human health and the environment at Homestead AFB.

The FDEP industrial soil cleanup goals will be used as PRGs for the PAHs, lead, arsenic and mercury in surface soils at the four OUs. The use of FDEP soil cleanup goals will be protective of human health and the environment, maintain consistency with previously completed remedial actions at other Homestead AFB sites, and comply with ARARs and TBCs.

5.4.3 PRGs Based on Site-Specific Risk Assessment

Risk-based PRGs were developed by first identifying and defining media of concern, chemicals of concern, present and future land use, exposure pathways, and target risk levels.

Chemical concentrations that would result in the prescribed target risk levels in the environmental media of concern were then calculated.

A potential unacceptable noncarcinogenic human health risk was identified at OU18 under a hypothetical dermal exposure of construction workers to pesticides and metals in groundwater. The highest concentrations of the respective contaminants of concern that were found to be the primary risk drivers were detected in different monitoring wells with a large lateral separation (up to 500 feet). Therefore, the calculated health risk (HI = 2.1) is considered to be highly conservative because the exposure scenario is not likely to be a completed pathway. Further remedial action to address the pesticides and metals in groundwater at OU18 is not considered to be justified.

A potential noncarcinogenic human health risk was identified at OU26 from hypothetical construction worker dermal exposures to TCE in shallow groundwater. The PRG calculated for this exposure scenario is 580 µg/L. Although this PRG for TCE in groundwater exceeds the federal and state MCL for TCE, the surficial aquifer at the Base is not currently, nor is it planned to be, used for a potable water supply because of saltwater intrusion. Therefore, remediation of groundwater to MCLs is not necessary to protect human health. Recent sampling of the wells at site OU26 indicate that chlorinated VOC concentrations are steadily decreasing, and may already have decreased to levels below the PRG. Subsequent sampling in support of the selected alternative at the site will provide more information on site conditions.

5.4.4 Summary of PRGs

PRGs for the contaminants of concern at the four OUs are listed in Table 5-4.

TABLE 5-1

SUMMARY OF COPCs IDENTIFIED IN THE HUMAN HEALTH RISK ASSESSMENT AT OUs 18, 26, 28, AND 29

OU18	Surface Soil	Total Soil	Groundwater	Sediment	Surface Water
	PAHs (non and carc) Aldrin Heptachlor epoxide Aluminum, Arsenic, Barium, Chromium, Copper	3,3'-Dichlorobenzidene PAHs (non and carc) Aldrin, Dieldrin Heptachlor epoxide Aluminum, Antimony, Arsenic, Barium, Beryllium, Chromium, Copper, Iron	PAHs (non and carc) Aldrin, Heptachlor Heptachlor epoxide Antimony, Arsenic, Beryllium, Iron, Manganese, Thallium, Vanadium	PAHs (non and carc) Heptachlor Heptachlor epoxide Antimony, Arsenic, Beryllium, Cadmium, Chromium, Iron, Mercury, Vanadium, Zinc	Arsenic
OU26	**Surface Soil**	**Total Soil**	**Groundwater**	**Sediment**	**Surface Water**
(Site-Wide, Excluding Soil Hot Spot)	PAHs (non and carc) Arsenic, Cadmium Chromium, Iron Lead*, Manganese, Zinc	PAHs (non and carc) Antimony, Arsenic, Beryllium, Cadmium, Chromium, Iron, Lead*, Manganese, Mercury, Zinc	Chloromethane cis-1,2-DCE trans-1,2-DCE, PCE TCE, Vinyl Chloride Heptachlor Antimony, Manganese	1,2-DCE (total), Benzene, Chlorobenzene, Chloromethane 1,2-DCB, 1,3-DCB, 1,4-DCB PAHs (non and carc) Heptachlor epoxide Antimony, Arsenic, Beryllium, Cadmium Chromium, Copper Iron, Lead* Mercury	Chlorobenzene Arsenic Lead*
OU26	**Surface Soil**	**Total Soil**			
(Soil Hot Spot)	PAHs (non and carc) Cadmium, Chromium Iron, Lead* Manganese Mercury	PAHs (non and carc) Cadmium, Chromium Iron, Lead* Manganese Mercury			
OU28	**Surface Soil**	**Total Soil**	**Groundwater**		
	PAHs (non and carc) Aldrin, Dieldrin Heptachlor Heptachlor epoxide Aluminum, Antimony Arsenic, Barium Cadmium, Chromium, Iron, Lead* Mercury	PAHs (non and carc) Aldrin, Dieldrin Heptachlor Heptachlor epoxide Aluminum, Antimony Arsenic, Barium Cadmium, Chromium, Iron, Lead* Manganese, Mercury	1,2_DCE (total) PCE, TCE Beryllium, Iron		
OU29	**Surface Soil**	**Total Soil**	**Groundwater**		
	PAHs (non and carc) Heptachlor epoxide Aluminum, Arsenic Cadmium, Chromium Lead*, Manganese	1,1-DCE PAHs (non and carc) Heptachlor epoxide Aluminum, Arsenic Beryllium, Cadmium, Chromium, Iron Lead*, Manganese	1,2-DCE (total) TCE Vinyl chloride		

*Lead does not have EPA-established toxicity factors, therefore, it could not be evaluated in the quantitative risk assessment

TABLE 5-2

SUMMARY OF THE RESULTS OF THE BASELINE RISK ASSESSMENT

SITE	HUMAN HEALTH RISK			ECOLOGICAL RISK
	Noncarcinogenic HI	Carcinogenic Risk	Lead*	
OU18	The highest noncarcinogenic risk was 2.1 for future construction workers. Dermal contact with pesticides and metals in the groundwater was the major contributor to the HI. However, the HI is very likely overstated due to the fact that the highest concentrations of these COPCs occur in different monitoring wells.	The highest carcinogenic risk was 4×10^{-4} for occupational workers. Risk is driven by the incidental ingestion of and dermal contact with PAHs in surface soils.	Lead was not identified as a COPC in the human health risk assessment.	A potential risk was identified to sensitive plant species due to PAHs detected in the surface soils. Also, metals detected in the sediment may pose a risk to avian and mammalian receptors. However, the bioavailability of the metals is uncertain.
OU26 Total Exposures	The highest noncarcinogenic risk for total exposures (excluding the hot spot) was 3.8 for future construction workers. Dermal contact with TCE in groundwater was the major contributor to the HI. However, the HI is very likely overstated due to the localized nature of the TCE plume.	The highest carcinogenic risk for total exposures (excluding the hot spot) was 2×10^{-5} for occupational workers. This risk does not exceed USEPA's acceptable range of 1×10^{-6} to 1×10^{-4}. Therefore, no unacceptable carcinogenic risks are expected.	Lead was detected in two surface soil samples at concentrations (506 mg/kg and 551mg/kg) that exceeded the screening values of 400mg/kg and 500 mg/kg.	No potential risks were identified for ecologically-relevant receptors at the site.
OU26 Hot Spot	The highest noncarcinogenic risk for exposures to the soil hot spot was 3.4 for future construction workers. Incidental ingestion of mercury was the major contributor to the HI. This indicates the potential for adverse noncarcinogenic health effects.	The highest carcinogenic risk for exposures to the soil hot spot was 1×10^{-6} for occupational workers. This risk does not exceed USEPA's acceptable range of 1×10^{-6} to 1×10^{-4}. Therefore, no unacceptable carcinogenic risks are expected.	Lead was detected in the surface soil hot spot sample at a concentration of 2210 mg/kg; this concentration exceeded the screening values of 400mg/kg and 500 mg/kg, and exceeds the FDEP cleanup goal of 1,000 mg/kg.	No potential risks were identified for ecologically-relevant receptors at the site.

TABLE 5-2

SUMMARY OF THE RESULTS OF THE BASELINE RISK ASSESSMENT

SITE	HUMAN HEALTH RISK			ECOLOGICAL RISK
	Noncarcinogenic HI	Carcinogenic Risk	Lead*	
OU28	The highest noncarcinogenic risk was 0.4 for future construction workers. This HI is below the EPA target level of 1. Therefore, no unacceptable noncarcinogenic effects are expected.	The highest carcinogenic risk was 2×10^{-5} for occupational workers. This risk is within USEPA's acceptable risk range of 1×10^{-6} to 1×10^{-4}. Therefore, no unacceptable carcinogenic risks are expected.	Lead was detected in six surface soil samples at concentrations ranging from 469 mg/kg to 20,200 mg/kg that exceeded the screening values of 400mg/kg and 500 mg/kg. Several concentrations also exceeded the FDEP cleanup goal of 1,000 mg/kg.	An unacceptable risk from lead is present in the surface soils located at Building 744. Also, a potential risk from cadmium in the surface soils was identified; however, the cadmium concentrations were below background and the risk is likely overstated.
OU29	The highest noncarcinogenic risk was 0.3 for future construction workers. This HI is below the EPA target level of 1. Therefore, no unacceptable noncarcinogenic effects are expected.	The highest carcinogenic risk was 5×10^{-5} for occupational workers due to the PAHs in surface soil. This risk is within USEPA's acceptable risk range of 1×10^{-6} to 1×10^{-4}. Therefore, no unacceptable carcinogenic risks are expected. However, several PAHs exceeded FDEP soil cleanup goals.	Lead was detected in two surface soil samples at concentrations (520 mg/kg and 760 mg/kg) that exceeded the screening values of 400mg/kg and 500 mg/kg. However, no concentrations exceeded the 1,000 mg/kg FDEP cleanup goal.	A potential risk for cadmium in the surface soils was identified; however, the cadmium concentrations were below background concentrations and the risk is likely overstated.

*Lead does not have a USEPA established toxicity factor; therefore, it was not evaluated quantitatively in the human health risk assessment.
HI = Hazard Index

TABLE 5-3

SUMMARY OF COPECs IDENTIFIED IN THE ECOLOGICAL HEALTH RISK ASSESSMENT AT OUs 18, 26, 28, AND 29

	DIRECT EXPOSURE[1]		INDIRECT EXPOSURE[2]
OU18	Sediment	Soil	Ingestion
	PAHs (non and carc), Carbazole 4,4'-DDD, 4,4'-DDE alpha-Chlordane, Heptachlor Heptachlor epoxide, Methoxychlor Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper Lead, Mercury, Selenium Vanadium, Zinc	PAHs (non and carc) Carbazole, Dibenzofuran 4,4'-DDD, 4,4'-DDE Aldrin, delta-BHC Endosulfan I, Endosulfan sulfate Endrin ketone, Heptachlor epoxide Methoxychlor Aluminum, Antimony, Barium Chromium, Copper, Iron Lead, Mercury, Vanadium, Zinc	PAHs (non and carc) 4,4'-DDD, 4,4'-DDE, 4,4'-DDT Aldrin, alpha-Chlordane delta-BHC, Endosulfan I Endosulfan sulfate, Endrin ketone Heptachlor, Heptachlor epoxide Methoxychlor Antimony, Arsenic, Barium Cadmium, Lead, Mercury Selenium, Zinc

	DIRECT EXPOSURE[1]		INDIRECT EXPOSURE[2]
OU26	Sediment	Surface Water	Ingestion
	1,2-DCE, 2-Butanone, Benzene Chlorobenzene, Chloromethane PAHs (non and carc) Bis(2-ethylhexyl)phthalate 1,2-DCB, 1,3-DCB, 1,4-DCB 4,4'-DDD, 4,4'-DDE, 4,4'-DDT alpha-Chlordane Heptachlor epoxide Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper Lead, Mercury, Nickel Selenium, Vanadium, Zinc	Barium Lead Mercury	PAHs (non and carc) Bis(2-ethylhexyl)phthalate 4,4'-DDD, 4,4'-DDE, 4,4'-DDT alpha-Chlordane Heptachlor epoxide Antimony, Arsenic Cadmium, Chromium Lead, Mercury, Vanadium

	DIRECT EXPOSURE[1]	INDIRECT EXPOSURE[2]
OU28	Soil	Ingestion
	PAHs (non and carc) Carbazole, Dibenzofuran 4,4'-DDD, 4,4'-DDE, 4,4'-DDT Aldrin, delta-BHC, gamma-BHC alpha-Chlordane, gamma-Chlordane Endosulfan I, Endrin Endrin aldehyde, Endrin ketone Heptachlor, Heptachlor epoxide Methoxychlor Aluminum, Antimony, Arsenic, Barium, Cadmium, Chromium Copper, Iron, Lead Manganese, Mercury, Silver Vanadium, Zinc	PAHs (non and carc) 4,4'-DDD, 4,4'-DDE, 4,4'-DDT Aldrin, delta-BHC, gamma-BHC alpha-Chlordane, gamma-Chlordane Dieldrin, Endosulfan I Endrin, Endrin aldehyde Endrin ketone, Heptachlor Heptachlor epoxide, Methoxychlor Antimony, Arsenic Cadmium, Lead, Mercury

TABLE 5-3

SUMMARY OF COPECs IDENTIFIED IN THE ECOLOGICAL HEALTH RISK ASSESSMENT AT OUs 18, 26, 28, AND 29

OU29	DIRECT EXPOSURE[1]	INDIRECT EXPOSURE[2]
	Soil	Ingestion
	1,1-DCE	PAHs (non and carc), Carbazole
	PAHs (non and carc)	4,4'-DDD, 4,4'-DDE, 4,4'-DDT
	4,4'-DDD, 4,4'-DDE, 4,4'-DDT	alpha-Chlordane, delta-BHC
	alpha-Chlordane, delta-BHC	Endrin ketone, Heptachlor epoxide
	Endrin ketone, Heptachlor epoxide	Methoxychlor
	Methoxychlor	Aluminum, Antimony, Arsenic,
	Aluminum, Antimony, Arsenic,	Cadmium, Lead, Mercury
	Cadmium, Chromium, Copper	
	Iron, Lead, Manganese, Mercury	
	Silver, Vanadium, Zinc	

[1] These media are listed to indicate COPECs considered through direct exposure (i.e., dermal contact).

[2] The ingestion pathway is included to illustrate COPECs considered through indirect exposure (i.e., incidental ingestion).

TABLE 5-4

PRELIMINARY REMEDIATION GOALS FOR CONTAMINANTS OF CONCERN AT HOMESTEAD AFB FS SITES

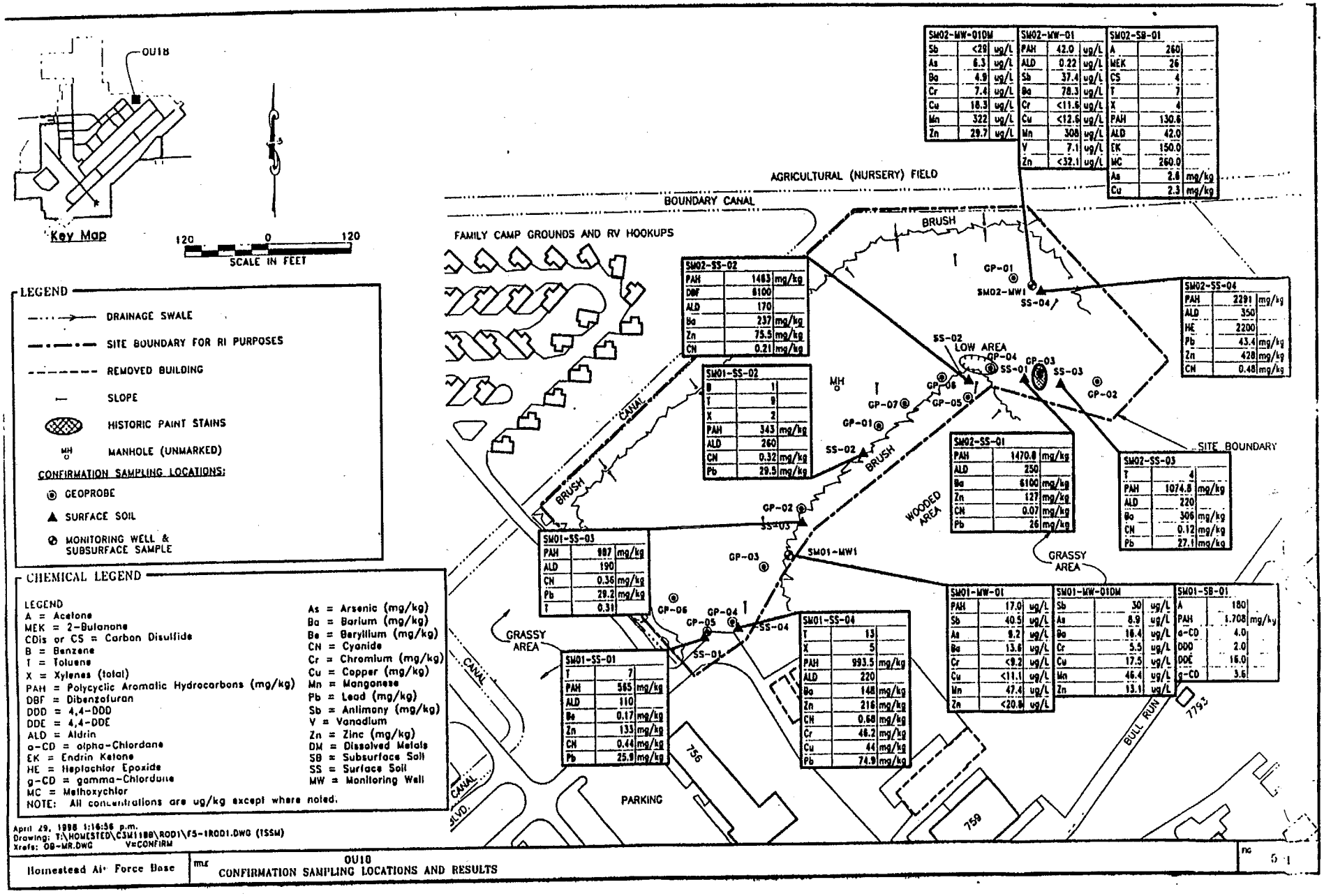
OU18	OU26	OU28	OU29	Contaminant	PRG[1] (mg/kg=soil, µg/L=water)	FDEP Goal/Guidance[4] (mg/kg=soil, µg/L=water)	Comments
X	X	X	X	Benzo(a)anthracene	4.9 mg/kg	4.9 mg/kg	
X	X	X	X	Benzo(a)pyrene	1.5 mg/kg[2]	0.5 mg/kg	
X	X	X	X	Benzo(b)fluoranthene	5 mg/kg	5 mg/kg	
X				Benzo(g,h,i)perylene	50 mg/kg	50 mg/kg	
X				Benzo(k)fluoranthene	48 mg/kg	48 mg/kg	
X	X	X	X	Dibenzo(a,h)anthracene	1.5 mg/kg[3]	0.5 mg/kg	
X	X	X	X	Indeno(1,2,3-cd)pyrene	1.5 mg/kg[3]	5 mg/kg	
	X			Trichloroethene (TCE)	580 µg/L	3 µg/L	PRG > MCL; however, PRG is protective of human health and environment. Not potable water source.
	X	X		Arsenic	10 mg/kg[2]	3.1 mg/kg	No unacceptable EPA risk identified. Use FDEP soil cleanup goal.
	X	X		Lead	1,000 mg/kg	1,000 mg/kg	No unacceptable EPA risk identified. Use FDEP soil cleanup goal.
	X			Mercury	480 mg/kg	480 mg/kg	RGO calculated from BRA at HI = 1 was 221 mg/kg. However, mercury occurs in only one sample and FDEP soil cleanup goal is considered protective.

[1] Preliminary Remediation Goal

[2] Acceptable concentration based on decision by the BCT.

[3] Concentration adjusted from FDEP soil cleanup goal based on toxicity equivalency factor to benzo(a)pyrene.

[4] Taken from FDEP Soil Cleanup Goals for Florida (FDEP 1995) or FDEP Groundwater Guidance Concentrations (FDEP 1994).



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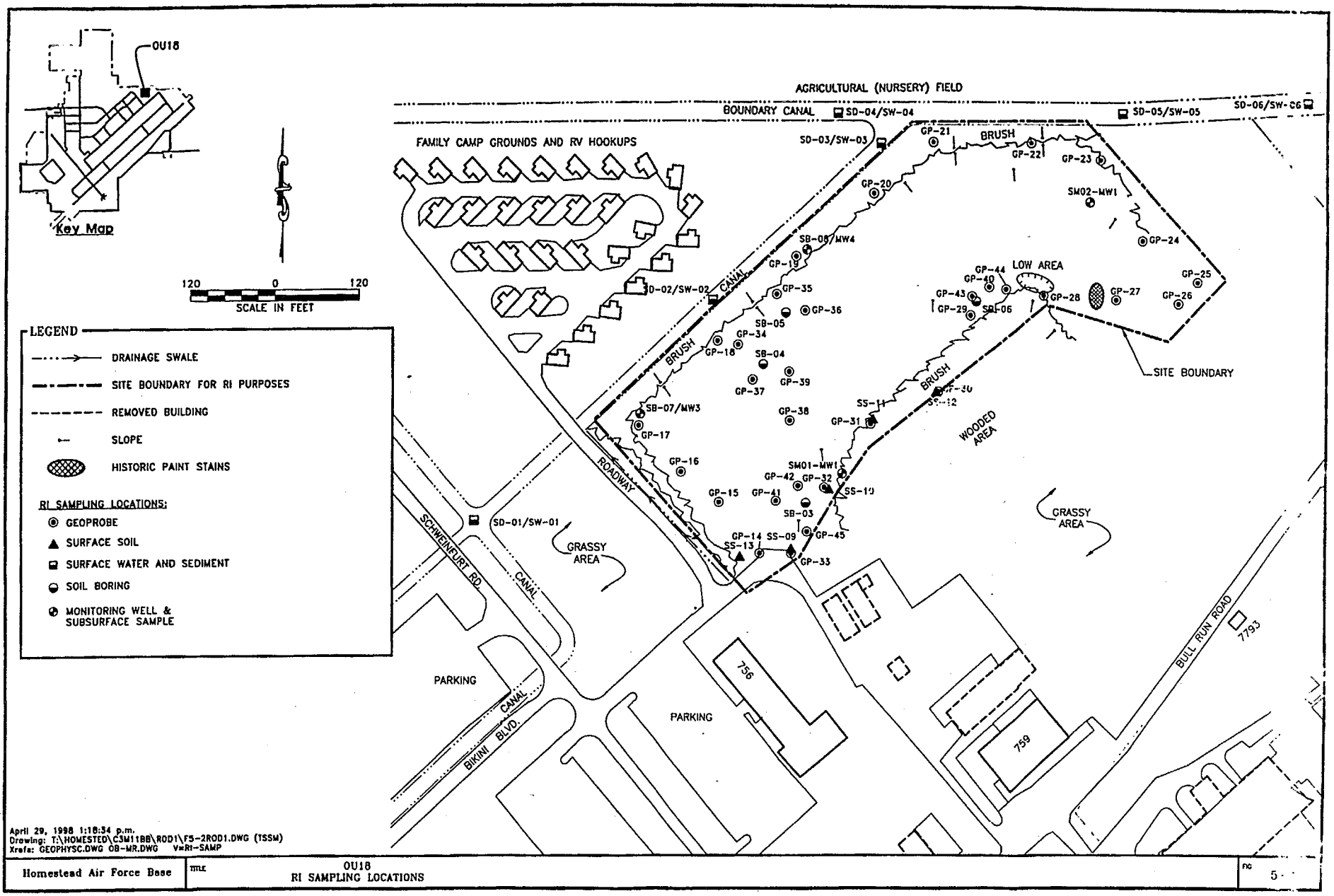
Homestead Air Force Base	OU1B CONFIRMATION SAMPLING LOCATIONS AND RESULTS	5-1



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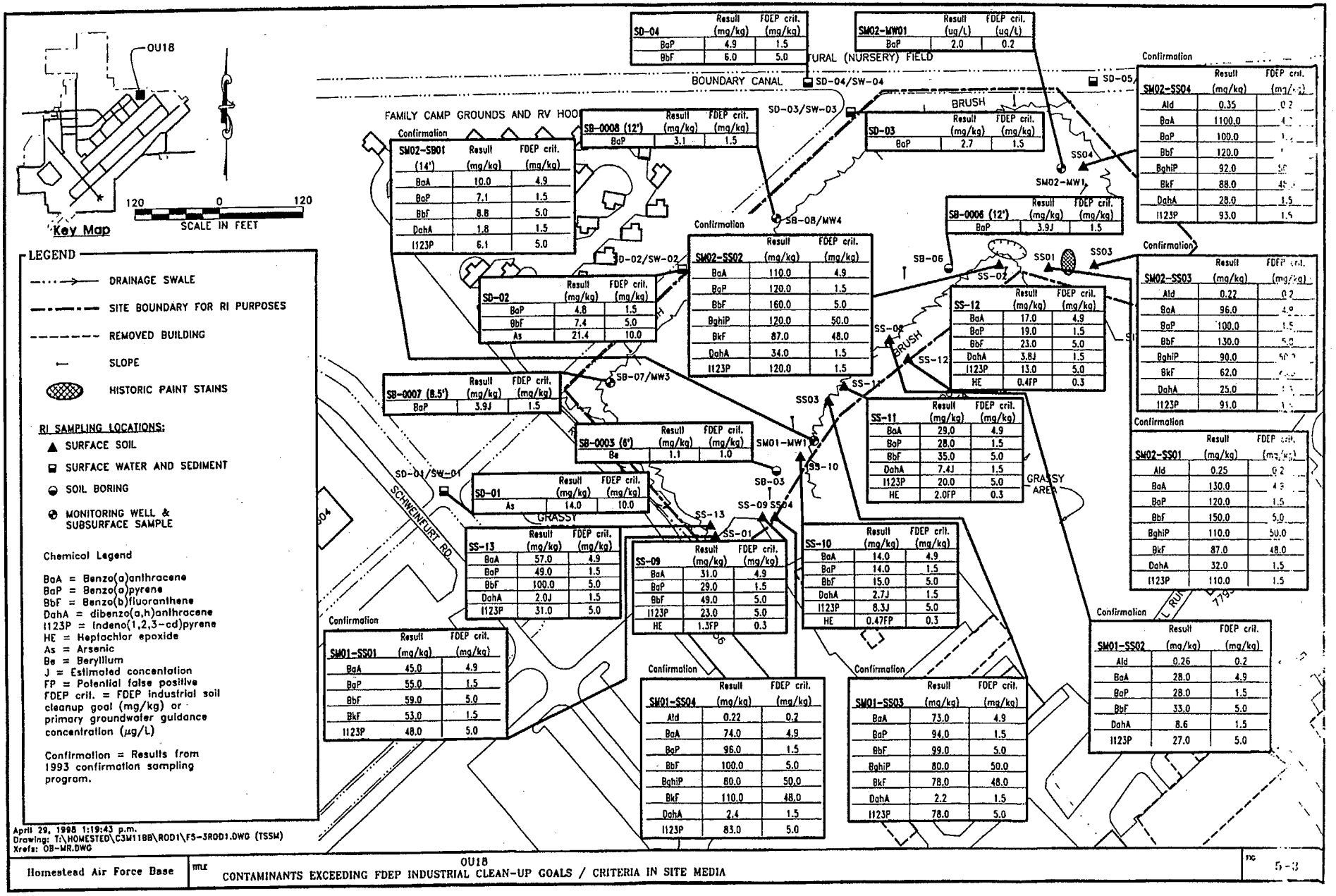
Homestead Air Force Base	title: OU18 RI SAMPLING LOCATIONS	no: 5



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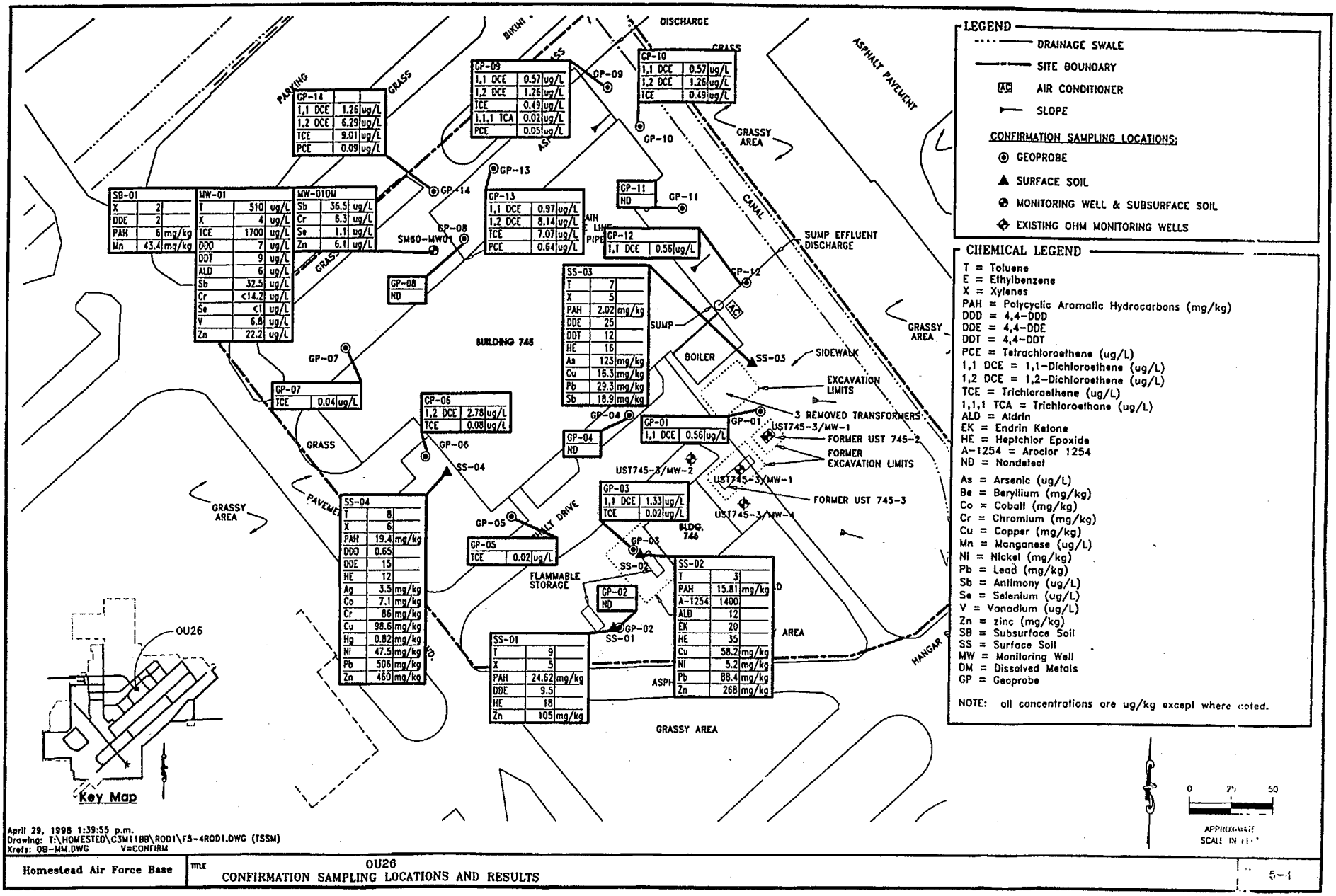
Homestead Air Force Base

OU18

CONTAMINANTS EXCEEDING FDEP INDUSTRIAL CLEAN-UP GOALS / CRITERIA IN SITE MEDIA

FIG 5-13



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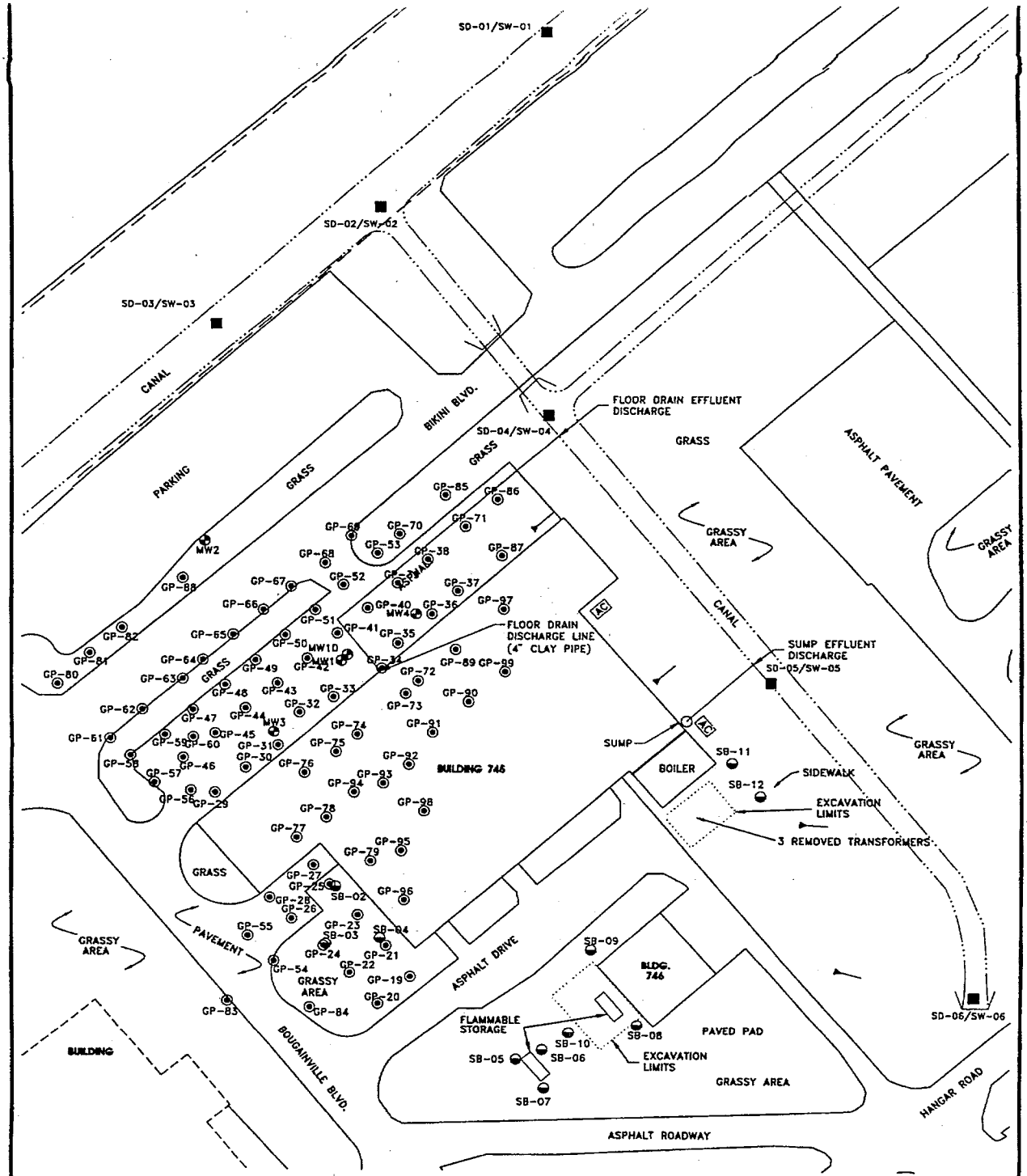
Homestead Air Force Base

0U26
CONFIRMATION SAMPLING LOCATIONS AND RESULTS

5-1



LEGEND

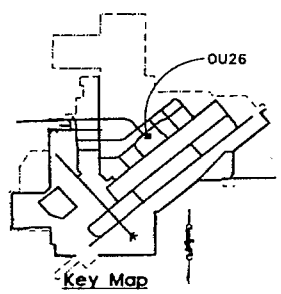
- AC — AIR CONDITIONER
- SLOPE

RI SAMPLING LOCATIONS:

- GEOPROBE
- SOIL BORING
- MONITORING WELL & SUBSURFACE SOIL
- SEDIMENT / SURFACE WATER

0 25 50

APPROXIMATE SCALE IN FEET



Key Map

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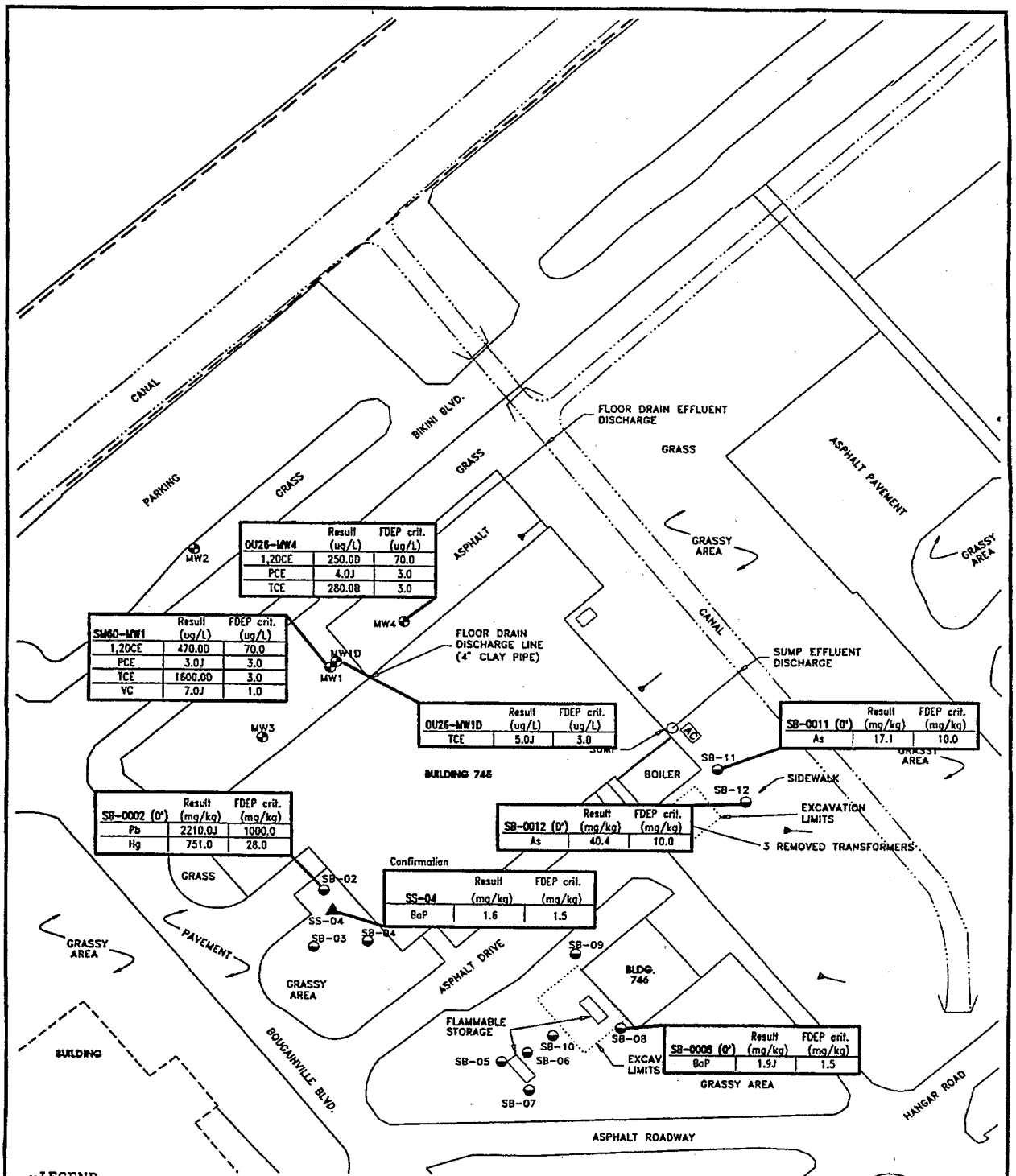
Homestead Air Force Base	mle OU26 RI SAMPLING LOCATIONS	no 5-5



OU26-MW4	Result (ug/L)	FDEP crit. (ug/L)
1,2DCE	250.0D	70.0
PCE	4.0J	3.0
TCE	280.0D	3.0

SWMU-MW1	Result (ug/L)	FDEP crit. (ug/L)
1,2DCE	470.0D	70.0
PCE	3.0J	3.0
TCE	1600.0D	3.0
VC	7.0J	1.0

OU26-MW1D	Result (ug/L)	FDEP crit. (ug/L)
TCE	5.0J	3.0

SB-0011 (0')	Result (mg/kg)	FDEP crit. (mg/kg)
As	17.1	10.0

SB-0002 (0')	Result (mg/kg)	FDEP crit. (mg/kg)
Pb	2210.0J	1000.0
Hg	751.0	28.0

SB-0012 (0')	Result (mg/kg)	FDEP crit. (mg/kg)
As	40.4	10.0

Confirmation

SS-04	Result (mg/kg)	FDEP crit. (mg/kg)
BaP	1.6	1.5

SB-0006 (0')	Result (mg/kg)	FDEP crit. (mg/kg)
BaP	1.9J	1.5

LEGEND

- AC — AIR CONDITIONER
- SLOPE

RI SAMPLING LOCATIONS:

- SOIL BORING
- MONITORING WELL
- SURFACE SOIL

Chemical Legend

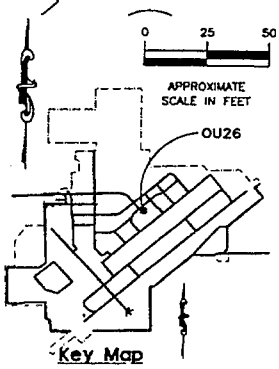
CB = Chlorobenzene
1,4DCB = 1,4-Dichlorobenzene
1,2DCE = 1,2-Dichloroethene
PCE = Tetrachloroethene
TCE = Trichloroethene
VC = Vinyl chloride
BaA = Benzo(a)anthracene
BaP = Benzo(a)pyrene
BbF = Benzo(b)fluoranthene
BkF = Benzo(k)fluoranthene
DahA = Dibenzo(a,h)anthracene
I123P = Indeno(1,2,3-cd)pyrene
As = Arsenic
Hg = Mercury
Pb = Lead

J = Estimated result
D = Diluted

FDEP crit. = FDEP industrial soil cleanup goal (mg/kg) or groundwater guidance concentration (µg/L)

Confirmation = Results from 1993 confirmation sampling program.

0 25 50
APPROXIMATE SCALE IN FEET



Key Map

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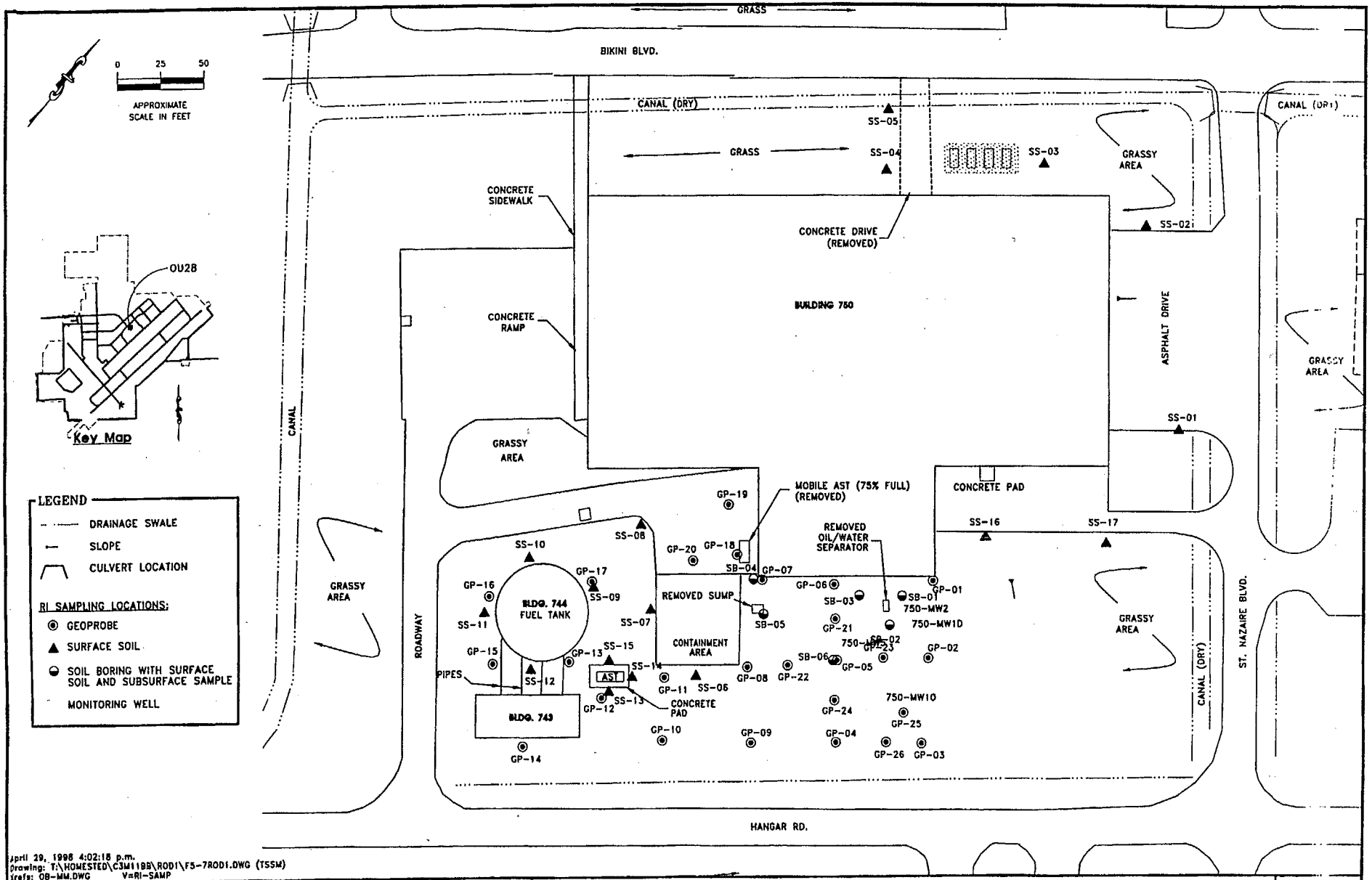
Homestead Air Force Base

TITLE
OU26
CONTAMINANTS EXCEEDING FDEP INDUSTRIAL CLEAN-UP GOALS / CRITERIA IN SITE MEDIA

FIG 5-6



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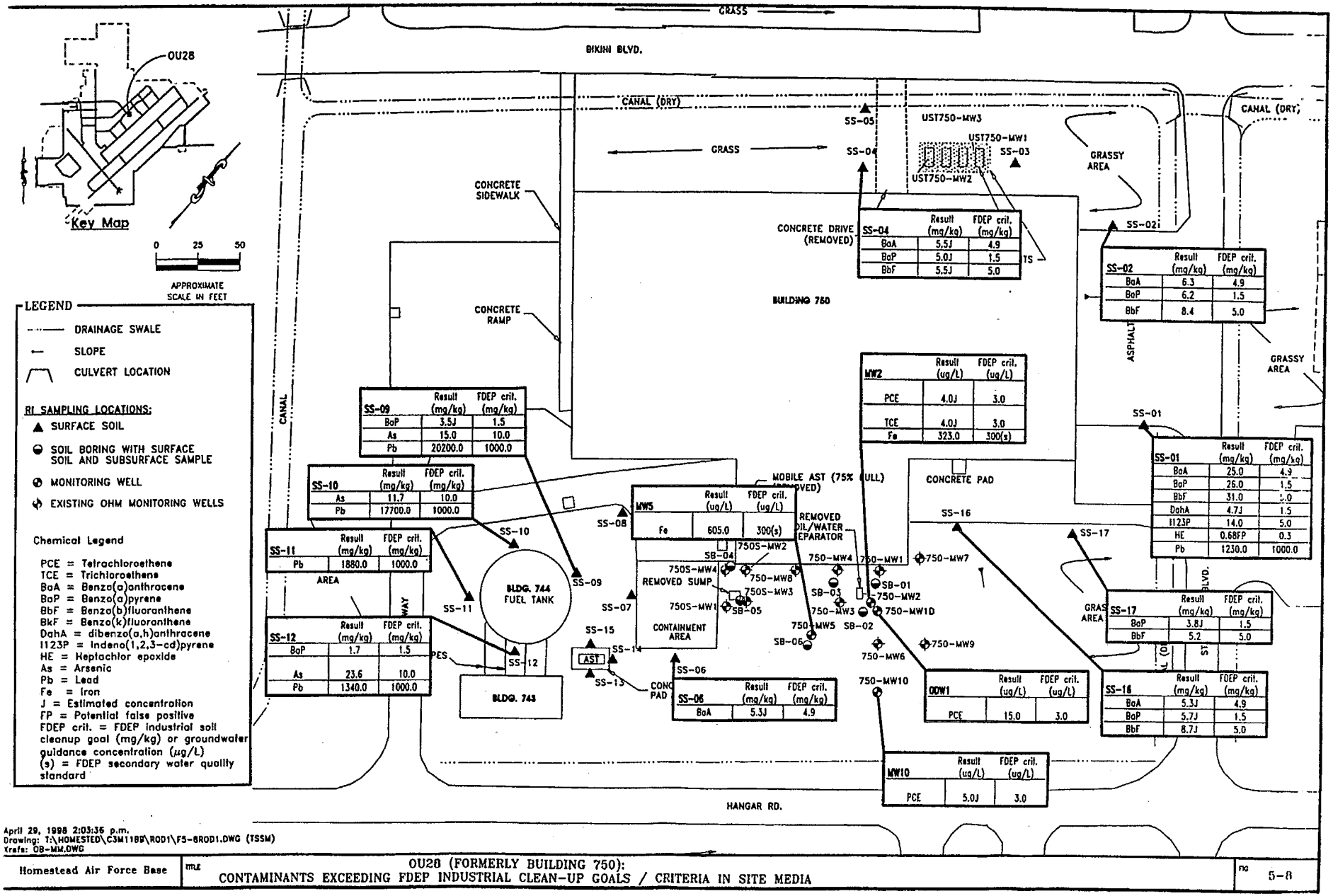
Homestead Air Force Base	mtx	OU28 (FORMERLY BUILDING 750): RI SAMPLING LOCATIONS	FIG 5-7



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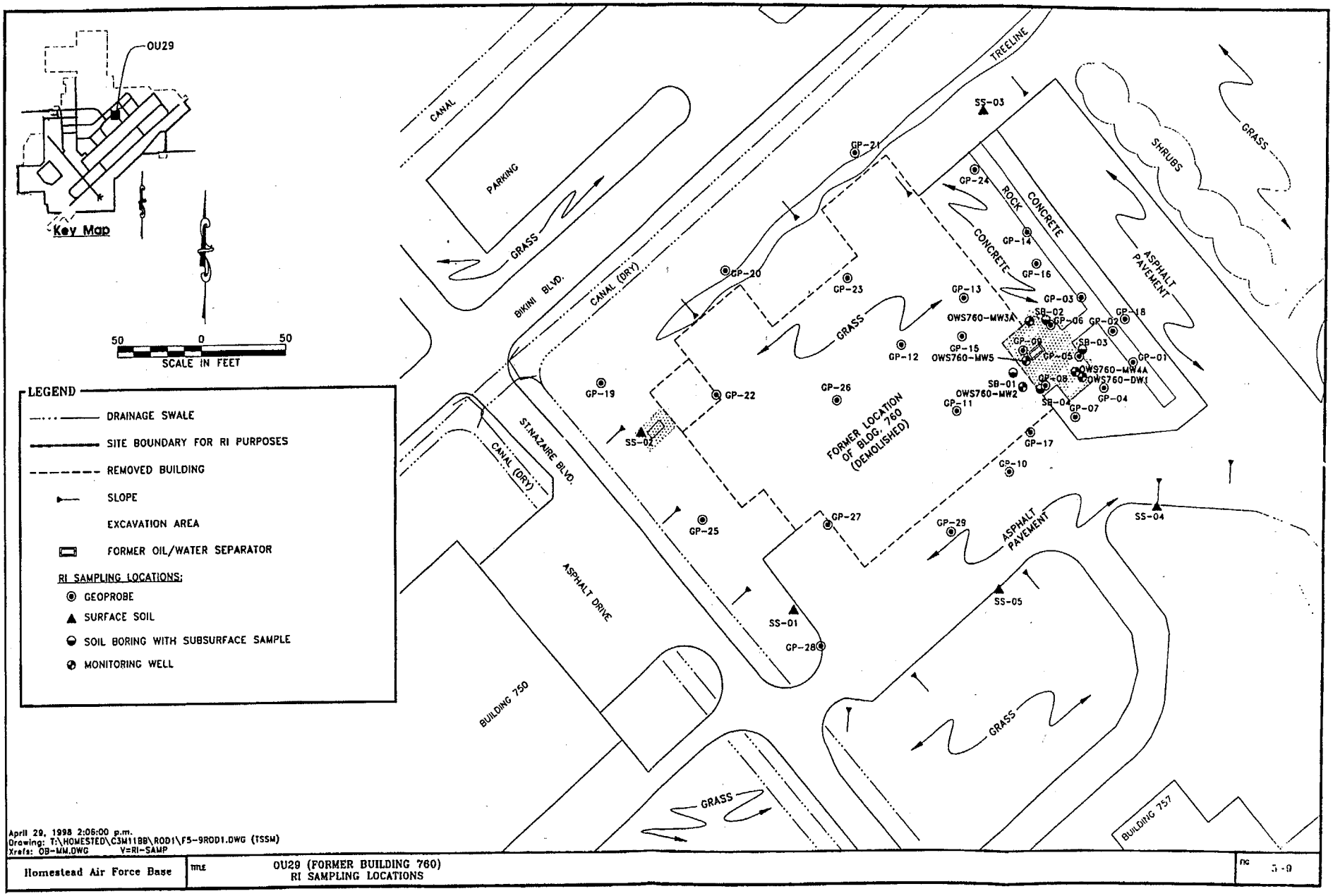

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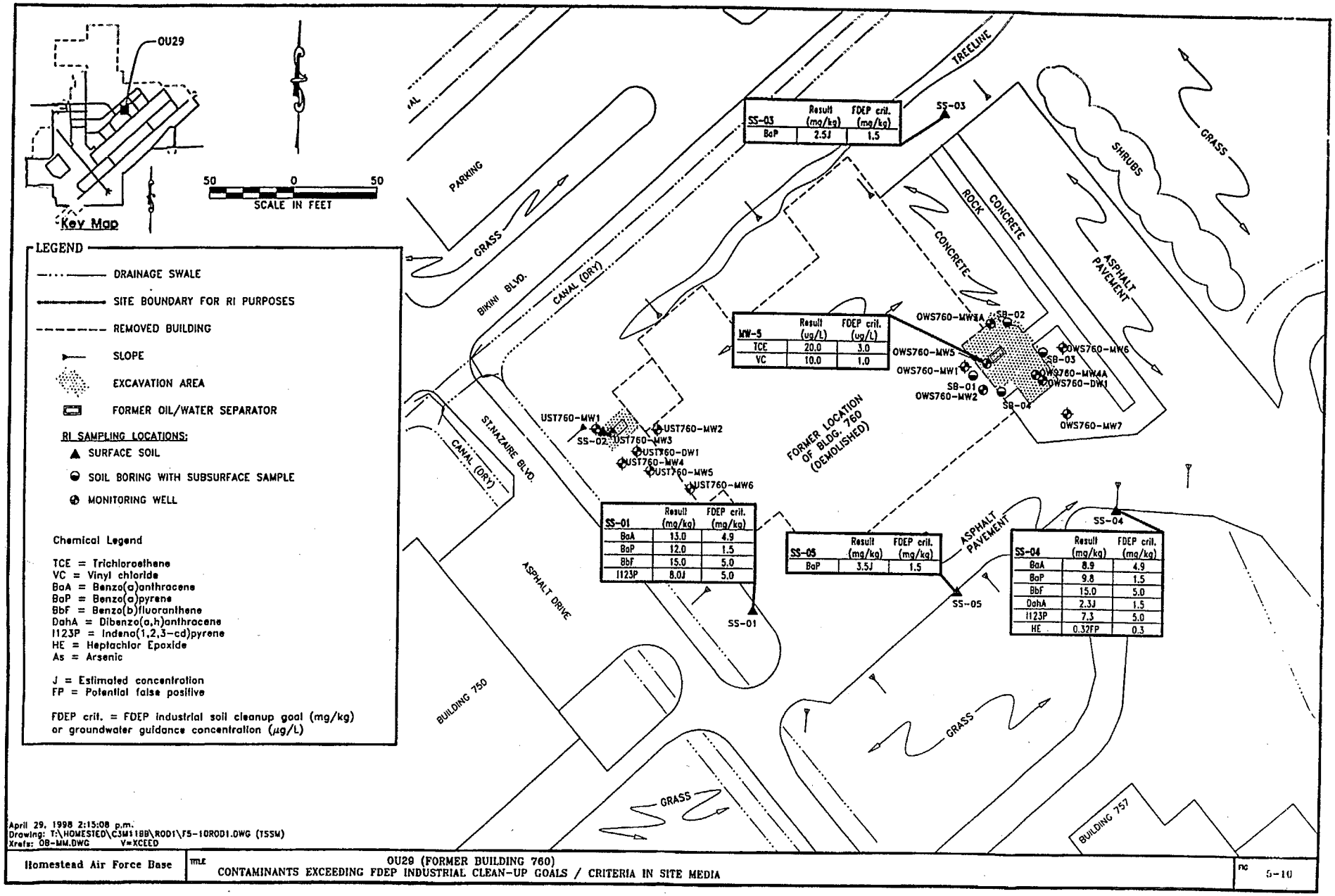
Homestead Air Force Base	TITLE: OU29 (FORMER BUILDING 760) RI SAMPLING LOCATIONS	FIG 5-9



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Homestead Air Force Base	TITLE: OU29 (FORMER BUILDING 760) CONTAMINANTS EXCEEDING FDEP INDUSTRIAL CLEAN-UP GOALS / CRITERIA IN SITE MEDIA	NO. 5-10

6.0 REMEDIAL ALTERNATIVES

This section describes the development of remedial alternatives for each OU site. The alternatives are designed to satisfy the remedial action objectives discussed in Section 6.1.

6.1 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) specify the contaminants and media of interest, exposure pathways, and preliminary remediation goals (PRGs) that permit a range of remedial action alternatives to be developed. The RAOs can be developed on a media-specific or operable unit-specific basis and result in goals for the protection of human health or the environment (USEPA 1988a). The process for developing RAOs for the Homestead AFB sites included:

- A review of federal and state environmental regulations and standards to help refine remediation criteria that address human health and environmental risks posed by site contamination

- Calculation of PRGs for contaminants and media of interest where established regulations and standards do not exist or where site-specific, risk-related factors should be considered to protect human health or the environment

6.1.1 Identification of Applicable or Relevant and Appropriate Requirements (ARARs)

Applicable or Relevant and Appropriate Requirements (ARARs) are federal, state, and regional environmental and facility siting requirements with which a remedial action at a Superfund site must comply. The CERCLA of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 (collectively, CERCLA), and the NCP require compliance with ARARs. Only those state requirements that are more stringent than federal ARARs and are legally enforceable and consistently enforced statewide may be ARARs.

Pursuant to Section 121(d) of CERCLA, the on-site portion of a remedial action selected for a Superfund site must comply with all ARARs. Off-site, all requirements legally applicable at the time the action is carried out must be met. In addition to ARARs, guidance and other nonpromulgated criteria can be considered in evaluating remedial alternatives. These nonpromulgated guidance or criteria are referred to as TBCs (to-be-considered).

As part of the FS process, remedial alternatives, including the no-action alternative, were evaluated to assess the degree to which they attain or exceed ARARs, including federal and state public health and environmental standards. ARAR identification continues throughout the RI/FS as a better understanding is gained of site conditions, site contaminants, exposure pathways, and remedial action alternatives. A preliminary identification and discussion of ARARs for the four OUs at Homestead AFB is presented below.

Cleanup standards for remedial actions must attain a general standard of cleanup that assures protection of human health and the environment, is cost-effective, and uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, SARA requires that any hazardous substance or pollutant remaining on site meet the level or standard of control established by standards, requirements, criteria, or limitations that have been established under any federal environmental law, or any more stringent standards, requirements, criteria, or limitations promulgated in accordance with a state environmental statute.

A requirement may be applicable or relevant and appropriate to remedial activities at a site, but not necessarily both. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a site.

If a regulation is not applicable, it may still be relevant and appropriate. The basic considerations are whether the requirement (1) regulates or addresses problems or situations sufficiently similar to those encountered at the subject site (i.e., relevance), and (2) is appropriate to the circumstances of the release or threatened release, such that its use is well suited to the particular site. Determining whether a requirement is relevant and appropriate is

site-specific and must be based on best professional judgment. This judgment is based on a number of factors, including the characteristics of the remedial action, the hazardous substances present at the site, and the physical circumstances of the site and of the release, as compared to the statutory or regulatory requirement. Compliance with all requirements found to be applicable or relevant and appropriate is mandatory under SARA unless a waiver is obtained from the USEPA.

"To-be-considered" materials (TBCs) are nonpromulgated advisories, proposed rules, criteria, or guidance documents issued by federal or state governments that do not have the status of potential ARARs. However, these advisories and guidance are to be considered when determining protective cleanup levels where no ARARs exists, or where ARARs are not sufficiently protective of human health and the environment. In these circumstances, TBC values are used to establish cleanup targets.

The ARARs presented herein are chemical-specific, location-specific, and action-specific requirements. Although some action-specific requirements are presented, applicability of these ARARs can only be addressed once detailed remedial alternatives are developed for each location.

6.1.1.1 Chemical-Specific ARARs

Chemical-specific requirements are based on health or risk-based concentration limits of discharge limitations in environmental media (i.e., water, soil) for specific hazardous chemicals. These requirements may be used to set cleanup levels for the chemicals of concern in the designated media, or to set a safe level of discharge (e.g., water, air, etc.) that may occur as part of the remedial activity.

Sources for potential target cleanup levels included selected standards, criteria, and guidelines that are typically considered as ARARs for remedial actions conducted under CERCLA, as well as some recently published guidance and proposed action levels provided by state and county agencies that are typically considered as TBCs. A summary of the chemical-specific ARARs is presented in Table 6-1. Each citation in Table 6-1 is described

along with an explanation as to whether the citation is applicable or relevant and appropriate, followed by an identification of which of the four OU sites the citation may be pertinent to.

For groundwater, maximum contaminant limits (MCLs) established under the Safe Drinking Water Act (SDWA) are often accepted by regulatory agencies as cleanup levels for groundwater remedial activities, especially if the groundwater is or could be a drinking water source. At Homestead AFB, shallow groundwater is not used now and is not likely to be used in the future as a drinking water source because of problems associated with saltwater intrusion. For this reason, attainment of MCLs within the shallow groundwater is not necessary to be protective of human health. Nonzero maximum contaminant level goals (MCLGs) are also established under the SDWA. However, MCLGs are not federally enforceable and should only be used if site-specific health risk conditions warrant their use.

Although the shallow aquifer at Homestead AFB is not used and is not planned for use as a source of potable water due to salt water intrusion, groundwater in the vicinity of Homestead AFB, specifically the Biscayne Aquifer, is classified as a sole source of drinking water (Class G-1). Therefore, the identification of potential target cleanup levels for groundwater at Homestead AFB includes standards, criteria, and guidelines primarily for drinking water. These standards include MCLs and MCLGs, as well as the Florida drinking water standards. Also included are hazardous constituent concentration limits under RCRA Subpart F, which are applicable to releases from RCRA-regulated units.

State and federal standards and criteria for surface water quality are considered applicable or relevant and appropriate as long as there is the possibility of remedial activities impacting surface water bodies. Homestead AFB canal system was considered as site surface waters. Should any remedial activities at Homestead AFB impact these surface waters, compliance with both state and federal surface water quality standards and criteria may be required.

6.1.1.2 Location-Specific ARARs

Location-specific ARARs are restrictions placed on the types of activities that may occur in particular locations. The location of a site may be an important characteristic in determining its impact on human health and the environment; therefore, individual states may establish

location-specific ARARs. These ARARs may restrict or preclude certain remedial actions or may apply only to certain portions of a site. Examples of location-specific ARARs include federal and state requirements for preservation of historic landmarks, endangered species and wetlands protection, and the restrictions on management of hazardous waste in floodplain areas.

Potential location-specific ARARs for Homestead AFB are presented in Table 6-2. Each citation in Table 6-2 is described along with an explanation as to whether the citation is applicable or relevant and appropriate, followed by an identification of which of the four OU sites the citation may be pertinent to. Although the universe of location-specific ARARs is identified in Table 6-2, only those regulations that are deemed ARARs for the Homestead site are discussed below.

Due to the possible presence of both federal and state-listed threatened/endangered (T/E) species at the sites, the federal and state Endangered Species Acts are both considered "potentially" applicable. If T/E species are found at the sites, these acts would be applicable. In addition, the Migratory Bird Treaty Act is considered applicable if any migratory bird species (i.e., waterfowl) protected by this Act or their habitat is impacted by remedial actions.

Homestead AFB does have waters at the southwest end of the runways that fall under the current definition of wetland areas under federal wetland delineation guidance. The federal regulations governing wetlands, however, are not considered ARARs as long as the project does not impact the wetland areas. If remedial activities impact these wetland areas southwest of the runway at Homestead AFB, then the regulations concerning protection and preservation of wetlands will be considered applicable or relevant and appropriate and coordination with the U.S. Fish and Wildlife Service will need to be initiated prior to any remedial activity. The State of Florida also has its own wetlands regulations, and any remediation activity impacting these wetlands will require prior coordination with the state agency.

6.1.1.3 Action-Specific ARARs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on remediation actions with respect to hazardous and nonhazardous wastes. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected remedial alternative must be achieved.

The action-specific ARARs are intended to cover the potential remedial alternatives that may be applied. A summary of the action-specific ARARs is presented in Table 6-3. Each citation in Table 6-3 is described along with an explanation as to whether the citation is applicable or relevant and appropriate, followed by an identification of which of the four OU sites the citation may be pertinent to. Compliance with action-specific ARARs was evaluated for each alternative that was analyzed in detail.

6.1.1.4 Identification of Remedial Objectives

The RAOs proposed for the four OUs were used as guidelines during the development of remedial action alternatives. The proposed RAOs focus on the exposure setting for which protection of human health and the environment will be provided. Exposure settings take into consideration the chemicals of concern, contaminated media, and exposure pathways. The consideration of exposure pathways is important since protection may be achieved by reducing the likelihood of exposure and/or by reducing contamination levels.

The specific media and contaminants of concern at the four OUs include:

Media of Concern	Contaminant of Concern	OU18	OU26	OU28	OU29
Surface Soil	PAHs	X	X	X	X
	Lead		X	X	
	Mercury		X		
	Arsenic		X	X	
Sediment	See discussion below	X			
Groundwater	TCE		X		

Sediments in the canal next to OU18 were found to contain crushed asphalt that apparently eroded or washed into the canal from the OU18 site. Although no contaminant-specific cleanup criteria are available for the sediments and the BRA did not identify potential human health or environmental risks associated with the sediments, the USAF has committed to removing sediments that contain crushed asphalt at OU18. This removal will be done to eliminate the crushed asphalt as a potential future contaminant source.

RAOs have been developed for each of the four OUs, as follows:

- **OU18:**
  - Prevent human and ecological exposure to surface soils at OU18 that contain PAHs at concentrations above the FDEP industrial soil cleanup goals listed in Table 5-4.
  - Remove sediments containing crushed asphalt from the canal adjacent to OU18 to eliminate the crushed asphalt as a potential future contaminant source.
- **OU26:**
  - Prevent human and ecological exposure to surface soils at OU26 that contain PAHs, lead, mercury, and arsenic at concentrations above the FDEP industrial soil cleanup goals listed in Table 5-4.
  - Prevent construction worker dermal contact with groundwater at OU26 that contains TCE at concentrations above the risk-based concentration of 580 µg/L.
- **OU28:**
  - Prevent human and ecological exposure to surface soils at OU28 that contain PAHs, lead, and arsenic at concentrations above the FDEP industrial soil cleanup goals listed in Table 5-4.

- **OU29:**

  - Prevent human and ecological exposure to surface soils at OU29 that contain PAHs at concentrations above the FDEP industrial soil cleanup goals listed in Table 5-4.

The RAOs listed above are consistent with the goals of the BCT and the USEPA to protect human health and the environment for all contaminated media to the target risk levels of:

- ELCR of 1×10^{-6} for carcinogens
- HI equal to or less than 1.0 for noncarcinogens

6.2 ALTERNATIVE DEVELOPMENT AND SCREENING PROCESS

Alternatives for the OUs were developed in the FS by assembling combinations of representative process options that survived the technology screening. The alternatives were assembled to provide a range from no further action (NFA) to alternatives that use treatment to reduce toxicity, mobility, or volume (TMV). The screening was done to eliminate alternatives that achieved the same remedial action objectives but were considered less feasible. The screening criteria for alternatives include:

- **Effectiveness** - This criterion focuses on the alternative's ability to protect human health and the environment, reduce TMV, and minimize negative short-term impacts. Alternatives providing significantly less effectiveness compared to other alternatives may be eliminated.

- **Implementability** - This criterion focuses on the technical feasibility and availability of the technologies, as well as the administrative feasibility of implementing the alternative. Technical feasibility refers to the ability to construct, operate, and maintain an alternative. Administrative feasibility refers to the ability to obtain approvals to implement an alternative. Alternatives that are technically or administratively not feasible will be eliminated.

- **Cost** - This criterion focuses on capital and operation and maintenance (O&M) costs expected for each alternative relative to other alternatives under consideration. At this stage of screening, cost is used only to eliminate alternatives that are clearly more costly than other alternatives with relatively equal effectiveness and implementability.

Subsequent to the alternatives screening process, the alternatives that were carried forward were evaluated in the detailed analysis of alternatives. A description of the criteria used for the detailed analysis is as follows:

6.2.1 Detailed Analysis Criteria

The USEPA has developed nine criteria that encompass evaluation of statutory requirements and technical, cost, and institutional considerations (USEPA 1988). These nine criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume (TMV) through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The last two criteria will be evaluated in the Record of Decision following a review of the public comments received on the RI/FS reports and the proposed plan. State acceptance by the Florida Department of Environmental Protection (FDEP) will indicate whether the State agrees with the preferred alternative in the proposed plan. Following is a brief description of each of the remaining seven criteria.

6.2.1.1 Overall Protection of Human Health and the Environment

This criterion provides a final check to assess whether each alternative provides adequate protection of human health and the environment, focusing on how each risk and associated pathway are eliminated, reduced, or controlled. The assessment on overall protection draws from the assessments done under other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. This evaluation allows for consideration of whether an alternative poses any unacceptable short-term or cross-media impacts resulting from remediation.

6.2.1.2 Compliance with ARARs

This criterion is used to determine whether each alternative will meet federal and state ARARs. A description of ARARs is provided in Section 6.1. If an identified ARAR is not met by an alternative, then an evaluation on the appropriateness of a waiver should be made. Waivers could be applied in any of six circumstances identified by CERCLA (USEPA 1988).

6.2.1.3 Long-term Effectiveness and Permanence

This criterion addresses the risk remaining at the site associated with each alternative after remedial action has taken place and objectives have been met. The focus is on risk posed by residuals and/or untreated wastes after the cleanup criteria have been reached. The primary components of this criterion include consideration of the magnitude of residual risk and the adequacy and reliability of controls.

6.2.1.4 Reduction of TMV Through Treatment

This criterion addresses the statutory preference of CERCLA for remedial actions involving treatment technologies that permanently and significantly reduces toxicity, mobility and volume (TMV) of the principal hazardous substances at a site. This preference is satisfied when treatment is used to reduce the principal threats at a site by destroying toxic contaminants, irreversibly reducing contaminant mobility, or reducing the total volume of contaminated media.

6.2.1.5 Short-Term Effectiveness

This criterion assesses the short-term effectiveness of each alternative by assessing the risk to the community, workers, and environment during the construction and implementation of the remedial action, and the time required to achieve the remedial action objectives.

6.2.1.6 Implementability

Implementability is evaluated in terms of technical feasibility, administrative feasibility, and availability of services and materials. Technical feasibility assesses the ability to construct, operate, monitor and, if needed, expand an alternative. Administrative feasibility assesses the activities needed to coordinate with other agencies or obtain permits. Availability of services and materials considers locally available resources and available of technologies.

6.2.1.7 Cost

The cost of each alternative is evaluated by considering the capital cost, operations and maintenance cost, and total present worth cost. The present worth costs provide a common basis for comparing alternatives.

Feasibility-level cost estimates are intended to provide an accuracy range of +50 to -30 percent of actual cost. The final project cost will depend on actual labor and material cost, productivity, competitive market conditions, final project scope and schedule, and other variable factors.

As a result of these factors, the final project cost is likely to vary from the estimates provided in this FS. Funding needs should be carefully reviewed before final remedial action budgets are established. The selected alternative and corresponding cost estimates should be further refined in the remedial design stage.

A description of each alternative considered in the detailed analysis, on a site-by-site basis, is provided in the following discussion. Following the description of all alternatives evaluated for each site, by media, the results of the detailed analysis are summarized with the

recommendation for the preferred alternative. In general, the following alternatives were evaluated for site soils and/or sediments at Sites OU18, OU26, OU28, and OU29.

ALTERNATIVES EVALUATED FOR SITE SOILS/SEDIMENTS

Alternatives	OU18	OU26	OU28	OU29
No Further Action	x	x	x	x
Institutional Controls	x	x	x	x
Soil Cover	x			
Remove and Treat Using Thermal Desorption	x	x	x	x
Remove and Landfill	x	x	x	x
Land Treatment	x			

For groundwater at site OU26, the alternatives evaluated included No Further Action, groundwater monitoring, intrinsic remediation (natural attenuation), and groundwater collection and treatment.

6.3 ALTERNATIVES ADDRESSING OU18 SOILS AND SEDIMENTS

6.3.1 Description of Alternatives

Alternative OU18-1 - No Further Action

Alternative OU18-1 assumes that no remedial action would be implemented at OU18.

Alternative OU18-2 Institutional Controls

Alternative OU18-2 would consist of institutional controls including land use restrictions, long-term management, and a health and safety plan for all future intrusive work at the site. Additionally, fencing would be installed around OU18 to control and limit human access to the sites.

Alternative OU18-3 - Soil Cover

Alternative OU18-3 involves removing the existing asphalt-containing sediments and some abovegrade fill along the canal, placing them on top of OU18, regrading the site, and installing a vegetated soil cover over the site. This alternative would be implemented by:

- Removal of asphalt-containing sediments from the canal (estimated at about 800 bank cubic yards) and removal of existing site fill materials within 15 feet of the canal (estimated at about 8,000 bank cubic yards). Removal would be done using appropriately-sized, conventional earthmoving equipment. Wet sediments would be dewatered at the excavation site.

- Excavated materials would be placed over OU18 to help establish grades of 2 percent. Additional grading would be done as needed to achieve a 2 percent grade over the surface of OU18 and a maximum slope of 1 vertical to 3 horizontal along the sideslopes.

- Installation of a 24-inch soil cover, the upper 6 inches of which are capable of supporting vegetation, in accordance with State of Florida regulations for construction debris landfills (FAC, Title 12, Chapter 62-701). The perimeter slopes along the canal would be protected using erosion control matting and vegetation.

- Two existing monitoring wells located near the edge of OU18 will be abandoned and replaced within the 15-foot-wide buffer strip made between the landfill and the canal.

- Installation of a perimeter fence and warning signs around OU18.

Alternative OU18-3 would include a restriction on land access and use and would have the requirement for long-term management and groundwater monitoring.

Alternative OU18-4 - Remove and Treat Using Low Temperature Thermal Desorption (LTTD)

Alternative OU18-4 involves removal of asphaltic soils and sediments followed by treatment in a low temperature thermal destruction (LTTD) unit. This alternative would be implemented by:

- Removal of the upper 2 feet of contaminated surface soils (estimated at about 19,000 bank cubic yards) and asphaltic sediments (about 800 cubic yards) at OU18. Removal would be done using appropriately-sized, conventional earthmoving equipment.

- Backfilling the soil excavations with 6 inches of uncontaminated fill followed by regrading and revegetation of the ground surface.

- Transportation and treatment of excavated soils at a local LTTD incinerator, and subsequent beneficial reuse of the by-products in pavement materials.

Alternative OU18-5 - Remove and Landfill

Alternative OU18-5 involves removal of contaminated soils and asphalt-containing sediments for disposal in a solid waste (RCRA Subtitle D) landfill. This alternative would be implemented by:

- Removal of the upper 2 feet of contaminated surface soils (estimated at about 19,000 bank cubic yards) and the upper 1 foot of asphaltic sediments (estimated at about 800 bank cubic yards) at OU18. Removal would be done using appropriately sized, conventional earthmoving equipment. Wet sediments would be dewatered at the excavation site.

- Backfilling the soil excavations with 6 inches of uncontaminated fill followed by regrading and revegetation of the ground surface.

- Transportation and disposal of excavated soils and sediments at a local solid waste (RCRA Subtitle D) landfill.

Alternative OU18-6 - Land Treatment

Alternative OU18-6 involves removal of contaminated soils followed by land treatment of the material. The land treatment would include addition of nutrients and possibly microbes to enhance biodegradation of the contaminants. The land treatment alternative would be implemented by:

- Removal of the upper 2 feet of contaminated surface soils (estimated at about 19,000 bank cubic yards) at OU18. Removal would be done using appropriately-sized, conventional earthmoving equipment.

- Backfilling the excavations with 6 inches of uncontaminated fill followed by regrading and revegetation of the ground surface.

- Construction of a lined land treatment cell for treatment of the contaminated soils. Treatment would consist of biodegradation of organic constituents, which would be implemented by nutrient addition, moisture control, and possibly microbe addition.

Contaminated soils would be treated in thin (12 inches or less) lifts inside the treatment cell to allow for tilling/aerating the soil during treatment. The treatment cell would need to cover about 12 acres to simultaneously treat the entire estimated 18,800 cubic yards of contaminated soils. Alternatively, the excavations could be staged over a period of several years or the excavated materials could be temporarily stockpiled until space was available within the treatment cell. Because of the high amount of precipitation at Homestead AFB, it would likely be necessary to cover and not operate the treatment cell during the rainy season.

6.3.2 Detailed Analysis of Alternatives Addressing OU18 Soils and Sediment

Five alternatives that address OU18 soils and sediments were carried forward to detailed analysis, as follows:

- Alternative OU18-1: No Further Action (NFA)
- Alternative OU18-2: Institutional Controls
- Alternative OU18-3: Soil Cover
- Alternative OU18-4: Remove and Treat using LTTD
- Alternative OU18-5: Remove and Landfill

A detailed analysis of each alternative was completed using the criteria described in Section 6.2.1. Table 6-4 presents the results of this analysis.

6.3.3 Comparative Analysis Of Alternatives Addressing OU18 Soils and Sediments

6.3.3.1 Overall Protection of Human Health and the Environment

NFA (Alternative OU18-1) would not provide any protection and would not mitigate the potential unacceptable risks to human health and the environment from contaminants in surface soil as determined by the baseline risk assessment. Institutional controls (Alternative OU18-2) provides protection of human health by limiting access and thereby restricting an exposure pathway; however, no environmental protection is provided by institutional controls. A soil cover (Alternative OU18-3) provides both human health and environmental protection by eliminating exposure pathways. Removal and treatment using LTTD and disposal in a landfill (Alternatives OU18-4 and OU18-5) provides for complete removal of contaminated surface soils from OU18, thereby protecting human health and the environment.

6.3.3.2 Compliance with ARARs

Table 6-5 summarizes the action-specific ARARs applicable to the alternatives under consideration, and indicates if compliance is attainable.

NFA (Alternative OU18-1) and institutional controls (Alternative OU18-2) would not meet the chemical-specific ARAR – "Soil Cleanup Goals for Florida" (Technical Memorandum

dated September 29,1995). A waiver to this requirement may not be appropriate based on the six circumstances for a waiver identified by CERCLA (USEPA 1988).

The soil cover alternative (Alternative OU18-3) would meet the action-specific ARARs for closure of a construction debris landfill (FAC, Title 62, Chapter 62-701.730 and 40 CFR Part 257).

The other alternatives (Alternatives OU18-4 and OU18-5) are expected to meet ARARs and waivers would not be required.

6.3.3.3 Long-Term Effectiveness and Permanence

NFA (Alternative OU18-1) does not provide long-term protection of human health and the environment and would leave a residual risk equal to that identified in the baseline risk assessment. All other alternatives provide effective protection from human exposure through institutional controls. The permanence of institutional controls depends on long-term site management by the USAF.

The soil cover alternative (Alternative OU18-3) provides for permanent containment at OU18. The long-term effectiveness of containment at OU18 will be ensured by annual inspections, repairs as needed, and groundwater monitoring.

The LTTD alternative (Alternative OU18-4) provides for permanent irreversible treatment of PAHs. The landfill alternative (Alternative OU18-5) provides for relocation of contaminated soils and asphalt-containing sediments at a licensed solid waste facility, where long-term effectiveness is ensured through routine monitoring and maintenance.

6.3.3.4 Reduction of TMV through Treatment

NFA, institutional controls, soil cover, and landfilling (Alternatives OU18-1, OU18-2, OU18-3, and OU18-5) provide no reduction in TMV through treatment. LTTD (Alternative OU18-4) will reduce the toxicity of PAHs in the surface soil.

6.3.3.5 Short-Term Effectiveness

NFA (Alternative OU18-1) does not have any short-term impacts because no remedial action is implemented. For all the other alternatives under consideration, workers can be protected through implementation of a site-specific Health and Safety Plan. Homestead AFB personnel can be protected during construction through the use of appropriate traffic and access controls, as well as dust control measures for earthwork activities. Although general public access to the noncantonment area of Homestead AFB is less restricted than in the past, the site is located in a relatively remote portion of the Base near fenced and secured areas, and protection of the general public during construction of any alternative is not expected to be an issue.

6.3.3.6 Implementability

NFA, institutional controls, and soil cover (Alternatives OU18-1, OU18-2, and OU18-3) are technically feasible but may not be administratively feasible unless ARAR waivers are granted. LTTD and landfilling (Alternatives OU18-3, OU18-4, and OU18-5) are technically and administratively feasible.

6.3.3.7 Cost

The estimated capital cost, O&M cost, and present worth cost for all the OU18 alternatives are presented in Table 6-4. No capital or O&M costs are associated with NFA (Alternative OU18-1). For the other alternatives, capital costs range from a low of about $37,000 for Alternative OU18-2 to a high of about $2,200,000 for Alternative OU18-4. Annual O&M costs range from $0 (Alternatives OU-18-4, and OU-18-5) to about $11,000 for Alternative OU18-3.

The estimated present worth costs are sensitive to the length of time assumed for each alternative and to the actual quantity of contaminated materials that will be handled and/or treated. The OU18 alternatives, ranked from low to high present worth cost, along with the estimated or assumed remedial action life, are:

Alternative	Present Worth Cost at 5%	Remedial Action Life
OU18-2 Institutional Controls	$60,000	30 years
OU18-3 Soil Cover	$800,000	30 years
OU18-5 Remove and Landfill	$1,900,000	1 year
OU18-4 Remove and Treat using LTTD	$2,200,000	1 year

6.3.4 Proposed Alternative for OU18 Soils and Sediments

The proposed alternative for OU18 is **Alternative OU18-3 Soil Cover**. This alternative consists of removal and consolidation of asphaltic sediments, which are a potential source of PAHs, from the Boundary Canal. Additionally, the edge of existing fill materials will be excavated to be at least 15 feet from the edge of the canal and the slopes will be graded. After consolidation of these materials on top of the existing OU18 site, a vegetated soil cover will be placed over the entire site, with erosion protection for slopes along the canal. Alternative OU18-3 includes land use restrictions and long-term groundwater monitoring. This alternative complies with State of Florida closure rules for construction debris landfills. The estimated present worth cost of Alternative OU18-3 is $800,000.

6.4 ALTERNATIVES ADDRESSING OU26 SOILS

6.4.1 Description of Alternatives

Alternative OU26-1S - No Further Action

Alternative OU26-1S assumes that no remedial action would be implemented at OU26.

Alternative OU26-2S - Institutional Controls

Alternative OU26-2S would consist of institutional controls including land use restrictions, long-term management, and a health and safety plan for all future intrusive work at the site.

Additionally, fencing would be installed around OU26 to control and limit human access to the sites.

Alternative OU26-3S - Remove and Treat Using Low Temperature Thermal Desorption (LTTD)

Alternative OU26-3S involves removal of contaminated soils followed by treatment in a low temperature thermal destruction (LTTD) unit. This alternative would be implemented by:

- Removal of the upper 1 foot of contaminated surface soils (estimated at about 120 bank cubic yards) at OU26. Removal would be done using appropriately-sized, conventional earthmoving equipment.

- Backfilling the excavations with uncontaminated fill followed by regrading and revegetation of the ground surface.

- Transportation and treatment of excavated soils at a local LTTD incinerator, and subsequent beneficial reuse of the by-products in pavement materials.

Alternative OU26-4S - Remove and Landfill

Alternative OU26-4S involves removal of contaminated soils for disposal in a solid waste (RCRA Subtitle D) landfill. This alternative would be implemented by:

- Removal of the upper 1 foot of contaminated surface soils (estimated at about 120 bank cubic yards) at OU26. Removal would be done using appropriately-sized, conventional earthmoving equipment.

- Backfilling the excavations with uncontaminated fill followed by regrading and revegetation of the ground surface.

- Transportation and disposal of excavated soils at a local solid waste (RCRA Subtitle D) landfill.

6.4.2 Detailed Analysis of Alternatives Addressing OU26 Soils

Four alternatives that address OU26 soils were carried forward to detailed analysis, as follows:

- Alternative OU26-1S: NFA
- Alternative OU26-2S: Institutional Controls
- Alternative OU26-3S: Remove and Treat using LTTD
- Alternative OU26-4S: Remove and Landfill

A detailed analysis of each alternative was completed using the criteria described in Section 6.2.1. Table 6-6 presents the results of this analysis.

6.4.3 Comparative Analysis Of Alternatives Addressing OU26 Soils

6.4.3.1 Overall Protection of Human Health and the Environment

NFA (Alternative OU26-1S) would not provide any protection and would not mitigate the potential unacceptable risks to human health as determined by the baseline risk assessment. Institutional controls (Alternative OU26-2S) provides protection of human health by limiting access and thereby restricting an exposure pathway. Removal and treatment using a LTTD and disposal in a landfill (Alternatives OU26-3S and OU26-4S) provide for complete removal of contaminated surface soils from OU26, thereby protecting human health and the environment.

6.4.3.2 Compliance with ARARs

Table 6-5 summarizes the action-specific ARARs applicable to the alternatives under consideration, and indicates if compliance is attainable.

NFA (Alternative OU26-1S) and Institutional Controls (Alternative OU26-2S) would not meet the chemical-specific ARAR - "Soil Cleanup Goals for Florida" (Technical Memorandum dated September 29,1995). A waiver to this requirement may not be

NFA (Alternative OU26-1S) and Institutional Controls (Alternative OU26-2S) would not meet the chemical-specific ARAR - "Soil Cleanup Goals for Florida" (Technical Memorandum dated September 29,1995). However, a waiver to these chemical-specific ARARs is appropriate because Alternative OU26-2S will attain the standard of performance that is equivalent to the standard of performance for the chemical-specific ARARs. The standard of performance considered is the protection of human health and the environment as determined by the site-specific risk assessment. Alternative OU26-2S attains this standard of performance by eliminating exposure pathways.

The other alternatives (Alternatives OU26-3S and OU26-4S) are expected to meet ARARs and waivers would not be required.

6.4.3.3 Long-Term Effectiveness and Permanence

NFA (Alternative OU26-1S) does not provide long-term protection of human health and would leave a residual risk equal to that identified in the baseline risk assessment. All other alternatives provide effective protection from human exposure through institutional controls. The permanence of institutional controls depends on long-term site management by the USAF.

The LTTD alternative (Alternative OU26-3S) provides for permanent irreversible treatment of PAHs. The landfill alternative (Alternative OU26-4S) provides for relocation of contaminated soils at a licensed solid waste facility, where long-term effectiveness is ensured through routine monitoring and maintenance.

6.4.3.4 Reduction of TMV through Treatment

NFA, institutional controls, and landfilling (Alternatives OU26-1S, OU26-2S, and OU26-4S) provide no reduction in TMV through treatment. LTTD (Alternative OU26-3S) will reduce the toxicity of PAHs in the surface soil.

6.4.3.6 Implementability

NFA and institutional controls (Alternatives OU26-1S and OU26-2S) are technically feasible but may not be administratively feasible unless ARAR waivers are granted. LTTD and landfilling (Alternatives OU26-3S and OU26-4S) are technically and administratively feasible.

6.4.3.7 Cost

The estimated capital cost, O&M cost, and present worth cost for all the OU26 alternatives are presented in Table 6-6. No capital or O&M costs are associated with NFA (Alternative OU26-1S). For the other alternatives, capital costs range from a low of about $20,000 for Alternative OU26-4S to a high of about $31,000 for Alternative OU26-2S. Annual O&M costs range from $0 (Alternatives OU-18-4S, and OU-18-5S) to about $1,500 for Alternative OU26-2S.

The estimated present worth costs are sensitive to the length of time assumed for each alternative and to the actual quantity of contaminated materials that will be handled and/or treated. The OU26 soil alternatives, ranked from low present worth cost to high present worth cost, along with the estimated or assumed remedial action life, are:

Alternative	Present Worth Cost at 5%	Remedial Action Life
OU26-4S Remove and Landfill	$20,000	1 year
OU26-3S Remove and Treat using LTTD	$23,000	1 year
OU26-2S Institutional Controls	$54,000	30 years

6.4.4 Proposed Alternative for OU26 Soils

The proposed alternative for OU26 soils is **Alternative OU26-4S Remove and Landfill.** This alternative consists of removal of surface soils with PAHs, arsenic, lead, or mercury at concentrations that exceed FDEP industrial soil clean-up goals. These materials will be

hauled to a permitted solid waste landfill. The estimated present worth cost of Alternative OU26-4S is $20,000.

6.5 ALTERNATIVES ADDRESSING OU26 GROUNDWATER

6.5.1 Description of Alternatives

Alternative OU26-1G - No Further Action

Alternative OU26-1G assumes that no remedial action would be implemented for the groundwater at OU26.

Alternative OU26-2G - Groundwater Monitoring

Alternative OU26-2G includes groundwater monitoring of the TCE plume and implementation of institutional controls. The groundwater monitoring alternative includes:

- Long-term groundwater monitoring of TCE concentrations to document and quantify the concentrations of TCE and associated risk to human health and the environment
- Placing restrictions on current and future land and groundwater use in the contaminated area (e.g., restrict operation of base supply wells and future groundwater users)
- Long-term management and health and safety oversight by USAF personnel for any new construction projects in the contaminated area

Alternative OU26-3G - Intrinsic Remediation

Alternative OU26-3G includes monitoring for natural attenuation of the TCE plume and implementation of institutional controls. Natural attenuation involves all naturally-occurring processes that reduce contaminant concentrations over time. These *in situ* processes (intrinsic remediation) include biodegradation, abiotic transformation, dispersion, adsorption, and

- Placing restrictions on current and future land and groundwater use in the contaminated area (e.g., restrict operation of base supply wells and future groundwater users)

- Long-term management and health and safety oversight by USAF personnel for any new construction projects in the contaminated area

Alternative OU26-3G - Intrinsic Remediation

Alternative OU26-3G includes monitoring for natural attenuation of the TCE plume and implementation of institutional controls. Natural attenuation involves all naturally-occurring processes that reduce contaminant concentrations over time. These *in situ* processes (intrinsic remediation) include biodegradation, abiotic transformation, dispersion, adsorption, and volatilization. This alternative differs from the groundwater monitoring alternative by the consideration of the completed preliminary natural attenuation evaluation and the ongoing natural attenuation pilot study at site OU26.

The intrinsic remediation alternative would be implemented by:

- Long-term groundwater monitoring (for TCE and daughter products) to document, quantify, and confirm the natural attenuation processes indicated in the initial screening study and the pilot study

- Placing restrictions on current and future land and groundwater use in the contaminated area (e.g., restrict operation of base supply wells and future groundwater users)

- Long-term management and health and safety oversight by USAF personnel for any new construction projects in the contaminated area

- Evaluation of the long-term monitoring to determine if natural attenuation is occurring as predicted. The evaluation will be part of the annual groundwater monitoring report.

- Discharge of treated groundwater to a nearby canal under a National Pollution Discharge Elimination System (NPDES) permit.

A NPDES permit will be required because the treated groundwater will be discharged to a canal, a body of water of the State of Florida. Although discharge requirements have not been established, it is assumed that treatment of groundwater to FDEP's Class III freshwater standard of 80.7 µg/L (annual average) will be adequate. General groundwater chemistry may require the need for pretreatment to eliminate fouling and scaling of the air stripper. Use of a sequestering agent to control scaling is assumed at this time. No air emissions control equipment should be needed because the total VOC emissions are estimated to be well below regulatory thresholds and risk levels.

6.5.2 Detailed Analysis of Alternatives Addressing OU26 Groundwater

Four alternatives that address OU26 groundwater were carried forward to detailed analysis, as follows:

- Alternative OU26-1G: NFA
- Alternative OU26-2G: Groundwater Monitoring
- Alternative OU26-3G: Intrinsic Remediation
- Alternative OU26-4G: Groundwater Collection and Treatment

A detailed analysis of each alternative was completed using the criteria described in Section 6.2.1. Table 6-7 presents the results of this analysis.

6.5.3 Comparative Analysis Of Alternatives Addressing OU26 Groundwater

6.5.3.1 Overall Protection of Human Health and the Environment

The baseline risk assessment identified potential health risks for hypothetical construction workers who may be exposed to contaminated shallow groundwater at OU26. NFA (Alternative OU26-1G) would not provide any protection and would not mitigate the potential unacceptable risks to human health as determined by the baseline risk assessment.

Groundwater monitoring (Alternative OU26-2G), intrinsic remediation (Alternative OU26-3G), and groundwater collection and treatment (Alternative OU26-4G) provide protection against health risks to hypothetical construction workers through institutional controls. The key institutional control for this protection involves long-term management and health and safety oversight of potential future construction projects. Groundwater collection and treatment (Alternative OU26-4G) is expected to provide protection through treatment after an estimated 5 years of active remediation.

6.5.3.2 Compliance with ARARs

Table 6-5 summarizes the action-specific ARARs applicable to the alternatives under consideration, and indicates if compliance is attainable.

NFA, groundwater monitoring, and intrinsic remediation (Alternatives OU26-1G, OU26-2G, and OU26-3G) would not meet the chemical-specific ARARs applying to TCE in groundwater. A waiver to these requirements may be appropriate for Alternatives OU26-2G and OU26-3G since risks are controlled through monitoring and long-term management. The groundwater collection and treatment alternative (Alternative OU26-4G) is expected to comply with all ARARs and waivers would not be required.

6.5.3.3 Long-Term Effectiveness and Permanence

NFA (Alternative OU26-1G) does not provide long-term protection of human health and would leave a residual risk equal to that identified in the baseline risk assessment. The other groundwater alternatives provide effective protection from human exposure through institutional controls. The permanence of institutional controls depends on long-term site management by the USAF.

Intrinsic remediation (Alternative OU26-3G) processes appear to be occurring at the site; however, these processes by themselves do not appear to be effective in the short term at preventing contaminants from persisting in the aquifer. Natural attenuation processes will likely provide permanent long-term risk reduction of TCE contamination. The results of

6.5.3.3 Long-Term Effectiveness and Permanence

NFA (Alternative OU26-1G) does not provide long-term protection of human health and would leave a residual risk equal to that identified in the baseline risk assessment. The other groundwater alternatives provide effective protection from human exposure through institutional controls. The permanence of institutional controls depends on long-term site management by the USAF.

Intrinsic remediation (Alternative OU26-3G) processes appear to be occurring at the site; however, these processes by themselves do not appear to be effective in the short term at preventing contaminants from persisting in the aquifer. Natural attenuation processes will likely provide permanent long-term risk reduction of TCE contamination. The results of recent groundwater sampling at site OU26 indicate that the TCE concentration in site monitoring well SM60-MW1 may already have decreased to a concentration below the PRG. The effectiveness of this trend will be evaluated during the annual groundwater monitoring program.

Groundwater collection and treatment (Alternative OU26-4G) is a proven and reliable technology to hydraulically control the migration and remove contaminants from groundwater. Although pump-and-treat remediation has a poor record at remediating chlorinated solvent sites to maximum contaminant levels (MCLs), the PRGs for this remediation are considerably higher than MCLs (i.e., 580 µg/L) and are expected to be achievable in 5 years or less. The permanence of Alternative OU26-4G requires periodic monitoring and continuous operation of the pumping wells until contaminant concentrations are at levels that allow the processes of natural attenuation to effectively treat the plume.

6.5.3.4 Reduction of TMV through Treatment

NFA, groundwater monitoring, and intrinsic remediation (Alternatives OU26-1G, OU26-2G, and OU26-3G) will not reduce TMV through active treatment; however, in the long term, natural attenuation (primarily biodegradation) will likely reduce the volume and toxicity of site contaminants. Groundwater collection and treatment (Alternative OU26-4G) will reduce the volume of dissolved-phase contaminants through treatment on site.

(Alternatives OU26-2G, OU26-3G, and OU26-4G) are technically and administratively feasible. The collection and treatment alternative (Alternative OU26-4G) requires an aquifer stress test to more accurately define the radius of influence and pumping rate of an extraction well. This alternative also requires groundwater quality testing and bench testing to demonstrate reliability of process with respect to scaling due to precipitation. This alternative includes an NPDES-permitted discharge to the adjacent canal; if discharge to surface water is not allowed, surface irrigation or re-injection may be required. However, re-injection may not be feasible because of scaling and associated plugging. The monitoring alternatives require planning by qualified individuals to develop appropriate monitoring strategies and procedures.

6.5.3.7 Cost

The estimated capital cost, O&M cost, and present worth cost for all the alternatives are presented in Table 6-7. No capital or O&M costs are associated with Alternative OU26-1G. Capital costs range from a low of about $57,000 for Alternative OU26-2G to a high of about $370,000 for Alternative OU26-4G. Annual O&M costs range from about $12,000 for Alternative OU26-2G to about $79,000 for Alternative OU26-4G.

The estimated present worth costs are sensitive to the length of time assumed for each alternative and to the actual quantity of contaminated materials that will be handled and/or treated. The OU26 groundwater alternatives, ranked from low present worth cost to high present worth cost, along with the estimated or assumed remedial action life, are:

Alternative	Present Worth Cost at 5%	Remedial Action Life
OU26-2G Groundwater Monitoring	$250,000	30 year
OU26-3G Intrinsic Remediation	$360,000	30 years
OU26-4G Collection and Treatment	$530,000	8 years

6.5.4 Proposed Alternative for OU26 Groundwater

The proposed alternative for OU26 groundwater is **Alternative OU26-3G Intrinsic Remediation.** This alternative consists of deed restrictions, a natural attenuation evaluation, and long-term groundwater monitoring. The estimated present worth cost of Alternative OU26-3G is $360,000.

6.6 ALTERNATIVES ADDRESSING OU28 SOILS

6.6.1 Description of Alternatives

Alternative OU28-1 - No Further Action

Alternative OU28-1 assumes that no remedial action would be implemented at OU28.

Alternative OU28-2 - Institutional Controls

Alternative OU28-2 would consist of institutional controls including land use restrictions, long-term management, and a health and safety plan for all future intrusive work at the site. Additionally, fencing would be installed around OU28 to control and limit human access to the sites.

Alternative OU28-3 - Remove and Treat Using Low Temperature Thermal Desorption (LTTD)

Alternative OU28-3 involves removal of contaminated soils followed by treatment in a low temperature thermal destruction (LTTD) unit. This alternative would be implemented by:

- Removal of the upper 2 feet of contaminated surface soils (estimated at about 1,500 bank cubic yards) at OU28. Removal would be done using appropriately-sized, conventional earthmoving equipment.

- Backfilling the excavations with uncontaminated fill followed by regrading and revegetation of the ground surface.

- Encapsulation/stabilization of any excavated soils determined to be characteristically hazardous based on TCLP testing. To be conservative for this FS, it was assumed that about 460 bank cubic yards of soil containing lead around the tank at OU28 are characteristically hazardous; however, only one out of four analytical tests for total lead indicated a level that could potentially exceed the TCLP standard for lead. Encapsulation/stabilization would be done using pozzolonic or proprietary agents, and treatability testing would be needed to design the mix. Following successful stabilization, the stabilized soils would be transported to a local solid waste landfill for disposal.

- Transportation and treatment of excavated soils at a local LTTD incinerator, and subsequent beneficial reuse of the by-products in pavement materials.

Alternative OU28-4 Remove and Landfill

Alternative OU28-4 involves removal of contaminated soils for disposal in a solid waste (RCRA Subtitle D) landfill. This alternative would be implemented by:

- Removal of the upper 2 feet of contaminated surface soils (estimated at about 1,500 bank cubic yards) at OU28. Removal would be done using appropriately-sized, conventional earthmoving equipment.

- Backfilling the excavations with uncontaminated fill followed by regrading and revegetation of the ground surface.

- Encapsulation/stabilization of any excavated soils determined to be characteristically hazardous based on TCLP testing. To be conservative for this FS, it was assumed that about 460 bank cubic yards of soil containing lead around the tank at OU28 are characteristically hazardous; however, only one out of four analytical tests for total lead indicated a level that could potentially exceed the TCLP standard for lead. Encapsulation/stabilization would be done using pozzolonic or proprietary agents, and treatability testing

- Backfilling the excavations with uncontaminated fill followed by regrading and revegetation of the ground surface.

- Encapsulation/stabilization of any excavated soils determined to be characteristically hazardous based on TCLP testing. To be conservative for this FS, it was assumed that about 460 bank cubic yards of soil containing lead around the tank at OU28 are characteristically hazardous; however, only one out of four analytical tests for total lead indicated a level that could potentially exceed the TCLP standard for lead. Encapsulation/stabilization would be done using pozzolonic or proprietary agents, and treatability testing would be needed to design the mix. Following successful stabilization, the stabilized soils would be transported to a local solid waste landfill for disposal.

- Transportation and disposal of excavated soils at a local solid waste (RCRA Subtitle D) landfill.

- In addition, this alternative would include a groundwater assessment to determine if lead is present in the groundwater above action levels adjacent to the Building 744 Fuel Tank.

6.6.2 Detailed Analysis of Alternatives Addressing OU28 Soils

Four alternatives that address OU28 soils were carried forward to detailed analysis, as follows:

- Alternative OU28-1: NFA
- Alternative OU28-2: Institutional Controls
- Alternative OU28-3: Remove and Treat using LTTD
- Alternative OU28-4: Remove and Landfill

A detailed analysis of each alternative was completed using the criteria described in Section 6.2.1. Table 6-8 presents the results of this analysis.

6.6.3.2 Compliance with ARARs

Table 6-5 summarizes the action-specific ARARs applicable to the alternatives under consideration, and indicates if compliance is attainable.

NFA (Alternative OU28-1) and Institutional Controls (Alternative OU28-2) would not meet the chemical-specific ARAR – "Soil Cleanup Goals for Florida" (Technical Memorandum dated September 29,1995). A waiver to this requirement may not be appropriate based on the six circumstances for a waiver identified by CERCLA (USEPA 1988). The other alternatives (Alternatives OU28-3 and OU28-4) are expected to meet ARARs and waivers would not be required.

6.6.3.3 Long-Term Effectiveness and Permanence

NFA and institutional controls (Alternatives OU28-1 and OU28-2) do not provide long-term environmental protection and would leave a residual environmental risk equal to that identified in the baseline risk assessment. The LTTD alternative (Alternative OU28-3 provides for permanent irreversible treatment of PAHs. The landfill alternative (Alternative OU28-4) provides for relocation of contaminated soils at a licensed solid waste facility, where long-term effectiveness is ensured through routine monitoring and maintenance.

6.6.3.4 Reduction of TMV through Treatment

NFA, institutional controls, and landfilling alternatives (Alternatives OU28-1, OU28-2, and OU28-4) provide no reduction in TMV through treatment. LTTD (Alternative OU28-3) will also reduce the toxicity of PAHs and other organic constituents in the surface soil.

6.6.3.5 Short-Term Effectiveness

NFA (Alternative OU28-1) does not have any short-term impacts because no remedial action is implemented. For all the other alternatives under consideration, workers can be protected through implementation of a site-specific Health and Safety Plan. Homestead AFB personnel can be protected during construction through the use of appropriate traffic and access controls, as well as dust control measures for earthwork activities. Since general public

access to Homestead AFB is restricted, protection of the general public during construction of any alternative is not expected to be an issue.

6.6.3.6 Implementability

NFA and institutional controls (Alternatives OU28-1 and OU28-2) are technically feasible but may not be administratively feasible unless ARAR waivers are granted. LTTD and landfilling (Alternatives OU28-3 and OU28-4) are technically and administratively feasible.

6.6.3.7 Cost

The estimated capital cost, O&M cost, and present worth cost for all the OU28 alternatives are presented in Table 6-8. No capital or O&M costs are associated with NFA (Alternative OU28-1). For the other alternatives, capital costs range from a low of about $30,000 for Alternative OU28-2 to a high of about $370,000 for Alternative OU28-3. Annual O&M costs range from $0 (Alternatives OU-18-4, and OU-18-5) to about $1,500 for Alternative OU28-2.

The estimated present worth costs are sensitive to the length of time assumed for each alternative and to the actual quantity of contaminated materials that will be handled and/or treated. The OU28 alternatives, ranked from low present worth cost to high present worth cost, along with the estimated or assumed remedial action life, are:

Alternative	Present Worth Cost at 5%	Remedial Action Life
OU28-2 Institutional Controls	$53,000	30 years
OU28-5 Remove and Landfill	$340,000	1 year
OU28-4 Remove and Treat using LTTD	$370,000	1 year

Alternative	Present Worth Cost at 5%	Remedial Action Life
OU28-2 Institutional Controls	$53,000	30 years
OU28-4 Remove and Landfill	$340,000	1 year
OU28-3 Remove and Treat using LTTD	$370,000	1 year

6.6.4 Proposed Alternative for OU28

The proposed alternative for OU28 is **Alternative OU28-4 Remove and Landfill.** This alternative consists of removal of surface soils with PAHs, arsenic, or lead at concentrations that exceed FDEP industrial soil clean-up goals. These materials will be hauled to a permitted solid waste landfill. Any soils determined to be characteristically hazardous because of lead will be stabilized and then hauled off site to the permitted solid waste landfill. This alternative also includes a groundwater assessment to determine if lead above action levels is present around Building 744. Appropriate access restrictions and groundwater monitoring will be included in the transfer documents, as necessary. The estimated present worth cost of Alternative OU28-4 is $340,000.

6.7 ALTERNATIVES ADDRESSING OU29 SOILS

6.7.1 Description of Alternatives

Alternative OU29-1 - No Further Action

Alternative OU29-1 assumes that no remedial action would be implemented at OU29.

Alternative OU29-2 - Institutional Controls

Alternative OU29-2 would consist of institutional controls including land use restrictions, long-term management, and a health and safety plan for all future intrusive work at the site. Additionally, fencing would be installed around OU29 to control and limit human access to the sites.

- Backfilling the excavations with uncontaminated fill followed by regrading and revegetation of the ground surface.

- Transportation and treatment of excavated soils at a local LTTD incinerator, and subsequent beneficial reuse of the by-products in pavement materials.

Alternative OU29-4 - Remove and Landfill

Alternative OU29-4 involves removal of contaminated soils for disposal in a solid waste (RCRA Subtitle D) landfill. This alternative would be implemented by:

- Removal of the upper 2 feet of contaminated surface soils (estimated at about 920 bank cubic yards) at OU29. Removal would be done using appropriately-sized, conventional earthmoving equipment.

- Backfilling the excavations with uncontaminated fill followed by regrading and revegetation of the ground surface.

- Transportation and disposal of excavated soils at a local solid waste (RCRA Subtitle D) landfill.

6.7.2 Detailed Analysis of Alternatives Addressing OU29 Soils

Four alternatives that address OU29 soils were carried forward to detailed analysis, as follows:

- Alternative OU29-1: NFA
- Alternative OU29-2: Institutional Controls
- Alternative OU29-3: Remove and Treat using LTTD
- Alternative OU29-4: Remove and Landfill

A detailed analysis of each alternative was completed using the criteria described in Section 6.2.1. Table 6-9 presents the results of this analysis.

6.7.3 Comparative Analysis Of Alternatives Addressing OU29 Soils

6.7.3.1 Overall Protection of Human Health and the Environment

No potential unacceptable human health or environmental risks were identified by the baseline risk assessment. Therefore, NFA (Alternative OU29-1) would provide adequate protection of human health and the environment. Removal and treatment using a LTTD and disposal in a landfill (Alternatives OU29-3 and OU29-4) provide for complete removal of contaminated surface soils from OU29, thereby meeting the FDEP cleanup levels for PAHs in soil.

6.7.3.2 Compliance with ARARs

Table 6-5 summarizes the action-specific ARARs applicable to the alternatives under consideration, and indicates if compliance is attainable.

NFA (Alternative OU29-1) and Institutional Controls (Alternative OU29-2) would not meet the chemical-specific ARAR – "Soil Cleanup Goals for Florida" (Technical Memorandum dated September 29,1995). A waiver to this requirement may not be appropriate based on the six circumstances for a waiver identified by CERCLA (USEPA 1988). The other alternatives (Alternatives OU29-3 and OU29-4) are expected to meet ARARs and waivers would not be required.

6.7.3.3 Long-Term Effectiveness and Permanence

All the alternatives provide protection since the baseline risk assessment did not identify any unacceptable risks to human health or the environment. However, PAHs have been found at levels that exceed FDEP industrial soil clean-up goals. NFA and institutional controls (Alternatives OU29-1 and OU29-2) would not remove the soils that exceed these FDEP criteria, whereas LTTD and landfilling (Alternatives OU29-3 and OU29-4) would remove all soils that exceed the FDEP criteria. The LTTD alternative (Alternative OU29-3 provides for permanent irreversible treatment of PAHs. The landfill alternative (Alternative OU29-4) provides for relocation of contaminated soils at a licensed solid waste facility, where long-term effectiveness is ensured through routine monitoring and maintenance.

6.7.3.4 Reduction of TMV through Treatment

NFA, institutional controls, and landfilling alternatives (Alternatives OU29-1, OU29-2, and OU29-4) provide no reduction in TMV through treatment. LTTD (Alternative OU29-3) will also reduce the toxicity of PAHs and other organic constituents in the surface soil.

6.7.3.5 Short-Term Effectiveness

NFA (Alternative OU29-1) does not have any short-term impacts because no remedial action is implemented. For all the other alternatives under consideration, workers can be protected through implementation of a site-specific Health and Safety Plan. Homestead AFB personnel can be protected during construction through the use of appropriate traffic and access controls, as well as dust control measures for earthwork activities. Since general public access to Homestead AFB is restricted, protection of the general public during construction of any alternative is not expected to be an issue.

6.7.3.6 Implementability

NFA and institutional controls (Alternatives OU29-1 and OU29-2) are technically feasible but may not be administratively feasible unless ARAR waivers are granted. LTTD and landfilling (Alternatives OU29-3 and OU29-4) are technically and administratively feasible.

6.7.3.7 Cost

The estimated capital cost, O&M cost, and present worth cost for all the OU29 alternatives are presented in Table 6-9. No capital or O&M costs are associated with NFA (Alternative OU29-1). For the other alternatives, capital costs range from a low of about $26,000 for Alternative OU29-2 to a high of about $160,000 for Alternative OU29-3. Annual O&M costs range from $0 (Alternatives OU29-3 and OU29-4) to about $1,500 for Alternative OU29-2.

The estimated present worth costs are sensitive to the length of time assumed for each alternative and to the actual quantity of contaminated materials that will be handled and/or

treated. The OU29 alternatives, ranked from low present worth cost to high present worth cost, along with the estimated or assumed remedial action life, are:

Alternative	Present Worth Cost at 5%	Remedial Action Life
OU29-2 Institutional Controls	$49,000	30 years
OU29-4 Remove and Landfill	$140,000	1 year
OU29-3 Remove and Treat using LTTD	$160,000	1 year

6.7.4 Proposed Alternative for OU29 Soils

The proposed alternative for OU29 is **Alternative OU29-4 Remove and Landfill.** This alternative consists of removal of surface soils with PAHs at concentrations that exceed FDEP industrial soil clean-up goals. These materials will be hauled to a permitted solid waste landfill. The estimated present worth cost of Alternative OU29-4 is $140,000.

6.8 SELECTED REMEDIES SUMMARY

The Feasibility Study (W-C, 1997b) evaluated several remedial alternatives using the EPA evaluation criteria. The following table identifies the remedial alternatives selected for each OU based on the EPA criteria:

Site	Selected Alternative	Total Present Worth Cost
OU18	Soil Cover (soils and sediment)	$800,000
OU26	Remove and Landfill (soils)	$20,000
OU26	Intrinsic Remediation (groundwater)	$360,000
OU28	Remove and Landfill (soils)	$340,000
OU29	Remove and landfill (soils)	$140,000

6.9 STATUTORY DETERMINATIONS

The selected remedies are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost effective. These remedies utilize permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable. However, because treatment of the principal threats of the OUs was not found to be practicable, these remedies do not satisfy the statutory preference for treatment as a principal element.

Because the remedies for soil at OU18 and groundwater at OU26 will result in hazardous substances still remaining on site above health-based levels, a review will be conducted within five years of commencement of remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

Because the remedies for soil at OUs 28, 26, and 29 will not result in hazardous substances on site above health-based levels, the five-year review will not apply to these actions.

TABLE 6-1

SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
STATE/COUNTY						
Florida Air and Water Pollution Control Acts (Florida Statutes, Title 29, Chapter 403, Section 403)						
Florida Surface Water Standards (FAC, Title 62, Chapter 62 - 302.530)	Establishes surface water quality criteria based on use classification of the waters.	Applicable if remedial activities result in the discharge of contaminant to surface waters.		X		
Florida Safe Drinking Water Act (Florida Statutes, Title 29, Chapter 403, Sections 403.850 - 403.864)						
Florida Primary Drinking Water Standards (FAC, Title 62, Chapter 62 - 550.310)	Establishes maximum contaminant levels (MCLs) and standards for sources of drinking water. These are health based standards for specific contaminants.	State MCLs are more stringent than federal MCLs and therefore are applicable requirements.	X	X	X	X
Florida Secondary Drinking Water Standards (FAC, Title 62, Chapter 62 - 550.320)	Establishes secondary MCLs which are nonenforceable guidelines for public drinking water systems to protect the aesthetic quality of the water.	Secondary MCLs may be "to be considered" if groundwater is used as a drinking water source.			X	
Florida Department of Environmental Protection (FDEP)						
Cleanup Goals for the Military Sites in Florida, Technical Memorandum dated July 5, 1994.	Lists carcinogenic and noncarcinogenic soil clean-up goals for military installations in Florida.	Not an ARAR. Clean-up goals are only applicable to sites within the cantonment area that is contaminated with any of the listed contaminants.				
Soil Cleanup Goals for Florida, Technical Memorandum dated September 29, 1995	Soil cleanup goals based on human toxicity using generalized exposure assumptions.	Cleanup goals are applicable if site is contaminated with any of the listed contaminants.	X	X	X	X
Petroleum Contamination Site Cleanup Criteria (FAC, Title 62, Chapter 62-770)	Lists requirements for cleanup of contaminated soils, including procedures for determining cleanup levels.	Not an ARAR. Site is not contaminated with petroleum products.				
Dade County Department of Environmental Resources Management (DERM)						
Soil Clean-Up Goals for Homestead Air Reserve Base, letter to Air Force Base Conversion Agency, March 2, 1995	Lists carcinogenic and noncarcinogenic soil clean-up goals, specifically for sites at Homestead ARB.	Not an ARAR. The BCT decided that the industrial cleanup goals outlined in the September 1995 Soil Cleanup Goals for Florida would be used.				

TABLE 6-1

SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
FEDERAL						
Safe Drinking Water Act (40 U.S.C. Sect. 300 et seq.)						
National Primary Drinking Water Standards [40 CFR Parts 141, 142, (1990, 1991)	Establishes maximum contaminant levels (MCLs) for specific contaminants which are health-based standards for public drinking water systems.	Not an ARAR. The state MCLs are more stringent than the federal MCLs and therefore are applicable.				
National Secondary Drinking Water Standards (40 CFR Part 143)	Establishes secondary maximum contaminant levels (SMCLs) which are nonenforceable guidelines for public drinking water systems to protect the aesthetic quality of the water.	SMCLs may be "to be considered" if groundwater is used as a drinking water source.			X	
Maximum Contaminants Level Goals (MCLGs) [PL No. 99-339, 100 Stat. 642 (1986), (1990, 1991); 40 CFR 141,142]	Establishes drinking water quality goals at a level at which no adverse health effects may occur with an adequate margin of safety.	Not an ARAR. There are no MCLGs for chemicals of concern set above zero levels for existing or potential sources of drinking water.				
Resource, Conservation, and Recovery Act (42 U.S.C. Sect. 6901 et seq.)						
Releases from Solid Waste Management Units (40 CFR Part 264)	Subpart F (264.94) gives concentration limits in groundwater for hazardous constituents from a regulated unit.	Not an ARAR. No limits set forth for chemicals of concern at these sites.				
RCRA Facility Investigation Guidance (EPA, 1989)	Guidance levels for cleanup of contaminated soils based on EPA-derived chronic exposure assumptions; intended as screening levels at RCRA facilities to determine if a more detailed health-risk evaluation is warranted.	Not an ARAR. The concentration limits are superseded by the FDEP industrial cleanup goals outlined in the September 1995 Soil Cleanup Goals for Florida.				
Proposed RCRA Action Levels (55 FR 30798, 27 July 1990)	Risk-based action levels for contaminants in soil which, if exceeded, would trigger the need for a Corrective Measures Study.	Not an ARAR. The concentration limits are superseded by the FDEP industrial cleanup goals outlined in the September 1995 Soil Cleanup Goals for Florida.				

TABLE 6-1

SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
Water Pollution Control Act (33 U.S.C. Sect. 1251)						
National Pollutant Discharge Elimination System Regulations (40 CFR 125)	Establish procedures for determination of effluent limitations for discharges of pollutants to navigable waters.	Relevant and appropriate if contaminants are released to surface waters or if treated groundwater is discharged to surface waters.		X		
Toxic Pollutant Effluent Standards (40 CFR 129)	Establishes effluent standards for certain toxic pollutants (as designated by 40 CFR 401): aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, PCBs.	Not an ARAR. None of the toxic pollutants are chemicals of concern at these sites.				
Ambient Water Quality Standards (40 CFR 131)	Requires states to develop water quality criteria for surface waters based on their use and the criteria provided under Section 304(a) of the Clean Water Act.	Relevant and appropriate if contaminants are released to surface waters or if treated groundwater is discharged to surface waters.		X		
Guidelines Establishing Test Procedures for the Analysis of Pollutants (40 CFR 136)	Specific analytical procedures for NPDES applicants and reports.	Applicable if contaminants are released to surface waters or if treated groundwater is discharged to surface waters.		X		
Clean Air Act (42 U.S.C. Sect. 7401 - 7642)						
National Primary and Secondary Ambient Air Quality Standards (40 CFR 50)	Establishes ambient air quality standards to protect public health and welfare.	Applicable if contaminants are discharged to the atmosphere during waste handling or a treatment process.	X	X	X	X
National Emission Standards for Hazardous Air Pollutants (40 CFR 61)	Establishes emission standards for certain industrial pollutants and sources.	Will be an ARAR if the remedial action involves a specific industrial category for which NESHAPs have been established.	X	X	X	X

MCLs = Maximum Contaminant Level
SMCLs = Secondary Maximum Contaminant Level
MCLGs = Maximum Contaminant Level Goals
RCRA = Resource Conservation and Recovery Act
PCB = Polychlorinated Biphenyls
ARARs = Applicable or Relevant and Appropriate Requirements
TBC = To be considered
NPDES = National Pollutant Discharge Elimination System
NESHAPs = National Emission Standards for the Hazardous Air Pollutants
Note: An X means that the ARAR/TBC is potentially applicable to the site.

TABLE 6-2

SUMMARY OF POTENTIAL LOCATION-SPECIFIC ARARs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comments	OU18	OU26	OU28	OU29
FEDERAL						
Resource Conservation and Recovery Act (42 U.S.C. Sect. 6901 et seq.)						
Fault Areas [40 CFR 264.18(a)]	New facilities where treatment, storage or disposal of hazardous waste will be conducted is prohibited within 61 meters (200 feet) of a fault displaced in Holocene time.	Not an ARAR. Treatment, storage and disposal of waste will not be conducted within 61 meters of a fault displaced in Holocene time.				
Floodplain [40 CFR 264.18(b)]	New facilities where treatment, storage or disposal of hazardous waste will be conducted is prohibited within the 100-year floodplain.	Not an ARAR. Treatment, storage and disposal of waste will not be conducted within the 100-year floodplain of adjacent rivers. There are no 100-year flood plains at Homestead ARB.				
Salt Domes, Underground Mines, and Caves [40 CFR 264.18(c)	Prohibits noncontainerized or bulk liquid hazardous waste placement in salt domes, salt bed formations, and underground mines or caves.	Not an ARAR. No action which would place waste in a salt dome or salt bed formation, underground mine or cave is anticipated at this site.				
E.O. 11988 Protection of Floodplains	Limits activities in floodplain. Floodplain is defined as "the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of off-shore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." [40 CFR 6, Appendix A and 40 CFR 6.302]	Not an ARAR. As stated above, there are no 100-year flood plains at Homestead ARB.				
E.O. 11990 Protection of Wetlands	Minimizes impacts on areas designated as wetlands. [40 CFR 6, Appendix A]	Not an ARAR. No remedial activities will occur on or near listed wetland areas and no remedial activities will impact wetland areas.				
Clean Water Act Section 404 (33 U.S.C. Sect. 1251 et seq.)						
Dredge or Fill Material [33 U.S.C. 1251; 40 CFR 230; 33 CFR 320-330]	Action to prohibit discharge of dredged or fill material into waters of U.S. without permit.	Not an ARAR. Dredge and fill permit requirements apply if waters of the U.S. are impacted by remedial activities on the site. No dredge or fill material will be placed in waters of the U.S.				
Wetland Protection	Requires Federal agencies to avoid, to the extent possible, adverse impacts associated with destruction or loss of wetlands.	Not an ARAR. As described above, regulations are applicable only if the remedial activities impact the wetland area.				

TABLE 6-2

SUMMARY OF POTENTIAL LOCATION-SPECIFIC ARARs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comments	OU18	OU26	OU28	OU29
Safe Drinking Water Act (40 U.S.C. Sect. 300 et seq.)						
Drinking Water [40 CFR 149]	Includes regulations for defining sole source or principal drinking water source aquifers.	The Biscayne Aquifer is identified as a sole source of potable water in the area.	X	X	X	X
Wellhead Protection Program [42 USCA 300h-7]	Directs states to implement protection programs for wells and recharge areas for drinking water.	Wellhead protection areas exist at Homestead ARB.	X	X	X	X
Endangered Species Act (16 U.S.C. Sect. 1531 et seq.) (50 CFR 200, 50 CFR 402)	Protects endangered species and threatened species and preserves their habitat.	Although there are no known critical habitats in the immediate vicinity of the site or any known listed endangered species, if any are identified during the remedial activities this regulation would be applicable.	X	X	X	X
Bald Eagle Protection Act (16 U.S.C. Sect. 688 et seq.)	Protects all eagle species and restricts activities that may threaten or adversely affect their habitat.	Not an ARAR. Bald eagles are not known to inhabit Homestead ARB or the surrounding area and are not expected to in the future.				
Migratory Bird Treaty Act (16 U.S.C. Sect. 703 et seq.)	Protects migratory, resident, or range habitat of migratory birds including raptors and waterfowl.	Remedial actions cannot threaten or adversely affect the habitats of migratory waterfowl or raptors.	X	X	X	X
Wilderness Act (16 U.S.C. Sect. 1311 et seq.) (50 CFR 53.1 et seq.)	Limits activities within an area designed as a wilderness area.	Not an ARAR. The site is not within a federally-owned area designated as a wilderness area.				
Wildlife Refuge [16 U.S.C. 668 et seq.; 50 CFR Part 27]	Limits the type of activities permitted in an area designated as a National Wildlife Refuge System.	Not an ARAR. The site is not in an area designated as part of the National Wildlife Refuge System.				
Fish and Wildlife Coordination Act (16 U.S.C. Sect. 661 et seq.) (33 CFR Parts 320-330; 40 CFR 6.302)	Prohibits activities affecting/modifying streams or bodies of water if the activity has a negative impact on fish or wildlife.	Not an ARAR. Remedial activities will not modify a stream, river, or canal.				
Wild and Scenic Rivers Act (16 U.S.C. Sect. 1271 et seq.) (40 CFR 6.302(e))	Protects rivers that are designated as wild, scenic or recreational.	Not an ARAR. No rivers designated as wild, scenic or recreational will be affected by remedial activities.				
National Historic Preservation Act (NHPA) (16 U.S.C. Sect. 470 et seq.) (7 CFR 650, 36 CFR Part 65, Part 800)	Requires the preservation of historic properties included in or eligible for the National Register of Historic Places and to minimize harm to National Historic Landmarks.	Not an ARAR. No historical place or landmark identified at the site.				

TABLE 6-2

SUMMARY OF POTENTIAL LOCATION-SPECIFIC ARARs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comments	OU18	OU26	OU28	OU29
The Historic and Archaeological Data Preservation Act of 1974 (16 U.S.C. Sect. 469 et seq.) (40 CFR 6.301(c)	Establishes procedures to provide for preservation of historical and archaeological data which might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity program.	Not an ARAR. No historic site located on site.				
The Archaeological Resource Protection Act of 1979 (16 U.S.C. Sect. 470aa-47011 et seq.)	Requires a permit for any excavation or removal of archaeological resources form public or Indian lands.	Not an ARAR. No removal of archaeological resources is expected from remedial activities.				
Coastal Zone Management Act (16 U.S.C. Sect. 1451 et seq.)	Limits activities affecting the coastal zone, including lands thereunder and adjacent shorelands.	Not an ARAR. Homestead ARB is not located within the coastal zone management area.				
STATE						
Florida Rules on Hazardous Waste Warning Signs (FAC, Title 62, Chapter 62-736)	Establishes requirements for warning signs to protect citizens from unknowingly becoming exposed to hazardous wastes.	These requirements are applicable because sites are suspected to contain hazardous substances.				

Note: An X means that the ARAR is potentially applicable to the site.

TABLE 6-3

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
Federal						
Solid Waste Disposal Act (SWDA), as amended by Resource Conservation and Recovery Act of 1976 (RCRA) (42 U.S.C. Sect. 6901-6987)						
Criteria for Classification of Solid Waste Disposal Facilities and Practices (Subtitle D) (40 CFR Part 257)	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health. Prohibits open dumps.	Applicable to land disposal of nonhazardous solid waste. May be relevant and appropriate to stockpiling, treatment and disposal of nonhazardous solid waste and landfill closure actions.	X	X	X	X
Criteria for Municipal Waste Landfills (Subtitle D) (40 CFR Part 258)	Sets forth minimum criteria for municipal solid waste landfills, including closure and postclosure care requirements.	Not an ARAR. No municipal solid waste landfills exist at the site.				
Identification and Listing of Hazardous Wastes (Subtitle C) (40 CFR Part 261)	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265, 268, and Parts 124, 270, and 271.	Applicable if remedial action involves generation, storage, treatment, and/or disposal of hazardous waste.			X	
Standards Applicable to Generators of Hazardous Waste (Subtitle C) (40 CFR Part 262)	Establishes standards for generators of hazardous waste.	Applicable if remedial action involves off-site disposal or treatment of hazardous waste. On-site generation triggers selected provisions (i.e., waste determination, accumulation time).			X	
Standards Applicable to Transporters of Hazardous Waste (Subtitle C) (40 CFR Part 263)	Establishes standards which apply to persons transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	Applicable if remedial action involves off-site transportation of hazardous waste.			X	
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (Subtitle C) (40 CFR Part 264)	Establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose hazardous waste.	Not an ARAR. Remedial action will not involve stockpiling, treatment, or disposal of hazardous waste.				

TABLE 6-3

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
Interim Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities (Subtitle C) (40 CFR Part 265)	Establishes minimum national standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure or if the facility is subject to post-closure requirements, until post-closure requirements, until post-closure responsibilities are fulfilled.	Not an ARAR. Remedial action will not involve stockpiling, treatment, or disposal of hazardous waste.				
Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (40 CFR Part 266)	Establishes requirements which apply to recyclable materials that are claimed to recover economically significant amounts of precious metals, including gold and silver. Also establishes requirements which apply to disposal of recyclable materials, burning of used oil for energy recovery, and burning of hazardous waste in boilers and industrial furnaces.	Not an ARAR. No significant quantities of metals or other recyclable materials occur at the sites, and no burning or incineration of wastes for energy recovery will occur.				
Land Disposal (40 CFR Part 268)	Establishes a timetable for restriction of burial of hazardous wastes, contaminated soil, and debris. Prohibits the land disposal unless the waste has been treated to prescribed treatment standards. Land disposal restrictions (LDRs) do not apply to a specific hazardous waste until EPA has developed treatment standards for that waste. Treatment variances are typically needed for contaminated soils at CERCLA sites.	Applicable if the remedial action involves land disposal of regulated waste. LDRs and treatment standards apply to hazardous waste that has been removed from a land disposal unit or area of contamination.			X	
Resource, Conservation, and Recovery Act (RCRA) (42 U.S.C. Sect. 6901 et seq.)						
Subtitle I						
EPA Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (40 CFR Part 280)	Subpart F requires that the corrective action plan consider the "physical and chemical characteristics of the regulated substance, including its toxicity, persistence, and potential for migration."	Not an ARAR. No Underground Storage Tanks (USTs) and UST systems, as defined at 40 CFR 280.12, exist at these sites.				

TABLE 6-3

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
Safe Drinking Water Act (SDWA) (42 U.S.C. Sect. 300(f) et. seq.)						
Standards for Owners and Operators of Public Water Supply System (40 CFR 141)	Provides treatment (water quality) requirements for public water supply systems.	Not an ARAR. Florida Drinking Water Standards will be used to determine cleanup goals for groundwater contamination.				
Underground Injection Control Regulation (40 CFR Parts 144-147)	Provides for protection of underground sources of drinking water.	Not an ARAR. Remedial action will not involve underground injection.				
Federal Water Pollution Control Act (FWPCA), as amended by the Clean Water Act (CWA) of 1977 (33 U.S.C. Sect. 1251-1376)						
National Pollutant Discharge Elimination System (40 CFR Parts 122-125)	Requires permits for the discharge of pollutants from any point source into waters of the United States.	Potentially applicable to discharges to on-site or off-site surface water.		X		
National Pretreatment Standards (40 CFR Part 403)	Sets pretreatment standards to control pollutants which pass through or interfere with treatment processes in publicly owned treatment works (POTW) or which may contaminate sewage sludge.	Potentially applicable to discharges of treated groundwater to a local POTW.		X		
Toxic Substances Control Act (15 U.S.C. Sect. 2601-2629)						
PCB Requirements	Establishes storage and disposal requirements for PCBs.	Not an ARAR. Remedial action does not involve storage or disposal of PCBs or PCB-contaminated soils.				
Standards for Handling PCBs (40 CFR 761)	Establishes prohibitions of and requirements for the manufacture, processing, distribution in commerce, use, disposal, storage, and marketing of PCBs and PCB items.	Not an ARAR. Remedial action does not involve storage or disposal of PCBs or PCB-contaminated soils.				

TABLE 6-3

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
Clean Air Act (42 U.S.C. Sect. 7401-7642)						
New Source Performance Standards (NSPS) (40 CFR 60)	Establishes emission standards for certain categories of industrial stationary sources.	Not an ARAR. No remedial actions will be regulated by these standards.				
Prevention of Significant Deterioration (PSD) program (40 CFR 51 and 52)	Implements and sets rules for a regional air pollution control program.	Not an ARAR. Remedial action will not create emissions that will trigger these standards.				
Hazardous Materials Transportation Act (49 U.S.C. Sect. 1801-1813)						
Hazardous Materials Transportation Regulations (49 CFR Parts 107, 171-177)	Regulates transportation of hazardous materials.	Applicable if the remedial action involves transportation of hazardous materials.			X	
State						
Florida Hazardous Substance Release Notification Rules (FAC, Title 62, Chapter 62-150)	Establishes notification requirements for releases of hazardous substances.	Requirements are applicable if a release is discovered at a site. Would apply to potential releases that could occur during remedial action.	X	X	X	X
Florida Solid Waste Disposal Facilities Regulations (FAC, Title 62, Chapter 62-701)	Establishes requirements for solid waste management facilities.	Requirements are applicable if landfilling is used to dispose of contaminated materials.	X			
Florida Solid Waste Combustor Ash Regulations (FAC, Title 62, Chapter 62-702)	Establishes requirements for the management of ash that results from the combustion of solid wastes.	Not an ARAR. Solid waste combustor will not be used to thermally breakdown any solid wastes at a site.				
Florida Hazardous Waste Rules (FAC, Title 62, Chapter 62-730)	Establishes procedures for notification of hazardous waste activity, identification and listing of hazardous wastes, generators, and operators of treatment, storage, and disposal facilities.	Requirements are applicable if remedial actions involve on-site hazardous waste management, storage, treatment, and/or disposal.			X	
Petroleum Contamination Site Cleanup Criteria (FAC, Title 62, Chapter 62-770)	Lists requirements for cleanup of contaminated soils, including procedures for determining cleanup levels.	Not an ARAR. Site is not contaminated with petroleum products.				

TABLE 6-3

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Description	Comment	OU18	OU26	OU28	OU29
Florida Soil Thermal Treatment Facilities Regulations (FAC, Title 62, Chapter 62-775)	Establishes requirements for cleanup criteria of thermal treated, petroleum contaminated soils.	Not an ARAR. Site has no petroleum contaminated soils that will be thermally treated.				

SDWA = Safe Drinking Water Act
RCRA = Resource Conservation and Recovery Act
SWDA = Solid Waste Disposal Act
UST = Underground Storage Tank
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act
LDRs = Land Disposal Restrictions
POTW = Publicly Owned Treatment Works
PCBs = Polychlorinated Biphenyls

TABLE 6-4

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU18 SOILS AND SEDIMENTS HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU18-1 No Further Action	ALT. OU18-2 Institutional Controls	ALT. OU18-3 Soil Cover	ALT. OU18-4 Remove and Treat using LTTD	ALT. OU18-5 Remove and Landfill
	• Do nothing	• Access restrictions	• Remove asphaltic sediments from canal and place on surface of OU18 • Excavate edge of fill 10 feet away from canal • Regrade slopes and surface • Install 18" soil cover and 6" vegetative layer • Fence site and monitor groundwater	• Remove asphaltic sediments and upper 2 feet of asphaltic soil • Haul and treat at LTTD • Place 6" vegetative layer over site	• Remove asphaltic sediments and upper 2 feet of asphaltic soil • Haul and dispose at landfill • Place 6" vegetative layer over site
OVERALL PROTECTION					
Human Health Protection	No protection.	Some protection through access restrictions and long-term management.	Significant protection at site by eliminating potential pathways through consolidating contaminated soils and sediments beneath cover.	Permanent protection at site by removing contaminated soils and sediments.	Permanent protection at site by removing contaminated soils and sediments. Adequate protection off-site by containing waste in permitted
Environmental Protection	No protection.	No protection. Allows contamination to persist under influence of natural degradation processes.	Protection by removal of contaminated sediment from canal, grading and erosion protection of debris fill along canal, and consolidating contaminated soils and sediments beneath cover.	Permanent protection off-site by destroying PAHs and immobilizing Permanent protection by eliminating contamination sources at site, destroying PAHs, and immobilizing arsenic by re-use in pavement.	Permanent protection at site by removing contaminated soils and sediments. Adequate future off-site protection by containing waste in permitted landfill.
COMPLIANCE WITH ARARs					
Compliance with ARARs	Would not meet chemical specific requirements.	Would not meet chemical specific requirements.	Would not meet action specific requirements for solid waste disposal.	Meets all ARARs.	Meets all ARARs.
Appropriateness of waivers	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Considered to be appropriate because a soil cover will attain an equivalent standard of performance required for permitted solid waste facilities.	Not required.	Not required.
LONG-TERM EFFECTIVENESS					
Magnitude of residual risk	No reduction in risk associated with exposure to PAHs in surface soils or arsenic in sediments. PAHs in surface soils and PAHs/arsenic in sediments remain at levels above PRGs.	Some reduction in risk to potential human receptors; no reduction in risk to potential environmental receptors. PAHs in surface soils and PAHs/arsenic in sediments remain at levels above PRGs.	Consolidation of PAHs and arsenic under cover reduces risks to potential human and environmental receptors by eliminating pathway.	Soils containing PAHs and sediments containing PAHs/arsenic permanently removed from site. PAHs destroyed and arsenic immobilized. No residual risk.	Soils containing PAHs and sediments containing PAHs/arsenic permanently removed from site and contained in permitted landfill. No residual risk. USAF retains long-term liability of waste disposed at landfill.
Adequacy and reliability of controls	Not applicable.	Deed and access restrictions and long-term oversight can be adequate and reliable with proper management.	A soil cover with long-term O&M is adequate and reliable method to minimize exposures and control migration.	Removal of contaminated soils and sediments is adequate and reliable. Incineration is adequate and reliable method to destroy PAHs. Arsenic will not be destroyed, but re-use of material in pavement will immobilize the arsenic.	Removal of contaminated soils and sediments is adequate and reliable. Disposal at permitted landfill is adequate and reliable method to contain wastes.

TABLE 6-4

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU18 SOILS AND SEDIMENTS HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU18-1 No Further Action	ALT. OU18-2 Institutional Controls	ALT. OU18-3 Soil Cover	ALT. OU18-4 Remove and Treat using LTTD	ALT. OU18-5 Remove and Landfill
Need for 5-year review	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review would be required to ensure adequate protection of human health and the environment is maintained.	Not required.	Not required.
REDUCTION OF TMV					
Treatment process used and material treated	None.	None.	None.	Low temperature thermal desorption.	None.
Amount destroyed or treated	None.	None.	None.	An estimated 28,000 tons of surface soil and sediment containing PAHs.	None.
Reduction of TMV through treatment	None.	None.	None.	Reduces TMV of PAHs through thermal destruction.	None.
Irreversible treatment	None.	None.	None.	LTTD is irreversible.	None.
Type and quantity of residuals remaining after treatment	Not applicable.	Not applicable.	Not applicable.	All residual quantities are expected to be beneficially reused in pavement	None.
SHORT-TERM EFFECTIVENESS					
Time required to achieve remedial action objectives (RAOs)	RAOs would not be achieved in the short-term.	RAOs would not be achieved in short-term; however, reduction of human exposure to contaminants achieved immediately.	RAOs could be achieved within one year.	RAOs could be achieved within one year.	RAOs could be achieved within one year.
Protection of community and workers during remedial actions	No action taken	Little risk to community because access to Homestead AFB is restricted. Workers can be protected using standard health and safety	Little risk to community because access to Homestead AFB is restricted. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the LTTD. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the landfill. Workers can be protected using standard health and safety procedures.
Environmental impacts during remedial actions	None.	None.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Air emissions from LTTD controlled under operating permit.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Impacts from landfill controlled under operating permit.
IMPLEMENTABILITY					
Ability to construct and operate	Not applicable.	Fencing easily constructed.	Standard excavation and earth moving equipment can readily remove soil and sediment.	Standard excavation and earth moving equipment can readily remove soil and sediment. LTTD operation already set up within 40 miles of site.	Standard excavation and earth moving equipment can readily remove soil and sediment. Permitted solid waste landfill located within 40 miles of site.
Ease of doing more remedial action, if needed	Easy.	Easy.	Easy.	Easy.	Easy.
Ability to monitor effectiveness	Not applicable.	Easy.	Annual inspections and monitoring easy to implement.	Monitoring not required after remedial action.	Monitoring by USAF not required after remedial action. Landfill monitors under permit conditions.
Ability to obtain approvals and coordination with other agencies	Not applicable.	None required.	None required.	None required.	None required.
Availability of services and equipment	Not applicable.	Commercially available.	Commercially available.	Commercially available.	Commercially available.

TABLE 6-4

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU18 SOILS AND SEDIMENTS HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU18-1 No Further Action	ALT. OU18-2 Institutional Controls	ALT. OU18-3 Soil Cover	ALT. OU18-4 Remove and Treat using LTTD	ALT. OU18-5 Remove and Landfill
COST					
Capital Cost	$0	$37,000	$585,000	$2,139,000	$1,848,000
Present Worth Cost of O&M	$0	$23,000	$169,000	$0	$0
Present Worth Cost	$0	$60,000	$754,000	$2,139,000	$1,848,000
Cost Sensitive				If an 18" soil cover and 6" vegetative layer is placed Capital costs = $2,335000 Present worth cost = $2,335,000	If an 18" soil cover and 6" vegetative layer is placed Capital costs = $2,044,000 Present worth cost = $2,044,000

TABLE 6-5

ACTION-SPECIFIC ARARs/TBCs
HOMESTEAD AFB

Standard, Requirement, or Criteria	Alternatives Addressing Soils and Sediments					Alternatives Addressing Groundwater			
	No Action	Institutional Controls	Soil Cover	Remove and Treat using LTTD	Remove and Landfill	No Action	Groundwater Monitoring	Intrinsic Remediation	Groundwater Collection and Treatment
Federal									
Solid Waste Disposal Act (SWDA), as amended by Resource Conservation and Recovery Act of 1976 (RCRA) (42 U.S.C. Sect. 6901-6987)									
Criteria for Classification of Solid Waste disposal Facilities and Practices (Subtitle D) (40 CFR Part 257)			O		X				
Identification and Listing of Hazardous Wastes (Subtitle C) (40 CFR Part 261)			X	X	X				
Standards Applicable to Generators of Hazardous Wastes (Subtitle C) (40 CFR Part 262)			√	√	√				
Standards Applicable to Transporters of Hazardous Wastes (Subtitle C) (40 CFR Part 263)			√	√	√				
Land Disposal (40 CFR Part 268)			√	√	√				
Federal Water Pollution Control Act (FWPCA), as amended by the Clean Water Act (CWA) of 1977 (33 U.S.C. Sect. 1251-1376)									
National Pollutant Discharge Elimination System (40 CFR Parts 122-125)									X
National Pretreatment Standards (40 CFR Part 403)									X
Hazardous Materials Transportation Act (49 U.S.C. Sect. 1801-1813)									
Hazardous Materials Transportation Regulations (49 CFR Parts 107, 171-177)			√	√	√				
State									
Florida Hazardous Substance Release Notification rules (FAC, Title 62, Chapter 62-150)			√	√	√				
Florida Solid Waste Disposal Facilities Regulations (FAC, Title 62, Chapter 62-701)			O		X				
Florida Hazardous Waste Rules (FAC, Title 62, Chapter 62-730)			X	√	X				

NOTES:
X -- Action-specific ARAR is applicable and attainable at all OUs.
O -- Action-specific ARAR is applicable but not considered to be attainable. A waiver will be required allowing action to provide an equivalent standard of performance.
√ -- Action-specific ARAR applicable only if excavated soil is determined to be characteristically hazardous.

TABLE 6-6

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU26 SOILS AND SEDIMENTS
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU26-1S No Further Action	ALT. OU26-2S Institutional Controls	ALT. OU26-3S Remove and Treat using LTTD	ALT. OU26-4S Remove and Landfill
	• Do nothing	• Access restrictions	• Remove up to 1 foot of sediments • Haul and treat at LTTD • Backfill to grade with clean fill • Revegetate	• Remove up to 1 foot of sediments • Haul and dispose at landfill • Backfill to grade with clean fill • Revegetate
OVERALL PROTECTION				
Human Health Protection	No protection.	Some protection through access restrictions and long-term management.	Permanent protection at site by removing contaminated soils and sediments. Permanent protection off-site by destroying PAHs and immobilizing arsenic/lead/mercury by re-use in pavement.	Permanent protection at site by removing contaminated soils and sediments. Adequate protection off-site by containing waste in permitted landfill.
Environmental Protection	No protection required because no unacceptable risk identified by baseline risk assessment.	No protection. Allows contamination to persist under influence of natural degradation processes.	Permanent protection by eliminating contamination sources at site, destroying PAHs, and immobilizing arsenic/lead/mercury by re-use in pavement	Permanent protection at site by removing contaminated soils and sediments. Adequate future off-site protection by containing waste in permitted landfill.
COMPLIANCE WITH ARARs				
Compliance with ARARs	Would not meet chemical specific requirements.	Would not meet chemical specific requirements.	Meets all ARARs.	Meets all ARARs.
Appropriateness of waivers	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Not required.	Not required.
LONG-TERM				
Magnitude of residual risk	No reduction in risk associated with exposure to lead/mercury in surface soils. PAHs/arsenic/lead/mercury in surface soils and PAHs/arsenic/lead in sediments remain at levels above PRGs.	Some reduction in risk to potential human receptors. PAHs/arsenic/lead/mercury in surface soils and PAHs/arsenic/lead in sediments remain at levels above PRGs.	Soils containing PAHs/arsenic/lead/mercury and sediments containing PAHs/arsenic/lead permanently removed from site. PAHs destroyed and arsenic/lead/mercury immobilized. No residual risk.	Soils containing PAHs/arsenic/lead/mercury and sediments containing PAHs/arsenic/lead permanently removed from site and contained in permitted landfill. No residual risk. USAF retains long-term liability for waste disposed in landfill.
Adequacy and reliability of controls	Not applicable.	Deed and access restrictions and long-term oversight can be adequate and reliable with proper management	Removal of contaminated soils and sediments is adequate and reliable. Incineration is adequate and reliable method to destroy PAHs. Arsenic/lead/mercury will not be destroyed, but re-use of material in pavement will immobilize.	Removal of contaminated soils and sediments is adequate and reliable. Disposal at permitted landfill is adequate and reliable method to contain wastes.
Need for 5-year review	Review would be required to ensure adequate protection of human health and the	Review would be required to ensure adequate protection of human health and the	Not required.	Not required.

TABLE 6-6

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU26 SOILS AND SEDIMENTS
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU26-1S No Further Action	ALT. OU26-2S Institutional Controls	ALT. OU26-3S Remove and Treat using LTTD	ALT. OU26-4S Remove and Landfill
REDUCTION OF TMV				
Treatment process used and material treated	None.	None.	Low temperature thermal desorption.	None.
Amount destroyed or treated	None.	None.	An estimated 390 tons of surface soil and sediment containing PAHs.	None.
Reduction of TMV through treatment	None.	None.	Reduces TMV of PAHs through thermal destruction.	None.
Irreversible treatment	None.	None.	LTTD is irreversible.	None.
Type and quantity of residuals remaining after treatment	Not applicable.	Not applicable.	All residual quantities are expected to be beneficially reused in pavement processes.	None.
SHORT-TERM				
Time required to achieve remedial action objectives (RAOs)	RAOs would not be achieved in the short-term.	RAOs would not be achieved in short-term; however, reduction of human exposure to contaminants achieved immediately.	RAOs could be achieved within one year.	RAOs could be achieved within one year.
Protection of community and workers during remedial actions	No action taken	Little risk to community because access to Homestead AFB is restricted. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the LTTD. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the landfill. Workers can be protected using standard health and safety procedures.
Environmental impacts during remedial actions	None.	None.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Air emissions from LTTD controlled under operating permit.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Impacts from landfill controlled under operating permit.
IMPLEMENTABILITY				
Ability to construct and operate	Not applicable.	Fencing easily constructed.	Standard excavation and earth moving equipment can readily remove soil and sediment. LTTD operation already set up within 40 miles of site.	Standard excavation and earth moving equipment can readily remove soil and sediment. Permitted solid waste landfill located within 40 miles of site.
Ease of doing more remedial action, if needed	Easy.	Easy.	Easy.	Easy.
Ability to monitor effectiveness	Not applicable.	Easy.	Monitoring not required after remedial action.	Monitoring by USAF not required after remedial action. Landfill monitors under permit conditions.
Ability to obtain approvals and coordination with other	Not applicable.	None required	None required.	None required
Availability of services and equipment	Not applicable.	Commercially available.	Commercially available.	Commercially available.
COST				
Capital Cost	$0	$31,000	$49,000	$43,000
Present Worth Cost of O&M	$0	$2,000	$0	$0
Present Worth Cost	$0	$54,000	$49,000	$43,000

TABLE 6-7

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU26 GROUNDWATER
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT OU26-1G No Further Action	ALT OU26-2G Groundwater Monitoring	ALT OU26-3G Intrinsic Remediation	ALT OU26-4G Groundwater Collection and Treatment
	• Do nothing	• Monitor 5 wells for TCE	• Monitor 5 wells for TCE, daughter products, and natural attenuation parameters	• Pump at 100 gpm for 5 years • Treat using air stripper • Discharge to canal under NPDES permit • Monitor groundwater for 3 years after pumping is stopped
OVERALL PROTECTION				
Human Health Protection	No protection in the short-term.	Protection through access restrictions and site management	Protection through access restrictions and site management.	Protection through access restrictions and site management. Permanent protection after completion of remedial action.
Environmental Protection	No protection required because no unacceptable risk identified by baseline risk assessment.	Monitors for potential further degradation of groundwater. Allows for influence of natural attenuation processes.	Monitors for potential further degradation of groundwater. Allows for influence of natural attenuation processes.	Reduces total TCE mass in groundwater.
COMPLIANCE WITH ARARs				
Compliance with ARARs	Would not meet chemical specific requirements.	Would not immediately meet chemical specific requirement.	Would not immediately meet chemical specific requirement.	Would meet chemical specific requirement in estimated 5 years.
Appropriateness of waivers	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Considered to be appropriate since protection is afforded through site management and monitoring of potential plume migration.	Considered to be appropriate since protection is afforded through site management and monitoring of potential plume migration.	Not required.
LONG-TERM EFFECTIVENESS				
Magnitude of residual risk	No reduction of risk to construction worker exposure to groundwater.	Risk to construction workers mitigated by institutional controls. Allows TCE to remain in groundwater and naturally attenuate.	Risk to construction workers mitigated by institutional controls. Allows TCE to remain in groundwater and naturally attenuate.	Risk to construction workers mitigated by institutional controls and decreased over time by active remediation of aquifer
Adequacy and reliability of controls	Not applicable.	Institutional controls adequate and reliable within Homestead AFB boundaries. Groundwater monitoring adequate and reliable for tracking TCE over time.	Institutional controls adequate and reliable within Homestead AFB boundaries. Natural attenuation processes may not be adequate at reducing TCE concentrations and need to be demonstrated through monitoring.	Groundwater collection and treatment adequate to contain TCE plume. Reliability to achieve low TCE levels (e.g. MCLs) is poor given body of evidence from other TCE pump and treat sites. Monitoring will prove effectiveness.
Need for 5-year review	Review would be required to ensure adequate protection of human health and the environment is maintained	Review would be required to ensure adequate protection of human health and the environment is maintained	Review would be required to ensure adequate protection of human health and the environment is maintained	Review would be required to ensure adequate protection of human health and the environment is maintained
REDUCTION OF TMV				
Treatment process used and material treated	None	None	Intrinsic remediation processed include dispersion, volatilization, biodegradation, adsorption, and chemical reactions.	Transferring TCE from groundwater to the vapor phase using an air stripper.
Amount destroyed or treated	None.	None by active remediation. Contamination at the site expected to attenuate over time.	None by active remediation. Contamination at the site expected to attenuate over time.	TCE will be transferred from groundwater to air
Reduction of TMV through treatment	None.	Volume and toxicity of TCE expected to gradually reduce over time.	Volume and toxicity of TCE expected to gradually reduce over time.	Volume of contaminated media will be reduced as plume shrinks during groundwater extraction.
Irreversible treatment	None.	None	Biodegradation and chemical reactions are irreversible	Volatilization is not irreversible because contaminants are transferred to air

TABLE 6-7

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU26 GROUNDWATER
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU26-1G No Further Action	ALT. OU26-2G Groundwater Monitoring	ALT. OU26-3G Intrinsic Remediation	ALT. OU26-4G Groundwater Collection and Treatment
REDUCTION OF TMV (Con't)				
Type and quantity of residuals remaining after treatment	Not applicable.	None	None	None.
SHORT-TERM EFFECTIVENESS				
Time required to achieve remedial action objectives (RAOs)	Objective would not be achieved in the short-term.	Protection of construction workers achieved immediately.	Protection of construction workers achieved immediately.	Protection of construction workers achieved immediately. Reduction of TCE to PRGs estimated after 5 years of active remediation
Protection of community and workers during remedial actions	No action taken.	Little risk to community because access to Homestead AFB is restricted. Workers can be protected using standard health and safety procedures.	Little risk to community because access to Homestead AFB is restricted. Workers can be protected using standard health and safety procedures.	Little risk to community because access to Homestead AFB is restricted Workers can be protected using standard health and safety procedures.
Environmental impacts during remedial actions	No action taken	None.	None.	Very low concentration of TCE in emissions from air stripper.
IMPLEMENTABILITY				
Ability to construct and operate	Not applicable.	No construction. Monitoring readily implemented.	No construction. Monitoring readily implemented.	New extraction and treatment systems easily constructed. Operation expected to be difficult given high mineral content of water
Ease of doing more remedial action, if needed	Easy.	Easy to add new monitoring wells or sample for additional parameters, if needed.	Easy to add new monitoring wells or sample for additional parameters, if needed.	Easy to expand extraction well containment system, if needed
Ability to monitor effectiveness	Not applicable.	Monitoring TCE levels will provide early warning if contaminants are migrating further away from source area.	Monitoring will prove effectiveness of natural attenuation and provide early warning if contaminants are migrating further away from source area.	Monitoring TCE levels will prove effectiveness of removal and provide early warning if contaminants are migrating further away from source area.
Ability to obtain approvals and coordination with other agencies	Not applicable.	None required.	None required	NPDES permit obtainable. Previously issued for other sites on Homestead AFB
Availability of services and equipment	Not applicable.	Commercially available.	Commercially available.	Commercially available.
COST				
Capital Cost	$0	$57,000	$86,000	$371,000
Present Worth Cost of O&M	$0	$192,000	$409,000	$162,000
Present Worth Cost	$0	$249,000	$495,000	$533,000

TABLE 6-8
DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU28 SOILS
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU28-1 No Further Action	ALT. OU28-2 Institutional Controls	ALT. OU28-3 Remove and Treat using LTTD	ALT. OU28-4 Remove and Landfill
	• Do nothing	• Access restrictions	• Remove up to 2 feet of surface soil • Haul and treat at LTTD • Backfill to grade with clean fill • Revegetate	• Remove up to 2 feet of surface soil • Haul and dispose at landfill • Backfill to grade with clean fill • Revegetate • Confirmation groundwater sampling for lead
OVERALL PROTECTION				
Human Health Protection	No protection required because no unacceptable risk identified by baseline risk assessment.	Protection through access restrictions and long-term management.	Permanent protection at site by removing contaminated soils. Permanent protection off-site by destroying PAHs and immobilizing arsenic/lead by re-use in pavement	Permanent protection at site by removing contaminated soils. Adequate protection off-site by containing waste in permitted landfill.
Environmental Protection	No protection.	No protection. Allows contamination to persist under influence of natural degradation processes.	Permanent protection by eliminating contamination sources at site, destroying PAHs, and immobilizing arsenic/lead by re-use in pavement.	Permanent protection at site by removing contaminated soils. Adequate future off-site protection by containing waste in permitted landfill.
COMPLIANCE WITH ARARs				
Compliance with ARARs	Would not meet chemical specific requirements.	Would not meet chemical specific requirements.	Meets all ARARs.	Meets all ARARs.
Appropriateness of waivers	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Not required	Not required.
LONG-TERM				
Magnitude of residual risk	No reduction in risk associated with environmental exposures to lead in surface soils. PAHs/arsenic/lead in surface soils remain at levels above PRGs.	No reduction in risk associated with environmental exposures to lead in surface soils. PAHs/arsenic/lead in surface soils remain at levels above PRGs.	Soils containing PAHs/arsenic/lead permanently removed from site. PAHs destroyed and arsenic/lead immobilized. No residual risk.	Soils containing PAHs/arsenic/lead permanently removed from site and contained in permitted landfill. No residual risk. USAF retains long-term liability of waste disposed at landfill
Adequacy and reliability of controls	Not applicable.	Deed and access restrictions and long-term oversight may not control environmental exposures.	Removal of contaminated soils and sediments is adequate and reliable. Incineration is adequate and reliable method to destroy PAHs. Arsenic will not be destroyed, but re-use of material in pavement will immobilize the arsenic	Removal of contaminated soils and sediments is adequate and reliable. Disposal at permitted landfill is adequate and reliable method to contain wastes.
Need for 5-year review	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review would be required to ensure adequate protection of human health and the environment is maintained.	Not required.	Not required.

TABLE 6-8

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU28 SOILS
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU28-1 No Further Action	ALT. OU28-2 Institutional Controls	ALT. OU28-3 Remove and Treat using LTTD	ALT. OU28-4 Remove and Landfill
REDUCTION OF TMV (Con't)				
Reduction of TMV through treatment	None.	None.	Reduces TMV of PAHs through thermal destruction and mobility of lead through encapsulation/stabilization.	None.
Irreversible treatment	None.	None.	LTTD is irreversible.	None.
Type and quantity of residuals remaining after treatment	Not applicable.	Not applicable.	Residual quantities from LTTD are expected to be beneficially reused in pavement processes. Residual quantities from encapsulation/stabilization to be landfilled.	None.
SHORT-TERM				
Time required to achieve remedial action objectives (RAOs)	RAOs would not be achieved in the short-term.	RAOs would not be achieved in short-term.	RAOs could be achieved within one year.	RAOs could be achieved within one year.
Protection of community and workers during remedial actions	No action taken	Little risk to community because access to Homestead AFB is restricted. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the LTTD. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the landfill. Workers can be protected using standard health and safety procedures.
Environmental impacts during remedial actions	None.	None.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Air emissions from LTTD controlled under operating permit.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Impacts from landfill controlled under operating permit.
IMPLEMENTABILITY				
Ability to construct and operate	Not applicable.	Fencing easily constructed.	Standard excavation and earth moving equipment can readily remove soil and sediment. LTTD operation already set up within 40 miles of site.	Standard excavation and earth moving equipment can readily remove soil and sediment. Permitted solid waste landfill located within 40 miles of site.
Ease of doing more remedial action, if needed	Easy.	Easy.	Easy.	Easy.
Ability to monitor effectiveness	Not applicable.	Easy.	Monitoring not required after remedial action.	Monitoring by USAF not required after remedial action. Landfill monitors under permit conditions.
Ability to obtain approvals and coordination with other	Not applicable.	None required	None required.	None required.
Availability of services and equipment	Not applicable.	Commercially available.	Commercially available.	Commercially available.
COST				
Capital Cost	$0	$30,000	$367,000	$345,000
Present Worth Cost of O&M	$0	$23,000	$0	$0
Present Worth Cost	$0	$53,000	$367,000	$345,000

TABLE 6-9

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU29 SOILS
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU29-1 No Further Action	ALT. OU29-2 Institutional Controls	ALT. OU29-3 Remove and Treat using LTTD	ALT. OU29-4 Remove and Landfill
	• Do nothing	• Access restrictions	• Remove up to 2 feet of surface soil • Haul and treat at LTTD • Backfill to grade with clean fill • Revegetate	• Remove up to 2 feet of surface soil • Haul and dispose at landfill • Backfill to grade with clean fill • Revegetate
OVERALL PROTECTION				
Human Health Protection	No protection required because no unacceptable risk identified by baseline risk assessment.	Protection through access restrictions and long-term management.	Permanent protection at site by removing contaminated soils. Permanent protection off-site by destroying PAHs.	Permanent protection at site by removing contaminated soils. Adequate protection off-site by containing waste in permitted landfill.
Environmental Protection	No protection required because no unacceptable risk identified by baseline risk assessment.	No protection. Allows contamination to persist under influence of natural degradation processes.	Permanent protection by eliminating contamination sources at site and destroying PAHs.	Permanent protection at site by removing contaminated soils. Adequate future off-site protection by containing waste in permitted landfill.
COMPLIANCE WITH ARARs				
Compliance with ARARs	Would not meet chemical specific requirements.	Would not meet chemical specific requirements.	Meets all ARARs.	Meets all ARARs.
Appropriateness of waivers	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Not appropriate. None of the six circumstances identified by CERCLA would be met.	Not required.	Not required.
LONG-TERM				
Magnitude of residual risk	PAHs in surface soils remain at levels above PRGs.	PAHs in surface soils and PAHs/arsenic in sediments remain at levels above PRGs.	Soils containing PAHs permanently removed from site. PAHs destroyed. No residual risk.	Soils containing PAHs permanently removed from site and contained in permitted landfill. No residual risk. USAF retains long-term liability of waste disposed at landfill.
Adequacy and reliability of controls	Not applicable.	Deed and access restrictions and long term oversight can be adequate and reliable with proper management.	Removal of contaminated soils and sediments is adequate and reliable. Incineration is adequate and reliable method to destroy PAHs. Arsenic will not be destroyed, but re-use of material in pavement will immobilize the arsenic.	Removal of contaminated soils and sediments is adequate and reliable. Disposal at permitted landfill is adequate and reliable method to contain wastes.
Need for 5-year review	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review would be required to ensure adequate protection of human health and the environment is maintained.	Not required.	Not required.
REDUCTION OF TMV				
Treatment process used and material treated	None.	None.	Low temperature thermal desorption.	None.
Amount destroyed or treated	None.	None.	An estimated 1,300 tons of surface soil containing PAHs.	None.
Reduction of TMV through treatment	None.	None.	Reduces TMV of PAHs through thermal destruction.	None.
Irreversible treatment	None.	None.	LTTD is irreversible.	None.
Type and quantity of residuals remaining after treatment	Not applicable.	Not applicable.	All residual quantities are expected to be beneficially reused in pavement processes.	None.

TABLE 6-9

DETAILED ANALYSIS OF ALTERNATIVES ADDRESSING OU29 SOILS
HOMESTEAD AFB, FEASIBILITY STUDY

EVALUATION CRITERION	ALT. OU29-1 No Further Action	ALT. OU29-2 Institutional Controls	ALT. OU29-3 Remove and Treat using LTTD	ALT. OU29-4 Remove and Landfill
SHORT-TERM				
Time required to achieve remedial action objectives (RAOs)	RAOs would not be achieved in the short-term.	RAOs would not be achieved in short term; however, reduction of human exposure to contaminants achieved immediately.	RAOs could be achieved within one year.	RAOs could be achieved within one year.
Protection of community and workers during remedial actions	No action taken	Little risk to community because access to Homestead AFB is restricted. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the LTTD. Workers can be protected using standard health and safety procedures.	Some community risk involved in transportation to the landfill. Workers can be protected using standard health and safety procedures.
Environmental impacts during remedial actions	None.	None.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Air emissions from LTTD controlled under operating permit.	Impacts during construction due to dust emissions and run-off can be controlled through construction erosion control. Impacts from landfill controlled under operating permit.
IMPLEMENTABILITY				
Ability to construct and operate	Not applicable.	Fencing easily constructed.	Standard excavation and earth moving equipment can readily remove soil and sediment. LTTD operation already set up within 40 miles of site.	Standard excavation and earth moving equipment can readily remove soil and sediment. Permitted solid waste landfill located within 40 miles of site.
Ease of doing more remedial action, if needed	Easy.	Easy.	Easy.	Easy.
Ability to monitor effectiveness	Not applicable.	Easy.	Monitoring not required after remedial action.	Monitoring by USAF not required after remedial action. Landfill monitors under permit conditions.
Ability to obtain approvals and coordination with other	Not applicable.	None required.	None required.	None required.
Availability of services and equipment	Not applicable.	Commercially available.	Commercially available.	Commercially available.
COST				
Capital Cost	$0	$26,000	$163,000	$143,000
Present Worth Cost of O&M	$0	$23,000	$0	$0
Present Worth Cost	$0	$49,000	$163,000	$143,000

7.0
RESPONSIVENESS SUMMARY

In accordance with the current ROD guidance, this section is reserved for community comments and the appropriate responses by the BRAC Cleanup Team (BCT) in regards to this ROD.

8.0
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