DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH FIGHTER WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

ENTERED

RECEIVED
AUG 2009
NMED Hazardous Waste Bureau

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New Mexico Environment Department
Attn: Mr. James Bearzi
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Dear New Mexico Environment Department

Holloman AFB is pleased to submit the RCRA Facility Investigation Work Plan AOC-U, Lost River for your review.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact Mr. David Scruggs of our Asset Management Flight at (575) 572-5395.

Sincerely

3 AUG 09

A. DAVID BUDAK, YF-3, DAFC

Attachment:
AOC-U Lost River RFI Work Plan

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FINAL

RCRA FACILITY INVESTIGATION WORK PLAN
AOC-U, LOST RIVER BASIN
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared For:

49 CES/CEA
Holloman Air Force Base
New Mexico

Under Contract To:

U.S. Army Corps of Engineers
Albuquerque District, HTRW Branch
4101 Jefferson Plaza Northeast
Albuquerque, New Mexico 87109-3435

Contract No. W912PP-09-D-0003
Delivery Order No. 0003

July 2009

Prepared by:

NATIONVIEW

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Birmingham, Alabama 35205
NationView Project Number: 8090010

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FINAL
RCRA FACILITY INVESTIGATION WORK PLAN
AOC-U, LOST RIVER BASIN
HOLLOMAN AIR FORCE BASE, NEW MEXICO

REVIEW SHEET

This Work Plan has been reviewed and approved by:

		7-16-09
David D. Martin Corporate Sponsor	Signature	Date
		7/16/09
Frank Gardner, P.G. Project Manager	Signature	Date
		7/16/09
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FINAL
RCRA FACILITY INVESTIGATION WORK PLAN
AOC-U, LOST RIVER BASIN
HOLLOMAN AIR FORCE BASE, NEW MEXICO

TABLE OF CONTENTS

Figures

Tables

Appendices

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ACRONYMS AND ABBREVIATIONS

AAF	Army Air Field
Accutest	Accutest Laboratories
ACM	Accelerated Corrective Measures
AFB	Air Force Base
AF Fm	Air Force Form
amsl	Above mean sea level
ANSI	American National Standards Institute
AOC	Area of Concern
AOC-U	Lost River Basin
ARARs	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
CES/CEA	Civil Engineering Squadron/Environmental Asset Management Flight
COC	Chain-of-custody
CSM	Conceptual Site Model
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
DPT	Direct Push Technology
DQOs	Data Quality Objectives
DRMO	Defense Reutilization Marketing Office
DRO	Diesel Range Organics
EA	Environmental Assessment
EDD	Electronic Data Deliverable
EM	Electromagnetic
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
ESRI	Environmental Systems Research Institute
°F	Degrees Fahrenheit
ft	Feet or foot
FWENC	Foster Wheeler Environmental Corporation
GIS	Geographical Information System
gpd	Gallons per day
GPS	Global Positioning System
GRO	Gasoline Range Organics

GTI	Groundwater Technology Government Services, Inc.
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HGL	HydroGeoLogic, Inc.
HHMSSL	Human Health Medium Specific Screening Level
HI	Hazard Index
ID	Inner Diameter
IDW	Investigation-Derived Waste
INRMP	Integrated Natural Resource Management Plan
IRP	Installation Restoration Program
J&E	Johnson and Ettinger
LCS	Laboratory Control Sample
LD	Laboratory Duplicate
LIMS	Laboratory Information Management System
LTM	Long Term Monitoring
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MGD	Million gallons per day
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
µg/L	Micrograms per liter
mg/L	Milligrams per liter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAD	North American Datum
NationView	NationView, LLC
NFA	No Further Action
ng/kg	Nanograms per kilogram
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NMWRRS	New Mexico Water Rights Reporting System
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
OD	Outer diameter
ORO	Oil Range Organics

OSHA	Occupational Safety and Health Administration
PARCC	Precision, accuracy, representativeness, comparability, and completeness
PA/SI	Preliminary Assessment/Site Inspection
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
P.G.	Professional Geologist
pH	Potential of Hydrogen
PID	Photoionization Detector
PMP	Project Management Plan
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Risk Assessment
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RL	Reporting Limit
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Scope of Work
SSLs	Soil Screening Levels
SVOCs	Semi-volatile organic compounds
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TAT	Turn-around time
1,1,1-TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons

TRPH	Total Recoverable Petroleum Hydrocarbons
UDMH	Unsymmetrical Dimethylhydrazine
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United Sates Fish and Wildlife Service
UTL	Upper Tolerance Level
UXO	Unexploded Ordnance
VOCs	Volatile Organic Compounds
WRCC	Western Regional Climate Center
WSMR	White Sands Missile Range
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

NationView, LLC (NationView), has been retained by the U.S. Army Corps of Engineers (USACE), Albuquerque District under contract W912PP-09-D-0003, Delivery Order No. 0003, to conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) of Area of Concern (AOC) U (Lost River Basin) at Holloman Air Force Base (HAFB), New Mexico. The Lost River Basin (AOC-U) is a surface water drainage area that intercepts runoff from a large portion of the base including several adjacent upgradient Solid Waste Management Units (SWMUs) and AOCs.

These SWMUs and AOCs include the following Environmental Restoration Program (ERP) sites:

- OT-04 (SWMU 102) - Acid Trailer Disposal Site
- OT-37 (AOC L) - Early Missile Test Site
- OT-38 (SWMU 137) - Test Sled Maintenance Area
- SS-39 (SWMUs 165, 177, 179, and 181) - Missile Fuel Spill Area
- LF-40 (SWMU 103) - Causeway Rubble Disposal Area
- DP-62 (AOC-RD) - Ritas Draw

This RFI Work Plan will address potential soil and water impact(s) to the Lost River Basin watershed from source areas that are located within the boundaries of HAFB. The Lost River Basin is considered an environmentally sensitive area under agreement between HAFB, White Sands Missile Range (WSMR), the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), and the New Mexico Department of Game and Fish (NMDGF) to protect the threatened White Sands pupfish.

The primary objective of this RFI is to evaluate the potential impact to the soil and groundwater within the Lost River Basin from six known upgradient SWMUs and AOCs. The AOC-U, Lost River Basin RFI will be performed according to the requirements set forth in the HAFB Hazardous Waste Facility Permit No. NM6572124422; Appendix 4-B RFI Outline, dated February 2004 (NMED, 2004). The Lost River Basin (AOC-U) and the six SWMUs and AOCs listed above are each listed on the HAFB RCRA Permit. The Lost River Basin (AOC-U), AOC-L (OT-37), SWMU 137 (OT-38), and SWMUs 165, 177, 179, and 181 (SS-39) are listed on Table A of the HAFB Permit as sites that currently require corrective action. Additionally, SWMU 102 (OT-04), SWMU 103 (LF-40), and AOC-RD (DP-62) are listed on Table B of the HAFB Permit as sites not currently requiring corrective action (closed sites).

1.1 RFI Work Plan Organization

This Work Plan will serve as the primary document for determining potential hazardous waste releases into the Lost River Basin (AOC-U) from upgradient Table A and Table B SWMUs and AOCs. This Work Plan is organized according to the requirements outlined in Appendix 4-B of the HAFB RCRA Permit as follows:

- Section 1 presents a summary of the RFI approach and its key elements, project and data quality objectives, HAFB background information, and relevant existing site assessment data for the Lost River Basin (AOC-U) and the upgradient ERP Sites (SWMUs and AOCs).
- Section 2 details the environmental setting in terms of hydrogeology, soils, surface water and sediment, and climate.
- Section 3 provides source characterization information.
- Section 4 provides information on the human populations and environmental systems as potential receptors that could be affected by a potential release into the Lost River Basin.
- Section 5 presents the Initial Conceptual Site Model (CSM) for the site, including a summary narrative, an outline of CSM elements, including data gathering requirements, release mechanisms, status, and required actions.
- Section 6 presents the Sampling and Analysis Plan (SAP) for the additional characterization of soil and groundwater for this RFI effort, as well as the specific sampling procedures, sample analysis, and related sample quality assurance/quality control (QA/QC) measures to be employed during the investigation.
- Section 7 presents the Risk Assessment Approach to be used for conducting a site specific risk based evaluation (if required).
- Section 8 describes the data management plan that will be used to support this RFI.
- Section 9 describes the Health and Safety requirements to be followed during this RFI.
- Section 10 presents the Project Management Plan (PMP), including the project organization, team member roles and responsibilities, and project schedule.

- Section 11 provides full references of the publications used to support the development of this document.

- The figures and tables referenced throughout this Work Plan are included under separate tabs following the text

- Appendices provide other key elements of the Work Plan, such as the Site-Specific Addendum to the Basewide Quality Assurance Project Plan (QAPP), the summary of past investigations and remedial actions, HAFB correspondence, and a Site-Specific Addendum to the Basewide Health and Safety Plan.

1.2 Project Objectives

The primary project objectives of the AOC-U Lost River Basin RFI are to:

1. Identify potential releases to the soil (surface and subsurface) and groundwater within the Lost River Basin from the six known upgradient SWMUs and AOCs that may have impacted the Basin via runoff from surface water tributaries and/or groundwater infiltration.

2. Delineate the horizontal extent of Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), Total Petroleum Hydrocarbons (TPH), Target Analyte List (TAL) metals, and perchlorate detected above action levels in the soil and groundwater samples collected throughout the Lost River Basin during this RFI.

3. Collect sufficient analytical data to complete a site-specific risk assessment (human health and ecological) of the groundwater and soil exposure pathways.

4. Collect the proper data to meet the data quality objectives (DQOs) to support closure of the site based on guidance from the New Mexico Environment Department (NMED).

1.3 Data Quality Objectives

The DQO process is designed to generate performance criteria for the collection of new data. Performance criteria represent the full set of specifications that are needed to design a data collection effort such that newly-collected data are of sufficient quality and quantity to address the primary project objectives outlined in Section 1.2 of this Work Plan.

The steps of the DQO process are:

1. Define the nature of the problem to be studied and develop a conceptual model of the environmental hazard to be investigated (see Section 5 of this Work Plan).

2. State the decisions or estimates that need to be made.

3. Determine the type(s) of data needed for decision-making.

4. Develop a decision making process that defines how the data will be used to draw conclusions from the investigation results (see Section 6.2.1 of this Work Plan).

5. Establish acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data. These criteria are known as performance criteria, or DQOs (see Section 6.2 and 6.4 of this Work Plan).

6. Design a data collection program that will generate data meeting the quantitative and qualitative criteria specified in Step 5 which includes:

    a. Type of data (see Sections 6.3 and Section 6.4 of this Work Plan),

    b. Number, location, and physical quantity of samples (see Sections 6.2 and 6.4 of this Work Plan),

    c. Quality Assurance (QA) and Quality Control (QC) activities to ensure that sampling design and measurement errors are managed sufficiently to meet the performance or acceptance criteria specified in the DQOs. The DQO criteria include measures of precision, accuracy, representativeness, comparability, and completeness (PARCC).

The results of this process were used to develop the Site-Specific Addendum to the Basewide QAPP included in Appendix A of this Work Plan.

1.4 HAFB Facility Description and Operational History

HAFB is located in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north-northeast of El Paso, Texas (Figure 1-1). HAFB has a population of 6,000, and supports approximately 21,000 active-duty Air Force, National Guard, Air Force Reserve, retirees, civilians, and their family members. HAFB occupies approximately 60,000 acres in the northeast quarter of Section 1, Township 17 South, Range 8 East. The White Sands Missile Range testing facilities occupy additional land extending northward from the Base. Private and public owned lands border the remainder of HAFB. The major highway servicing HAFB is Highway 70, which runs southwest from the town of Alamogordo and separates HAFB from publicly owned lands to the south. Alamogordo is located approximately 7 miles east of the base and has a population of approximately 35,000.

HAFB was first established in 1942 as Alamogordo Army Air Field (AAF). From 1942 through 1945, Alamogordo AAF served as the training ground for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the Base. In 1947, Air Material Command announced the air field would be its primary site for the testing and development of un-manned aircraft, guided missiles, and other research programs. On January 13, 1948, the Alamogordo installation was renamed Holloman Air Force Base, in honor of the late Col. George V. Holloman, a pioneer in guided missile research. In 1968, the 49th Tactical Fighter Wing arrived at HAFB and has remained since, conducting fighter aircraft training and operations. HAFB has also served as the German Air Force's Tactical Training Center since 1996.

1.5 AOC-U Site Description and Background

The Lost River Basin (AOC-U) is a large intermittent drainage basin that receives surficial runoff from various upgradient SWMUs and AOCs (ERP Sites). The Lost River Basin is located within the northern portion of HAFB (Figure 1-2). Surface water generally flows from the east to the west during the rainy season (late July through September) and is dry during the remaining months. The Lost River Basin receives surface runoff from six ERP sites that include nine SWMUs and AOCs that are listed on the HAFB RCRA Permit. The six potential source areas (ERP sites) are shown on Figure 1-3 and include the following sites:

- **OT-04 (SWMU-102) Acid Trailer Disposal Site –** Site OT-04 is located adjacent to an arroyo known as Ritas Draw, which is a tributary of the Lost River. During the late 1950s, various types of materials including rocket propellants and other fuel components were buried on this one-half acre tract.

- **DP-62 (AOC-RD) Ritas Draw Disposal Pit –** Site DP-62 is located 300 feet (ft) east of Site OT-04. Ritas Draw contains numerous smaller arroyos and terminates into the Lost River. Two partially buried drums were discovered during a field reconnaissance of the area in 1998.

- **OT-37 (AOC-L) Early Missile Test Site –** The Early Missile Test Site was used to develop rocket and missile systems from 1947 to 1955 and is located along the southern side of the Lost River Basin. The site includes three vertical launch pads and an inclined test track. Fuels used at these sites included JP-4, kerosene, and solid rocket propellants. There are several arroyos adjacent to these launch facilities that drain directly into the Lost River Basin.

- **OT-38 (SWMU-137) Test Sled Maintenance Area –** The Test Sled Maintenance Area is located near the Building 1166 Test Track Drain Field. Waste oils, solvents, and paint strippers used in the sled industrial maintenance area (Building 1166) could have migrated via the surface water or groundwater pathways into adjacent Lost River Basin arroyos.

- **SS-39 (SWMUs -165, -177, -179, and -181) Missile Fuel Spill Area –** The Missile Fuel Spill Area is located south of the test sled launch area near Building 1176, along the northern side of the Lost River Basin. The launch pad was constructed in 1960 with concrete drains that delivered spilled oxidizers and fuels that were diluted with water and flushed into the Lost River. This practice ceased in 1975 when catch basins were installed to collect the spilled liquid fuels.

- **LF-40 (SWMU-103) Causeway Rubble Disposal Area –** The Causeway Rubble Disposal Area was located south of the Sled Test Track Area along the perimeter of the Lost River Basin. This site was utilized for stockpiling concrete rubble for use as a base construction material for a road that crosses the Lost River Basin southwest of the test track launch pad.

Based on their proximity to the Lost River Basin (AOC-U) and its tributaries (e.g. Ritas Draw), several of these ERP sites may have contributed contaminants via surface water runoff and/or groundwater infiltration into the Basin.

1.6 Nature and Extent of Known Contamination

Previous investigations have identified a number of contaminants of concern that have impacted the soil and groundwater at the ERP sites that are upgradient of the Lost River Basin including:

- VOCs (e.g., trichloroethene [TCE])
- Metals (e.g., arsenic and lead)
- TPH
- Perchlorate

During the recent Supplemental RFI conducted at SS-39 by HydroGeoLogic, Inc. (HGL) in 2006, TCE, perchlorate, arsenic, and lead were detected above current action levels in groundwater samples collected from wells located along the boundary of the Lost River Basin.

1.7 Summary of Previous Investigations and Remedial Actions

The following sections present a summary of the findings from previous investigations conducted at the Lost River Basin (AOC-U) and the six potential upgradient ERP site source areas (OT-04 [SWMU-102], OT-37 [AOC-L], OT-38 [SWMU-137], SS-39 [SWMUs -165, -177, -179, and -181], LF-40 [SWMU-103], and DP-62 [AOC-RD]). Since 1983, the associated upgradient SWMUs, AOCs, and the Lost River Basin have been the subject of numerous environmental investigations. This section provides an overview and chronology of the previous investigations and removal actions that were conducted at each of these sites from 1983 through 2007. Historical environmental data collected from the Lost River Basin (AOC-U) and the referenced upgradient ERP sites were obtained from the Holloman Administrative Record and include the following reports:

- *Installation Restoration Program Phase I Records Search,* 1983, CH2M Hill
- *RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report*, 1988, A.T. Kearney, Inc. and DPRA, Inc.
- *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites,* 1992, Radian Corporation
- *Final Site OT-04 Unexploded Ordnance (UXO) Removal Action Report,* 1994, Human Factor Applications, Inc.
- *Draft Final Phase I RCRA Facility Investigation Report, Table 2 Solid Waste Management Units,* 1994, Radian Corporation
- *Draft Final Phase II RCRA Facility Investigation Report, Table 1 Solid Waste Management Units,* 1995, Foster Wheeler Environmental Corporation
- *Decision Documents Installation Restoration Program Multiple Sites,* 1995, Radian Corporation
- *Results of Additional Groundwater Sampling at Site SS-39,* 1998, Groundwater Technology Government Services, Inc.
- *Preliminary Assessment/Site Inspection Report for AOC-Ritas Draw,* 1998, Groundwater Technology Government Services, Inc.
- *RCRA Facility Investigation Report ERP Site No. DP-62, Ritas Draw,* 2004, Bhate Environmental Associates, Inc.
- *Final 2005 Long-Term Groundwater Monitoring Report,* 2006, Bhate Environmental Associates, Inc.

- *Final Accelerated Corrective Measures Work Plan Multiple Sites,* 2007, Bhate Environmental Associates, Inc.
- *Supplemental RCRA Facility Investigation DP-30/SD-33 (SWMU 113B), SS-39 (SWMUs 165, 177, 179, and 181) and SD-27 (SWMU 141),* 2007, HydroGeoLogic, Inc.

Selected analytical data summary tables and figures depicting sampling locations for these previous investigations are included in Appendix B of this Work Plan. The following sections describe the key findings from the previous investigations conducted at each site that may represent potential releases into the Lost River Basin (AOC-U).

1.7.1 AOC-U - Lost River Basin

1.7.1.1 RCRA Facility Assessment

The Lost River Basin is listed on Table A of the HAFB RCRA Permit as AOC-U and was not previously identified as an ERP site. AOC-U is a large intermittent drainage basin that receives annual runoff from several ERP sites located along its perimeter (Figure 1-3). The RCRA Facility Assessment (RFA) Report (A.T. Kearney, 1988) initially identified the Lost River Basin as an AOC that warranted further investigation. Releases of hazardous wastes or constituents to the soil from the adjacent test sled launch area (SS-39) were observed during the visual site inspection.

1.7.1.2 RCRA Facility Investigation

The only previous investigation conducted at AOC-U was an RFI conducted in 1993 (Radian, 1994). Hand auger samples were collected at locations where contaminated surface water runoff potentially entered the basin from upgradient potential source areas (SS-39 and LF-40). Samples from 0 to 2 ft below ground surface (bgs) and 2 to 4 ft bgs were collected at the mouth of five small drainages, and 0 to 2 ft bgs samples were collected 100 ft into the basin from each of these drainages. The results of the previous RFI conducted at 29 different waste sites (Radian, 1992), which included upgradient sites SS-39 and LF-40, were used to establish the analytical sampling requirements for each of the five drainages. Based on the contaminants identified at the upgradient source areas, the soil samples were analyzed for one or more of the following: VOCs; SVOCs; total recoverable petroleum hydrocarbons (TRPH); and metals.

Four VOCs were detected at concentrations that were all below the current NMED Soil Screening Levels (SSLs) (NMED, 2006a). SVOCs and TRPH was not detected in any of the samples collected during the RFI. Six metals were detected above the detection limit. However, with the exception of arsenic, the maximum detection for each metal was below its NMED residential SSL. Arsenic was detected in soil samples AOC-U-A06-01-01 (6.99 milligrams per kilogram [mg/kg]), AOC-U-A07-01-01 (6.39 mg/kg), AOC-U-A08-01-01 (7.36 mg/kg), and AOC-U-A09-01-01 (7.24 mg/kg) at concentrations slightly above the SSL (3.9 mg/kg). A figure showing the hand auger sampling locations and a summary table of the RFI soil results are included in Appendix B-1-1 of this Work Plan.

A risk assessment was conducted for the AOC-U RFI Report to determine the need for further investigation. The presence of acetone in samples collected downgradient of SS-39 indicated a limited release into the basin; however the concentrations of all detected constituents were below the risk-based trigger criteria. The risk assessment concluded it was unlikely that AOC-U posed a significant risk to human health or the environment. The following subsections summarize the previous investigations that were conducted at each of the six ERP Sites that are located upgradient from the Lost River Basin.

Groundwater samples have been collected within the Lost River Basin (AOC-U) during previous investigations conducted at Site SS-39 (Missile Fuel Spill Area). Several of these groundwater samples contained detections of TCE and perchlorate that exceeded current NMED and/or USEPA action levels. These exceedences are summarized in Section 5.1.1.1 (AOC-U Groundwater Conditions) and are presented graphically on Figures 5-1 through 5-3 of this Work Plan.

1.7.2 OT-04 Acid Trailer Burial Site

The Acid Trailer Burial Site is a SWMU, and is listed on Table B (sites not requiring Corrective Action) of the HAFB RCRA Permit as SWMU 102. OT-04 is located adjacent to Ritas Draw, which is an arroyo that drains into the Lost River (Figure 1-3). In 1958, it was reported that two empty fuming nitric acid transport trailers and waste materials were dumped and buried on a one-half acre tract of land along three small side channels of Ritas Draw arroyo. The majority of the waste at OT-04 may have originated from the former Unconventional Fuels Storage Area located one-half mile to the south. The Unconventional Fuels Storage Area housed propellants, oxidizers, and other fuel components that were used for rocket and sled tests conducted at HAFB (Radian, 1992).

OT-04 was initially identified as an Installation Restoration Program (IRP) site in the IRP Records Search conducted in 1983 (CH2M Hill, 1983). The RFA Report (A.T. Kearney, 1988) identified OT-04 as SWMU 102 and concluded that the potential for a release was low to all media since the nitric acid trailers had been rinsed prior to burial.

1.7.2.1 Remedial Investigation

The site was initially investigated during the 29 Waste Sites RI conducted by Radian in 1991. During the RI an electromagnetic (EM) survey was performed to determine the locations of buried waste. Based on the results of the EM survey, 19 test pits were dug. Solid rocket boosters, laboratory equipment, over 100 amber bottles containing chemicals, metal debris, and an empty stainless steel tank trailer were encountered in the exploratory pits. Several of the amber bottles contained picric acid (an explosive) and were subsequently exploded in place by the Base Explosive Ordnance Detachment (Radian, 1992). The results of the EM survey and findings from the exploratory pits are summarized on various figures and a table included in Appendix B-2-1.

Four monitoring wells (MW-04-01 through MW04-04) were installed around the perimeter of the site to determine if a release to the groundwater had occurred. Groundwater samples were analyzed for VOCs, TRPH, metals, total dissolved solids (TDS), and water quality parameters. A figure showing the locations of the four monitoring wells and the data summary tables summarizing the detected organic and inorganic constituents are included in Appendix B-2-1. Selenium and antimony were the only constituents (VOCs, SVOCs, TRPH, or metals) that were detected above a New Mexico Water Quality Control Commission (NMWQCC) standard or U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL). Selenium was detected in monitoring well MW-04-04 (downgradient well located within the Lost River drainage area) with a concentration of 0.071 milligrams per liter (mg/L). This detection slightly exceeds the current MCL and the NMWQCC standard (0.05 mg/L). Antimony was detected in monitoring well MW-04-02 with a concentration of 0.15 mg/L which exceeds the USEPA MCL of 0.006 mg/L. Furthermore, TDS concentrations ranged from 17,000 to 66,000 mg/L with the maximum concentration detected in the groundwater sample from MW-04-04. All of the TDS concentrations exceed the current NMWQCC standard (1,000 mg/L) and are above 10,000 mg/L (Class IIIB water resource, groundwater designated as unfit for human consumption).

A risk assessment (RA) was conducted for OT-04 as part of the RI. The RA concluded that an unacceptable risk to the White Sands pupfish may exist due to the selenium concentrations detected in the downgradient well (MW-04-04). Because of the uncertainty surrounding the selenium detected in this groundwater sample, further investigation was recommended to assess background water quality.

1.7.2.2 RCRA Facility Investigation

The following additional investigations were conducted at OT-04 (SWMU 102) to address the concerns raised by the RI (Foster Wheeler Environmental Corporation [FWENC, 1995]).

- A voluntary corrective action in 1994
- A Base-wide background study in 1993
- The Phase II RFI in 1994

To eliminate the threat to public safety identified during the RI, a 5 ft high chain link fence was erected in 1994. Additionally as part of the voluntary corrective action, all OT-04 surficial debris was located, identified, and safely removed (Human Factors Applications, Inc., 1994). A study was conducted in 1993 to determine the background concentrations of selected inorganic compounds present in the soil and groundwater at HAFB. An additional monitoring well (MW-BG-04) was installed near OT-04 as part of the study. The 1993 background upper tolerance level (UTL) for total selenium in groundwater was calculated to be 0.079 mg/L.

During the Phase II RFI, groundwater samples were collected from three existing wells (MW-04-01, MW-04-02, and MW-04-04) and one background well (MW-BG-04). A map showing the monitoring well locations is included in Appendix B-2-2. Each of the groundwater samples collected during the RFI was analyzed for total selenium. A summary table of the selenium results is also included in Appendix B-2-2. The maximum concentration of selenium (0.054 mg/L) was detected in the downgradient well MW-04-04. Although this detection was slightly above the NMWQCC standard and USEPA MCL (0.05 mg/L) it was below the 1993 HAFB background UTL (0.079 mg/L).

1.7.2.3 Site OT-04 NFA Decision Document

The IRP Site OT-04 Decision Document for No Further Action (NFA) was prepared and approved by NMED in 1995 (Radian, 1995). A copy of the approved OT-04 Decision Document is included in Appendix B-2-3.

1.7.3 DP-62 Ritas Draw Disposal Pit

Ritas Draw Disposal Pit is an AOC, and is now listed on Table B of the HAFB RCRA Permit as AOC-RD. Site DP-62 is located approximately 300 ft east of the Acid Trailer Burial Site (OT-04) and is located within three arroyos that drain into Ritas Draw (Figure 1-3). During a field reconnaissance of the Ritas Draw area, two drums were discovered. These drums were believed to be related to the early missile testing that occurred at HAFB during the 1950s. The drums were empty with no evident soil staining, and the original content of the drums was unknown. As a result of this finding, a Preliminary Assessment/Site Inspection (PA/SI) was conducted by Groundwater Technology Government Services, Inc. (GTI) in May 1998.

1.7.3.1 Preliminary Assessment/Site Inspection

The purpose of the PA/SI was to determine if a release had occurred at the DP-62 site. A geophysical survey was conducted to locate other possible drums related to missile testing that occurred at HAFB during the 1950s. Based upon the results of the geophysical survey, four boreholes were advanced at the site in May of 1998 (GTI, 1998b).

A magnetometer geophysical survey was utilized on the ground surface to search for other metallic drums and debris. The geophysical survey identified five anomalies that exhibited a high magnetic response; indicating metallic objects (see Appendix B-3-1). Based on these results, four soil borings were advanced at the locations suspected to contain metallic debris.

The four borings (RITA-1 through RITA-4) were completed to depths from 6.5 to 20 ft bgs and two soil samples were collected from each boring. Each soil sample was analyzed by an offsite laboratory for VOCs, SVOCs, explosives, and TAL metals. A summary table of the detected analytes is also included in Appendix B-3-1. With the exception of eleven acetone detections (ranging from 10J to 25 micrograms per kilogram [µg/kg]) and one 2-butanone detection of 8.4J µg/kg, all VOCs, SVOCs, and explosives were not detected in the soil samples. The acetone and 2-butanone detections were below their current SSLs. Furthermore, arsenic (maximum detection of 17.4 mg/kg) was the only TAL metal detected above a current NMED residential SSL (3.9 mg/kg) (NMED, 2006a).

Two of the soil borings (RITA-3 and RITA-4) encountered groundwater and were converted into temporary sampling points. The groundwater samples collected from these sampling points were also analyzed for VOCs, SVOCs, explosives, and TAL metals. VOCs, SVOCs, and explosives were not detected above any groundwater action levels in the two groundwater samples. Antimony was the only TAL Metal detected above the NMWQCC standards or their applicable MCLs with detections ranging from 0.032 to 0.036 mg/L. A summary of the groundwater results from the PA/SI and figures showing the results of the magnetometer survey and soil sample locations are included in Appendix B-3-1 of this Work Plan. The PA/SI Report (GTI, 1998b) concluded that there were no indications of a release at the site.

1.7.3.2 DP-62 RCRA Facility Investigation

Bhate Environmental Associates, Inc. (Bhate) conducted a RFI at DP-62 in 2004 to address NMED concerns that not enough data had been collected from areas immediately adjacent to metallic debris identified from the PA/SI geophysical survey. Therefore, it was decided to collect shallow soil samples from boreholes advanced adjacent to the areas of exposed drums (Bhate, 2004). In March 2004, Bhate collected five soil samples from four hand augered soil boring locations (see Appendix B-3-2 of this Work Plan). The soil samples were analyzed for VOCs, SVOCs, TPH, and RCRA metals.

Data tables summarizing the DP-62 RFI analytical soil data are included in Appendix B-3-2 of this Work Plan. All VOCs, SVOCs, and TPH fractions (Gasoline Range Organics [GRO], Diesel Range Organics [DRO], and Oil Range Organics [ORO]) were not detected above the laboratory method detection limits (MDLs). Five of the eight RCRA metals were detected above the MDL. However the maximum detection for each metal was below its respective NMED residential SSL (NMED, 2006a). As a result of this sampling event, the drums exposed on the surface were removed and recycled as scrap metal. Based on the findings from the PA/SI and the RFI, the RFI Report concluded that the site did not pose any unacceptable risks and recommended NFA for DP-62 (Bhate, 2004).

1.7.3.3 NFA Statement of Basis

Based on the findings from the previous investigations Ritas Draw Disposal Pit (AOC-RD) was selected for NFA along with six other SWMUs and AOCs by HAFB in 2005. A copy of the NMED letter for the final permit decision approving NFA for ERP Site DP-62, Ritas Draw Disposal Pit (AOC-RD) is included in Appendix B-3-3 of this Work Plan.

1.7.4 OT-37 Early Missile Test Site

The Old Missile Test Site is a SWMU and is listed on Table A (sites requiring corrective action) of the HAFB RCRA Permit as the Early Missile Test Site, AOC-L. The Early Missile Test Site is located east of the Test Sled Maintenance Area along the southern side of the Lost River Basin (Figure 1-3). The Early Missile Test Site was used to develop rocket and missile systems from 1947 to 1955. The test site covers an area of approximately 160 acres and includes three block houses, the inclined test track, three vertical launch pads, and four transformer concrete pads (transformers have been removed). Fuels used at these sites included JP-4, kerosene, solid rocket propellants, and polychlorinated biphenyls (PCBs) that were contained in the transformer dielectric fluid. In 1983, OT-37 was initially identified as an IRP site in the IRP Records Search (CH2M Hill, 1983). The Early Missile Test Site was later identified as AOC-L in the RFA Report (A.T. Kearney, 1988) which stated that contaminant releases to the soil were probable.

1.7.4.1 Remedial Investigation

OT-37 was initially investigated during the 29 Waste Sites RI conducted by Radian Corporation in 1991. The RI focused on potential releases to the environment from the four former step-down transformers and the launch facilities. During the RI, seven soil borings (SB-37-01 through SB-37-07) and six monitoring wells (MW-37-01 through MW-37-06) were installed at the inclined track and the vertical launch pads. Two soil samples were collected from each soil boring and analyzed for VOCs, metals, and petroleum hydrocarbons. The groundwater samples collected from the six monitoring wells were analyzed for VOCs, metals, common anions, and TDS. Additionally, one surface soil sample collected from each transformer station was sent offsite for PCB and petroleum hydrocarbon analysis. The results and conclusions of the RI (Radian, 1992) are discussed below.

Transformer Stations

TRPH was detected in the surface soil samples collected from each of the four step-down transformer locations at concentrations ranging from 21.6 mg/kg to 30,600 mg/kg. The TRPH detected in the sample from HA-37-04 (30,600 mg/kg) exceeded the TPH Screening Guidelines for a dielectric fluid (1,560 mg/kg) (NMED, 2006b); all other detections were below this guideline. PCBs were detected at three of the former transformer locations. A PCB (Aroclor 1260) was detected in HA-37-14 (3.2 mg/kg) and exceeded the current NMED SSL (1.12 mg/kg) (NMED, 2006a); all other PCB detections were below their respective SSLs.

Vertical Launch Pad Facilities and the Inclined Test Track

Several VOCs were detected in the deeper soil samples across the site but at levels below their respective residential SSLs (NMED, 2006a). TRPH was detected in 5 of the 14 subsurface soil samples. With the exception of one sample collected at SB-37-03, all TRPH results were less than 48 mg/kg. TRPH was detected in the 0 to 2 ft bgs interval at SB-37-03 with a concentration of 3,860 mg/kg. This concentration of TRPH is above the TPH Screening Guidelines, residential direct exposure for an unknown oil (800 mg/kg) (NMED, 2006b); however, TRPH was not detected in the sample from 7.5 to 9.5 ft bgs collected from the same borehole. The metals detected in the soil samples collected from the seven soil borings at OT-37 were all below their respective residential SSLs.

With the exception of four antimony detections, ranging from 0.11 to 0.12 mg/L, all VOCs and metals detected in the groundwater samples collected from the six monitoring wells installed at OT-37 during the RI were all below the current NMWQCC Groundwater Standards (New Mexico Administrative Code [NMAC 20.6.2]) and USEPA MCLs. TDS concentrations ranged from 10,000 to 17,000 mg/L and exceeded the NMWQCC standard (1,000 mg/L) for each well. However, each of these TDS concentrations is also above 10,000 mg/L (Class IIIB water resource) indicating that the groundwater is unfit for human consumption. Furthermore, most of the concentrations of chloride, sulfate, fluoride, and nitrate (anions) also exceeded their respective NMWQCC standards in all of the OT-37 monitoring wells. The elevated anion concentrations are likely due to the naturally elevated TDS found in the groundwater at the site.

Data summary tables and a sample location figure for the surface soil, subsurface soil, and groundwater samples collected during the OT-37 RI are included in Appendix B-4-1 of this Work Plan. The RI Report (Radian, 1992) recommended implementation of a RCRA corrective action remedy and that a pre-design investigation may be warranted to determine the extent of remediation required at OT-37.

1.7.4.2 Accelerated Corrective Measures Investigation

In 2007 an Accelerated Corrective Measures (ACM) investigation was conducted by Bhate at OT-37 to fill in the data gaps identified during the RI (Radian, 1992). All ACM data collection activities were conducted in accordance with the NMED approved *Final Accelerated Corrective Measures Work Plan Multiple Sites* (Bhate, 2007). The OT-37 ACM investigation consisted of drilling 10 shallow direct push technology [DPT] boreholes (OT37-DP01 through OT37-DP10) around the perimeter of the four concrete transformer pads and eight deep boreholes at each vertical launch pad and the inclined test track (OT37-SB08 through OT37-SB15). Four of the deep soil borings were converted into permanent monitoring wells (OT37-MW07 through OT37-MW10). A round of groundwater samples were collected from four existing monitoring wells (OT37-MW01, OT37-MW04, OT37-MW05, and OT37-MW06), and from four new wells. Additionally, a sample of the tar that sporadically covers the ground surface in the vicinity of the inclined test track was collected for analysis.

Pending NMED approval of the HAFB *Basewide Background Study* Report (NationView|Bhate JV III, 2009), the ACM Multiple Sites Completion Report (which includes OT-37) has not been submitted to the NMED for review due to the detections of arsenic above the NMED action levels (soil and groundwater). The following subsections provide a brief summary of the results from the OT-37 ACM investigation. The complete results and conclusions for the OT-37 ACM investigation will be included in the ACM Multiple Sites Completion Report. The analytical results summary tables and sample location figures for the soil and groundwater samples collected during the OT-37 ACM are included in Appendix B-4-2 of this Work Plan.

Transformer Pad Soil Results

Twenty two samples collected from the ten shallow soil borings were analyzed for TPH (GRO, DRO, and ORO) and PCBs. The combined concentrations of the TPH fractions for each sample were below the TPH screening guidelines, residential direct exposure

(NMED, 2006b) for an unknown oil. The maximum concentration of PCBs (0.21 mg/kg [Aroclor 1260]) was below the NMED SSL (NMED, 2006a). Additionally, PCBs were not detected in the tar like substance (OT37-TAR) found on the ground surface surrounding the inclined test track.

Vertical Launch Pad Facilities and the Inclined Test Track Soil Results

Eighteen soil samples collected from eight soil borings advanced around the perimeter of the four former launch facilities were analyzed for VOCs, SVOCs, TPH (GRO, DRO, and ORO), PCBs, perchlorate, and eight RCRA metals. No PCBs were detected above the MDL and all VOCs and SVOCs were detected at concentrations well below the NMED residential SSLs. Only estimated concentrations of TPH-GRO and TPH-DRO were detected in the subsurface soil samples. Additionally, perchlorate was detected above the MDL in 15 soil samples with concentrations ranging from 280J nanograms per kilogram (ng/kg) to 14,000 ng/kg. Currently, NMED has not established soil cleanup levels for perchlorate. The current USEPA Region 6 Regional Screening Level (RSL) for perchlorate is 55 mg/kg (55,000,000 ng/kg) (USEPA 2009a). Therefore all of the perchlorate concentrations that were detected in the OT-37 soil samples were below the USEPA Region 6 RSL. Five RCRA metals were detected above the MDL. With the exception of arsenic, each RCRA metal was detected below its respective residential SSL (NMED, 2006a). Arsenic was detected in eight soil samples collected from four soil borings above the SSL (3.9 mg/kg) with concentrations ranging from 4.1 to 10 mg/kg. These detections of arsenic are slightly above the SSL and most likely represent the natural variability in soil geochemistry.

Groundwater Analytical Results

Groundwater samples were collected from eight monitoring wells and analyzed for VOCs, SVOCs, RCRA metals, PCBs, perchlorate, and TDS. All detected VOCs and SVOCs were well below the USEPA MCLs and the NMWQCC standards. Additionally PCBs were not detected in any of the groundwater samples. Perchlorate was detected in each OT-37 groundwater sample with concentrations ranging from 1.3 (OT37-MW09) to 6.7 micrograms per liter (µg/L) (OT37-MW10). However all perchlorate detections were below the USEPA Interim Drinking Water Health Advisory standard of 15 µg/L (USEPA 2008). Five RCRA metals were detected above the MDL. With the exception of arsenic, the other RCRA metals were detected below their respective USEPA MCLs and NMWQCC groundwater standards. Arsenic was detected in 4 of the 10 groundwater samples collected above the USEPA MCL (10 µg/L) with concentrations ranging from 11J to 18 µg/L. TDS concentrations ranged from 5,200JQ mg/L (OT37-MW09) to 22,000JQ mg/L (OT37-MW08) and exceeded the NMWQCC standard of 1,000 mg/L at each well. TDS concentrations also exceeded 10,000 mg/L in seven of the eight OT-37 monitoring wells with the exception of MW09.

1.7.5 OT-38 Test Sled Maintenance Area

The Test Sled Maintenance Area (OT-38) is a SWMU and is listed on Table A of the HAFB RCRA Permit as the Building 1166 Test Track Drain Field, SWMU 137. The Test Sled Maintenance Area is located adjacent to the Test Sled Track and north of the Lost River Basin (Figure 1-3). From 1951, when the test track became operational, until 1979, waste oils, solvents, and paint strippers used in the sled industrial maintenance area (Building 1166) were suspected of being discharged into the area's septic tank drain field (cesspool) behind Building 1166. Since 1979, all wastes have been accumulated in 55-gallon drums and turned over to the Defense Reutilization and Marketing Office (DRMO) for disposal or recycling. Personnel from the Exterior Plumbing Department indicated that the cesspool consisted of an unlined cavity below the ground surface that was about 6 ft deep and 10 ft long. In the late 1980s, the cesspool was replaced with a septic tank and leach field (approximately 150 ft of perforated polyvinyl chloride [PVC] pipe) that was installed at the former cesspool location. The personnel that installed the septic tank reported that wastes were not apparent in the former cesspool location.

OT-38 was initially identified as an IRP site in the IRP Records Search conducted in 1983 (CH2M Hill, 1983). The Test Sled Maintenance Area was later identified as SWMU 137 in the RFA Report (A.T. Kearney, 1988). The RFA Report stated that there was a high potential for releases to the soil and groundwater from hydrocarbon constituents.

1.7.5.1 Remedial Investigation

OT-38 was initially investigated during the 29 Waste Sites RI conducted in 1991 (Radian, 1992). The RI focused on a potential release to the environment from the former cesspool (drain field). Field activities conducted during the OT-38 RI included the installation of two soil borings (SB-38-01 and SB-38-02) adjacent to the former cesspool and three monitoring wells (MW-38-01 through MW-38-03) to determine whether a release to the groundwater had occurred. A composite soil sample was collected from each soil boring and analyzed for VOCs, metals, and petroleum hydrocarbons. The groundwater samples collected from the three monitoring wells were analyzed for VOCs, metals, TDS, and water quality parameters. The results and conclusions of the RI are briefly discussed below.

All metals that were detected in the four composite soil samples were below their respective residential SSLs (NMED, 2006a). Petroleum hydrocarbons were detected in each of the soil samples. The highest concentration of TRPH (1,540 mg/kg) was detected in the soil sample collected from the 0 to 10 ft bgs interval in SB-38-02. This concentration exceeded the TPH Screening Guideline for an unknown oil (800 mg/kg)

(NMED, 2006b). Additionally all detected VOCs were estimated concentrations below their respective residential SSLs (NMED, 2006a).

VOCs and metals detected in the groundwater samples collected from the three monitoring wells were all below their respective NMWQCC Groundwater Standards and USEPA MCLs. TDS concentrations ranged from 5,500 to 15,000 mg/L and exceeded the NMWQCC standard (1,000 mg/L) for each well. However, the average TDS concentration for these wells (11,833 mg/L) exceeds the allowable limits for TDS (10,000 mg/L) for the groundwater to be considered a viable drinking water source (Class IIIB water resource). Additionally the most of the concentrations for chloride, sulfate, fluoride, and nitrate (anions) also exceeded their respective NMWQCC standards. The elevated anion concentrations at OT-38 are likely also likely due to the naturally elevated TDS found in the groundwater at the site.

The analytical results and sample locations for the subsurface soil and groundwater samples collected during the OT-38 RI are included in Appendix B-5-1 of this Work Plan. The RI Report (Radian, 1992) determined that there were no risks to human health or the environment and recommended no further action for OT-38.

1.7.5.2 Accelerated Corrective Measures Investigation

In 2007 an ACM investigation was conducted by Bhate at OT-38 to fill in the data gaps identified in the RI Report (Radian, 1992). The ACM data collection activities were conducted in accordance with the NMED approved *Final Accelerated Corrective Measures Work Plan Multiple Sites* (Bhate, 2007). The OT-38 ACM investigation consisted of advancing three shallow boreholes (OT38-DP01 through OT38-DP03) around the boundary of the former cesspool and three additional boreholes (OT38-DP04 through OT38-DP06) along the length of the existing drainpipe. Additionally a round of groundwater samples were collected from the three previously installed monitoring wells (MW-38-01 through MW-38-03).

Pending NMED approval of the HAFB Basewide Background Study Report (NationView/Bhate JV III, 2009), the ACM Multiple Sites Completion Report (which includes OT-38) has not been submitted to the NMED for review due to the detection of arsenic slightly above NMED action levels (soil and groundwater). The following subsections provide a brief summary of the results for the OT-38 ACM investigation. The complete results and conclusions for the OT-38 ACM investigation will be included in the ACM Multiple Sites Completion Report. The analytical results summary tables and sample location figures for the soil and groundwater samples collected during the OT-38 ACM are included in Appendix B-5-2 of this Work Plan.

Soil Results

Seventeen soil samples collected from six soil borings were analyzed for VOCs, SVOCs, TPH (GRO, DRO, and ORO) PCBs, and RCRA metals. Only estimated concentrations of VOCs, SVOCs, and TPH fractions were detected, and all detections were well below the NMED residential SSLs and the TPH screening guidelines for an unknown oil. Additionally PCBs were not detected in any of the soil samples. Five RCRA metals were detected above the MDL. With the exception of arsenic, each RCRA metal was detected below its respective residential SSL (NMED, 2006a). Arsenic was detected in one soil sample (OT38-DP06-9) above the SSL (3.9 mg/kg) at a concentration of 5.5 mg/kg. This detection of arsenic slightly above the SSL most likely represents the natural variability in soil geochemistry.

Groundwater Results

Groundwater samples were collected from the three previously installed monitoring wells and analyzed for VOCs, SVOCs, PCBs, perchlorate, and TDS. All detected VOCs and SVOCs were below the USEPA MCLs and the NMWQCC standards. Additionally PCBs were not detected in any of the groundwater samples. Perchlorate was detected in each groundwater sample with concentrations ranging from 4.8 (MW-38-01) to 5.1 µg/L (MW-38-03). However, the perchlorate detections were all below the USEPA Interim Drinking Water Health Advisory standard (15 µg/L) (USEPA, 2008). Three RCRA metals were detected above the MDL. With the exception of arsenic, the other RCRA metals were detected below their respective USEPA MCLs and NMWQCC groundwater standards. Arsenic was detected in one groundwater sample (MW-38-02) slightly above the USEPA MCL (10 µg/L) at a concentration of 11 J µg/L. TDS concentrations ranged from 8,400 mg/L (MW-38-03) to 12,000Q mg/L (MW-38-02) and exceeded the NMWQCC standard of 1,000 mg/L at each well.

1.7.6 SS-39 Missile Fuel Spill Area

The Missile Fuel Spill Area (SS-39) comprises four SWMUs (165, 177, 179, and 181) that are listed on Table A of the HAFB RCRA Permit. SS-39 is located immediately south of Building 1176 along the northern perimeter of the Lost River Basin (Figure 1-3). SS-39 is located downgradient of Building 1176 which is part of the Test Sled Facility. Historically, spilled oxidizers and fuels were delivered to separate drains, diluted with water, and flushed into the Lost River. In 1975, catch basins were installed to collect spilled liquid fuels. Initially, during the IRP Records Search (CH2M Hill, 1983), SS-39 was limited only to the Test Sled Launch Area Collection Basin. This was a 30 ft by 20 ft surface impoundment that collected water used for reducing the velocity of vehicles on the sled test track. Fuel spills from the test track had reportedly been flushed into the Test Sled Launch Area Collection Basin. As a result of the RCRA Facility

Assessment (A.T. Kearney, 1988), SS-39 was expanded to include the Discharge Box (SWMU 179), the Building 1176 Drainage Troughs (SWMU 177) and Drainage Sumps (SWMU 181), and the Building 1176 Pond (SWMU 165). SWMU 165 was thought to be located between Building 1176 and the Lost River, however the pond has never been located. Figures which illustrate the locations of the referenced SS-39 SWMUs are included in Appendix B-6-1 of this Work Plan.

1.7.6.1 Remedial Investigation

The SS-39 Missile Fuel Spill Area was initially investigated during the 29 Waste Sites RI conducted in 1991 (Radian, 1992). The SS-39 RI consisted of completing two soil borings (SB-39-01 and SB39-02), five hand auger borings (HA-39-01 through HA-39-05), and the installation and sampling of four monitoring wells (MW-39-01 through MW-39-04) located within outfalls and drainages throughout the site. Soil samples were analyzed for VOCs, metals, and petroleum hydrocarbons and groundwater samples collected from the four monitoring wells were analyzed for VOCs, metals, TDS, and anions. The results and conclusions of the RI are briefly summarized below.

Metals (lead, cadmium, and chromium) were detected in the soil samples collected near the oxidizer and propellant spill outfalls; the maximum concentration of lead (1,300 mg/kg) was detected in HA-39-02 above the NMED residential SSL (400 mg/kg). The maximum concentrations for VOCs above NMED residential SSLs (NMED, 2006a) included TCE (40 mg/kg) and tetrachloroethene (PCE) (95 mg/kg) which were detected in soil samples collected from the Building 1176 drainage sump boreholes (SB-39-01 and SB-39-02). Additionally, TPH was detected above the TPH Screening Guideline for the residential direct exposure an unknown oil (800 mg/kg) (NMED, 2006b) in soil samples HA-39-04 (20,700 mg/kg) and SB-39-02 (2,620 mg/kg).

With the exception of maximum concentrations of cadmium (5.9 µg/L) and lead (19 µg/L) metals were not detected in groundwater samples above the NMWQCC standards or the USEPA MCLs. VOCs were detected in groundwater above current action levels in monitoring well MW-39-02 located downgradient of the Building 1176 drainage sump. VOCs detected in MW-39-02 above the NMWQCC standards and/or USEPA MCLs included TCE (59 µg/L), carbon tetrachloride (5.8 µg/L), 1,1,1-trichloroethane [1,1,1-TCA] (240 µg/L), and 1,1-dichloroethene [1,1-DCE] (9.6 µg/L). TDS concentrations exceeded the NMWQCC standard (1,000 mg/L) and ranged from 2,600 to 14,000 mg/L with the maximum concentration detected in the groundwater sample from MW-39-04.

The analytical results and sample locations for the soil and groundwater samples collected during the SS-39 RI are included in Appendix B-6-1 of this Work Plan. The RI Report (Radian, 1992) concluded that this evaluation indicated an unacceptable risk.

1.7.6.2 RCRA Facility Investigation

To address the concerns of the RI, Radian performed a RFI in 1993 to further delineate the VOCs, petroleum hydrocarbons, and metals contamination that was identified during the RI. During the RFI (Radian, 1994) soil samples were collected from 10 soil borings (179-B01 through 179-B08 and 181-B01 and 181-B02) and hand auger locations (179-A01 through 179-A05) installed along drainage ditches and below oxidizer and propellant outfalls. Soil samples were analyzed for SVOCs and metals. Additionally groundwater samples were collected form 15 temporary sampling locations using DPT methods and field screened for VOCs. Eight groundwater samples (177-H01 through 177-H04 and 179-H01 through 179-H04) were then submitted for off-site confirmation analysis for VOCs.

The analytical results and sample locations for the soil and groundwater samples collected during the SS-39 RFI are included in Appendix B-6-2 of this Work Plan. SVOCs and metals were not detected in any of the RFI soil samples above the NMED residential SSLs. The groundwater data indicated that TCE was above the NMWQCC standards and the USEPA MCL at six locations with concentrations ranging from 27.6 to 2,730 µg/L. Furthermore 1,1,1-TCA and 1,1-dichloroethane (1,1-DCA) were detected above action levels at one location (177-H03). Additionally data was collected from flora and fauna from the Lost River Basin to support an ecological risk assessment. The assessment concluded that there was not an unacceptable risk to ecological receptors. Therefore a Decision Document for No further Action was prepared and submitted in September 1995, but was never signed by NMED.

1.7.6.3 Additional Groundwater Sampling Event

In May/June 1998, Groundwater Technology, Inc. collected groundwater samples from 16 locations (SS39-1 through SS39-16) to delineate the extent of the TCE plume that was previously characterized during the RI and RFI studies conducted at SS-39. The work was performed to fulfill a request for supplemental information by the NMED based on the RFI Report. Groundwater samples were analyzed for VOCs and soil samples were not collected for chemical analysis.

A map showing the groundwater sample locations and an analytical sample summary table for this additional sampling event are included in Appendix B-6-3 of this Work Plan. TCE was detected the above NMWQCC standard and the USEPA MCL at seven locations (SS39-1, -2, -4, -7, -8, -13, and -14). The concentrations of TCE in these samples ranged from 27 to 280 µg/L. These TCE detections were from sampling points located 300 to 500 ft south-southwest of Building 1176; however the downgradient extent of the TCE plume was delineated by sample points which yielded non-detectable TCE results. With the exception of benzene (1.0 µg/L) detected in SS-39-9, all other

VOCs were detected below the reporting limit (RL). The Additional Groundwater Sampling Report recommended NFA for SS-39 based on this data (GTI, 1998a).

1.7.6.4 Groundwater Long Term Monitoring

Long Term Monitoring (LTM) at Site SS-39 began in 1997 and continued on a biennial basis until December 2005. The data from the 2005 LTM Report (Bhate, 2006b) shows that TCE, carbon tetrachloride, and chloroform have been consistently detected in monitoring well MW-39-02 (located downgradient of Building 1176). Following review of the 2003 LTM Report and previous site investigation reports, NMED determined that an additional investigation was required to fill in data gaps at SS-39.

1.7.6.5 Supplemental RCRA Facility Investigation

Supplemental RFI activities were performed at SS-39 between May and July 2006. The following information was obtained form the Supplemental RFI Report (HydroGeoLogic, Inc., 2007). The SS-39 Supplemental RFI included the collection of additional soil, sediment, and groundwater samples throughout the site. During the Supplemental RFI, five soil borings (SB-39-01R, SB-39-02R, HA-39-01R, HA-39-02R, and SB-39-17) were advanced for the collection of additional subsurface soil samples adjacent to several of the 1991 RI borings. Eleven soil samples were collected from these borings and analyzed for unsymmetrical dimethylhydrazine (UDMH), aniline, and RCRA metals. Additionally, one sediment sample (SD-29-01) was collected from the Concrete Collection Basin and analyzed for SVOCs, UDMH, and RCRA metals.

As part of the Supplemental RFI, four permanent monitoring wells (MW-39-05, MW-39-06, MW-39-06A, and MW-39-07) were installed along the edge of the Lost River Basin. Additionally, five hand-augered pre-pack monitoring wells (MW-39-08 through MW-39-12) were installed to collect groundwater samples from within the Lost River Basin. During this investigation, one round of groundwater samples was collected for offsite analysis from the nine new wells and one previously installed monitoring well (MW-39-02). During the July 2006 Supplemental RFI groundwater sampling event, the 10 monitoring wells were sampled for VOCs, RCRA metals (total and dissolved), perchlorate, UDMH, aniline, and TDS. A summary of the sample results from the Supplemental SS-39 RFI is presented below.

<u>Sediment Sampling</u>

Three SVOCs and six RCRA metals were detected in the sediment sample (SD-39-01) collected from the Concrete Collection Basin. Of the detected SVOCs and metals, only lead (1,430 mg/kg) was detected at a concentration exceeding a NMED residential SSL (400 mg/kg) (NMED, 2006a). A summary of the sediment analytical results are included in Appendix B-6-4 of this Work Plan.

Subsurface Soil Sampling

Two subsurface soil samples were collected from each of the five boreholes from approximately 2 to 4 and 8 to 10 ft bgs. UDMH and aniline were not detected in the subsurface soil samples. Of the seven RCRA metals detected, four (arsenic, cadmium, chromium, and lead) were detected above the NMED residential SSLs in two samples (HA-39-01R and SB-39-02R). The detection of arsenic (8.27 mg/kg) in the 2 to 4 ft interval from HA-39-01R was above the NMED residential SSL (3.9 mg/kg) (NMED, 2006a). Additionally, cadmium (50.7 mg/kg), chromium (290 mg/kg), and lead (612 mg/kg) detected in the 8 to 10 ft interval in SB-39-02R all exceeded their SSLs (39, 210, and 400 mg/kg, respectively). A summary table of the soil analytical results and a figure showing the constituents that exceeded SSLs in these soil borings are included in Appendix B-6-4 of this Work Plan.

Groundwater Sampling

During the July 2006 Supplemental RFI groundwater sampling event, 13 VOCs, 1 metal, and perchlorate were detected in the SS-39 monitoring wells. UDMH and aniline were not detected in groundwater samples collected during the Supplemental RFI sampling event. Of the 13 detected VOCs, TCE was the only constituent detected above the USEPA MCL (5 µg/L) and the NMWQCC standard (100 µg/L). TCE was detected in groundwater above the USEPA MCL in six monitoring wells (MW-39-02, MW-39-05, MW-39-06, MW-39-06D, MW-39-08, and MW-39-11). The maximum concentrations of TCE were detected in monitoring wells MW-39-06 (366J µg/L) and MW-39-06D (113 µg/L). Barium (total) was the only RCRA metal to be detected in groundwater during the Supplemental RFI at a concentration of 19 µg/L in MW-39-07. This detection was below the respective NMWQCC standard (1,000 µg/L) and USEPA MCL (2,000 µg/L). Dissolved metals data for the July 2006 groundwater sampling event were rejected by the laboratory, and therefore not reported (HydroGeoLogic Inc., 2007).

At the request of NMED, the groundwater was also analyzed for perchlorate and TDS. Perchlorate was detected in each SS-39 groundwater sample with concentrations ranging from 12 (MW-39-02) to 130 µg/L (MW-39-09, MW-39-10, and MW-39-11). The perchlorate concentrations in MW-39-05, MW-39-06, MW-39-06D, MW-39-07, MW-39-08, MW-39-09, MW-39-10, MW-39-11, and MW-39-12 were all above the USEPA Interim Drinking Water Health Advisory standard (15 µg/L) (USEPA, 2008). Additionally, TDS concentrations in the vicinity of the TCE groundwater plume ranged from 16,300 to 136,000 mg/L. All of the TDS concentrations within the TCE plume exceeded the NMWQCC standard (1,000 mg/L) and are above 10,000 mg/L (Class IIIB water resource, groundwater designated as unfit for human consumption). A summary table of the groundwater analytical results and a figure showing the constituents that exceeded USEPA MCLs and NMWQCC standards in these groundwater samples are included in Appendix B-6-4 of this Work Plan.

1.7.7 LF-40 Causeway Rubble Disposal Site

The Causeway Rubble Disposal Site is a SWMU, and is listed on Table B of the HAFB RCRA Permit as SWMU 103. LF-40 is located south of the Sled Test Track Area and south of OT-38 (Figure 1-3). This disposal area was a staging area for construction debris including concrete, steel reinforcing bars, and asphalt from the Sled Test Track that was utilized as a base construction material staging area for the causeway that crosses the west end of the Lost River Basin. LF-40 was approximately ¼-mile long, 40 ft wide and five ft high.

1.7.7.1 IRP Records Search and RFA

LF-40 was initially identified as an IRP site in the IRP Records Search conducted in 1983 (CH2M Hill, 1983). Since no hazardous material was known to be associated with the concrete rubble and construction debris, the site was not rated in the IRP Records Search Report. The RFA Report (A.T. Kearney, 1988) identified LF-40 as SWMU 103 and concluded that there was no potential for release to any environmental media as there was no evidence that hazardous wastes or constituents had ever been managed at this unit.

1.7.7.2 Site LF-40 NFA Decision Document

Based on the findings stated in the IRP Records Search and RFA Reports, the Causeway Rubble Disposal Site, LF-40 (SWMU 103) was selected for NFA. The IRP Site LF-40 Decision Document for NFA was prepared and approved by NMED in 1993 (EA Engineering, 1993). A copy of the approved LF-40 Decision Document is included in Appendix B-7-1 of this Work Plan.

2 ENVIRONMENTAL SETTING

2.1 Physiography and Topography

HAFB is located within the Sacramento Mountains Physiographic Province on the western edge of the Sacramento Mountains. HAFB is approximately 60,000 acres in area, and is located at a mean elevation of 4,093 feet above mean sea level (amsl). The region is characterized by high tablelands with rolling summit plains; cuesta-formed mountains dipping eastward and of west-facing escarpments with the wide bracketed basin forming the basin and range complex. The Base is located in the Tularosa Sub-basin, which is part of the Central Closed Basins. The bordering mountains rise abruptly to altitudes of 7,000 to 12,000 feet amsl. The San Andres Mountains bound the basin to the west (about 30 miles) with the Sacramento Mountains approximately 10 miles to the east. At its widest point, the basin is about 60 miles east to west and stretches approximately 150 miles north to south.

In the vicinity of HAFB, the ground surface is relatively flat and slopes gently to the southwest. There are localized areas of greater topographic relief related to arroyos present on the Base, as described in Section 2.3 of this Work Plan.

2.2 Climate

As a whole, New Mexico has a mild, arid to semi-arid, continental climate characterized by light precipitation totals; abundant sunshine, relatively low humidity and relatively large annual and diurnal temperature range (Western Regional Climate Center [WRCC], 2003). The climate of the Central Closed Basins varies with elevation. The base is found in the low areas and is characterized by warm temperatures and dry air. Daytime temperatures often exceed 100 degrees Fahrenheit (°F) in the summer months and middle 50s in the winter. A preponderance of clear skies and relatively low humidity permits rapid night time cooling resulting in average diurnal temperature ranges of 25 to 35°F. Potential evapotranspiration, at 67 inches per year, significantly exceeds annual precipitation, which is usually less than 10 inches. The very low rainfall amounts resulting in the arid conditions, which with the topographically induced wind patterns combining with the sparse vegetation, tend to cause localized “dust devils”. Much of the precipitation falls during the mid-summer monsoonal period (July and August) as brief, yet frequent, intense thunderstorms culminating in 30 – 40% of the total annual rainfall.

2.3 Surface Water and Hydrology

Intermittent streams and arroyos in the basin lowlands are important only during the infrequent periods of heavy rainfall. The Tularosa Basin contains all of the surface flow in its boundaries. The nearest inflow of surface waters to the Base comes from the Lost

River, located in the north-central region of the Base. The Lost River Drainage Basin is the main drainage area within the boundaries of HAFB (Figure 2-1). The upper reaches of the Three Rivers and the Sacramento River are perennial in the basin. HAFB is dissected by several southwest trending arroyos that control the surface drainage. Hay Draw arroyo is located in the far north. Malone and Ritas Draw, which drain into the Lost River and Dillard Draw arroyos, are located along the eastern perimeter of the Base. Approximately 10,000 years ago, indications are of a much wetter climate. The present day Lake Otero encompassed a much larger area, possibly upwards of several hundred square miles. Its remains are the Alkali Flat and Lake Lucero. Lake Lucero is a temporary feature of merely a few inches in depth during the rainy season.

Potable water is available from municipal wells along the margins of the basin with more saline water towards the center. The principal sources of potable water are located in a long narrow north-south trending area on the upslope sides of Tularosa and Alamogordo and in the far southern part of the basin. HAFB is also supplied potable water from Lake Bonito, which is in the Pecos River Basin.

The hydrology of the southern portion of the Base (south of the wastewater treatment plant) is dominated by several manmade features that form a connected hydrologic system. The principal components of this system are: the storm water drainage canal, Lagoon G, Lake Holloman, and Lake Stinky. In addition, there are both natural and constructed wetlands in this area, some of which are related to and dependent on the manmade surface water features.

HAFB currently generates under 1 million gallons per day (MGD) of wastewater. Approximately 200,000 to 250,000 gallons per day (gpd) of treated effluent empty into Lagoon G (approximately 46 acres) through a 6-inch force-main. This effluent is eventually discharged to the storm water drainage canal southwest of Lagoon G and north of Highway 70. A berm surrounding this lagoon prevents storm water from flowing into the lagoon. The storm water drainage canal starts at a point north of Lagoon G, and then extends southwest of the lagoon into Lake Holloman. The canal is about 2 feet wide and 1 mile long with an elevation change of about 5 feet between Lagoon G and Lake Holloman. The canal also receives effluent from Lagoon G.

Lake Holloman was created in 1965 to receive excess flow from the previous sewage treatment lagoon system. It was formed by the construction of a non-engineered earthen dam midway along an existing ephemeral lake (playa) that normally received runoff from HAFB. Lake Holloman receives water from the storm water drainage canal, Lagoon G, and effluent from the wastewater treatment plant (WWTP). The amount of effluent going to Lake Holloman can be adjusted depending on the water requirements of Lagoon G and the constructed wetlands. The lake is in a state of dynamic equilibrium, rising and falling with seasonal and annual variations in runoff, local shallow groundwater, and treated effluent from the WWTP.

Lake Stinky encompasses as much as 35 acres of playa below Lake Holloman. This area represents a remnant of the original playa grassland present in the project area prior to the construction of the lagoon system for the original wastewater treatment system in 1948. Persistent seepage from Lake Holloman is sufficient to maintain a limited surface water expression in Lake Stinky, as well as a substantial growth of wetland vegetation (tamarisk and salt grass) at the base of the dam separating Lake Stinky and Lake Holloman. During most years, total annual discharge to Lake Holloman is sufficient to result in overflow to Lake Stinky. On these occasions, Lake Stinky extends south from the dam through culverts underneath U.S. Highway 70/82 to encompass as much as 61 acres.

There are approximately 119 acres of jurisdictional wetlands on the main base (United States Air Force, 1996), the majority of which are located south of the WWTP near Lagoon G and Lake Holloman (79 acres). Some of these areas are fed partly by seepage from artificial impoundments (e.g., north end of Lake Stinky; west and south of Lagoon G). Others may have an independent existence, or be only slightly affected by the impoundments. These latter areas seem to be remnants of the wetlands that existed before the construction of the present system. Many of the wetlands located south of the WWTP are important foraging areas for resident and migrating birds and/or bats.

2.4 Regional Geology

2.4.1 Area Geology

The sedimentary rocks which make up the adjacent mountain ranges are between 500 and 250 million years old. During the period when the area was submerged under the shallow intra-continental sea, the layers of limestone, shale, gypsum, and sandstone were deposited. In time, these layers were pushed upward through various tectonic forces forming a large bulge on the surface. Approximately 10 million years ago the center began to subside resulting in a vertical drop of thousands of feet leaving the edges still standing (the present day Sacramento and San Andreas mountain ranges). In the millions of years following, rainfall, snowmelt, and wind eroded the mountain sediments depositing them in the valley (i.e. Tularosa Basin). Water carrying eroded gypsum, limestone, dolomite, gravel, and other alluvial matter continues to flow into the basin with no route of exit.

The Tularosa sub-basin is geologically described as a bolson, which is an extensive flat alluvium-floored depression, into which drainage from the surrounding mountains flows toward a central playa. The overlying alluvium generally consists of unconsolidated gravels (limestone, dolomite, and gypsum), sands, and clays. A fining sequence from the San Andreas and Sacramento Ranges towards the basin’s center characterizes the area with the near surface soils as alluvial, eolian, and lacustrine deposits. The alluvial fan deposits are laterally discontinuous units of interbedded sand, silt, and clay while the eolian deposits consist primarily of gypsum sands. The eolian and alluvial deposits are usually indistinguishable due to the reworking of the alluvial sediment by eolian processes. The playa, or lacustrine deposits, consist of silty clay containing gypsum and are contiguous with the alluvial fan and eolian deposits.

Mesozoic rocks in the northwest mark the Colorado Plateau, topped by younger Tertiary strata. Quaternary age sediments have washed off the Southern Rockies into the open basins and the Rio Grande Rift, a failed spreading center or aulacogen. This would-be ocean basin runs up the center of the state with the Rio Grande flowing down its middle, exposing the Paleozoic and Precambrian rocks on its uplifted flanks. Later Cenozoic volcanic intrusions of Quaternary and Tertiary age are also associated with the rifting.

The great Permian Basin of Texas continues into the state from the southeast with younger Quaternary-Tertiary sediments of the Great Plains cover the whole eastern edge. Basin-and-range terrain of Tertiary sediments and volcanics appear in the extreme southwest coupled with wide dry basins choked with Quaternary coarse sediments eroded from the blocks of uplifted older rocks.

2.4.2 AOC-U Site Specific Geology

Site-specific geologic information has been obtained from lithologic data collected during previous subsurface sampling performed along the boundary of AOC-U (Lost River Basin) during the investigation of peripheral SWMUs and ERP sites.

The central portion of AOC-U generally has a thin (approximately 1/8-inch) layer of evaporite gypsum at the surface during its dry season (October through early July). The soils within AOC-U consist primarily of silty-sands with occasional thin bands of clay from the surface to a depth of approximately 2 ft bgs. A silty-clay with interbedded clay lenses occurs from 2 ft bgs to approximately 8 ft bgs.

2.5 Regional Hydrogeology

2.5.1 Area Hydrogeology

The majority (over 70 %) of the ERP Sites, SWMUs, and AOCs located across HAFB have groundwater monitoring wells containing water with an average TDS concentration greater than 10,000 mg/L. This TDS data supports the hypothesis that TDS concentrations below 10,000 mg/L at HAFB are caused by dilution of natural groundwater from leaking water lines and surface irrigation from the domestic water supply. TDS concentrations greater than 10,000 mg/L exceed the NMWQCC limit as potable water and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, USEPA guidelines (USEPA, 1986) have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L.

Figure 2-2 shows the general groundwater flow direction at the Base. Groundwater quality in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains and becomes increasingly mineralized toward the central portion of the basin and discharge areas. The preponderance of the groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin, with the primary source of recharge as rainfall percolation and minor amounts of stream run-off along the western edge of the Sacramento Mountains. Surface water/rainfall migrates downward into the alluvial sediments at the edge of the shallow aquifer near the ranges, and flows downgradient through progressively finer-grained sediments towards the central basin. Because the Tularosa Basin is a closed system, water that enters the area only leaves either through evaporation or percolation. This elevated amount of percolation results in a fairly high water table. Beneath HAFB, the water table ranges from 5 to 50 ft bgs. Flow for the Base is generally towards the southwest with localized influences from the variations in the topography of the Base. The ground surface slopes at a slightly higher rate than the water table such that the depth to groundwater in the northern areas of the Base is comparably greater (25 to 40 feet bgs) than in the southern areas of the Base (less than 10 feet bgs). Near the arroyos, groundwater flows directly toward the surface drainage feature.

According to the groundwater well inventory prepared by the New Mexico Office of the State Engineer, there are approximately 25 domestic, 15 commercial, 7 irrigation, and 3 livestock wells located within a 4-mile radius of HAFB (New Mexico Water Rights Reporting System [NMWRRS] database, 2009).

2.5.2 AOC-U Site Specific Hydrogeology/Hydrology

AOC-U (Lost River Basin) is a large drainage basin, which receives runoff from various SWMUs and ERP sites in the northern portion of HAFB. The basin remains dry for most of the year, but during periods of heavy rainfall, runoff enters the basin from surrounding areas. Malone Draw and Ritas Draw converge to form the Lost River, which then flows into the Lost River Basin (Figure 1-3). The Lost River is an intermittent feature supplied by surface water flows, seeps, and springs (HAFB, 2001). Reportedly, permanent water exists within AOC-U in three different areas. During high water events and the rainy season (late July through September) the three segments of permanent water are connected. Below the playa in the westernmost reach of AOC-U, the Lost River emerges, and flows into the dune fields of the WSMR.

Groundwater occurs within AOC-U in a shallow unconfined aquifer ranging from approximately 5 ft bgs along the outer boundary of the basin to less than 0.5 ft bgs in the central portion of the basin. Groundwater within the basin flows to the west-southwest, along the path of the Lost River. During heavy rain events and the rainy season the basin fills with water for a short period of time. Surface water and groundwater within the Lost River Basin are interconnected.

2.6 Soils

Two soil types have been identified on the installation. The main soil type is the Holloman-Gypsum land-Yesum complex, 0 to 5 percent slopes. The other soil type is Mead silty clay loam, 0 to 1 percent slopes. This soil type is located only across the main drainage area for the installation. The distribution of soil types in the vicinity of HAFB is depicted on Figure 2-3 (USDA, 1981).

The Holloman-Gypsum land-Yesum complex, 0 to 5 percent slopes soil consists of large areas of shallow and deep, well drained soils and areas of exposed gypsum. The Holloman soil makes up about 35 percent of the complex. Typically, the surface layer is light brown very fine sandy loam about 3 inches thick. The upper 13 inches of the substratum is pink very fine sandy loam that is very high in gypsum. Below that, the substratum is white gypsum to a depth of more than 60 inches. This soil is calcareous and mildly alkaline to moderately alkaline throughout. Permeability is moderate, and available water capacity is very low.

Gypsum land makes up about 30 percent of the Holloman-Gypsum land-Yesum complex, 0 to 5 percent slopes. Typically, less than 1 inch of very fine sandy loam overlies soft to hard, white gypsum. The deep Yesum very fine sandy loam makes up about 20 percent of the complex. Typically, the surface layer is light brown very fine sandy loam about 3 inches thick. The upper 9 inches of the substratum is light brown fine sandy loam that is very high in gypsum. Below that, the substratum is pink very fine sandy loam to a depth of more than 60 inches. The soil is calcareous throughout and is mildly alkaline. Permeability is moderate, and available water capacity is moderate. Many fine gypsum crystals are found throughout the profile.

The soil type located across the main drainage area for the installation is Mead silty clay loam, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is on outer fringes of alluvial fans. This soil formed in fine textured alluvium over lacustrine lake sediment. It is very high in salt content because of periodic flooding and poor drainage. Slopes are smooth and concave. Typically, the surface layer is reddish brown silty clay loam and clay loam about 5 inches thick. The substratum, to a depth of 48 inches, is light reddish brown clay that has a high content of salts. Below that, the substratum is lacustrine material of variable texture and color to a depth of more than 60 inches. Included with this soil are areas of Holloman soils and Gypsum land along the margins of the unit of steep, short gully sides and knolls. These inclusions make up about 15 percent of the map unit for this soil type. Individual areas are generally smaller than 10 acres. This soil is moderately calcareous throughout and is moderately to strongly alkaline. It has a layer of salt that is more soluble than gypsum. Permeability is very slow, and available water capacity is low.

3 SOURCE CHARACTERIZATION

3.1 Potential Source Areas

As stated in Section 1 of this Work Plan, there are six known upgradient ERP sites that may have impacted AOC-U (Lost River Basin) via runoff from surface water tributaries and/or groundwater infiltration. The size of the area contributing to AOC-U lends itself to the potential for multiple source areas contributing to the groundwater contamination within the Basin. Currently, the nature and extent of soil and groundwater contamination resulting from historical releases from the upgradient ERP sites into the Lost River Basin have not been completely defined.

3.2 Previously Identified Contaminants of Concern

Based on all of the previous investigations described in Section 1.7 of this Work Plan, a number of chemicals have been detected above current regulatory limits. The contaminants of concern that have impacted the soil and groundwater at the ERP sites that are upgradient of AOC-U (Lost River Basin) are as follows:

- VOCs (TCE, PCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, and carbon tetrachloride)
- Metals (arsenic, antimony, chromium, cadmium, selenium, and lead)
- TPH
- PCBs (Aroclor 1260)
- Perchlorate

Although an isolated exceedence of the PCB Aroclor 1260 was detected at OT-37 during the 29 sites RI performed by Radian in 1991, Bhate performed sampling in 2007 during the ACM Investigation of OT-37 and PCBs were not detected in either soil or groundwater at the site.

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4 POTENTIAL RECEPTORS

This section identifies and describes potential receptors and environmental systems that are susceptible to contaminant exposure associated with the potential releases of hazardous materials into AOC-U (Lost River Basin) from adjacent ERP sites. The potential receptors include HAFB personnel and residents as well as the flora and fauna of the surrounding ecosystem.

4.1 Current Local Uses and Planned Future Uses of Groundwater

There are no potable water wells on HAFB. Potable water for the Base and the City of Alamogordo is derived from the nearby Sacramento Mountains. According to the groundwater well inventory prepared by the New Mexico Office of the State Engineer, there are approximately 25 domestic, 15 commercial, 7 irrigation, and 3 livestock wells located within a 4-mile radius of HAFB (NMWRRS database, 2009).

There are no water supply wells on the Base because the preponderance of groundwater beneath HAFB contains water with an average TDS concentration greater than 10,000 mg/L which exceeds the NMWQCC limit as potable water and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, USEPA guidelines (USEPA, 1986) have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L.

4.2 Current Local Uses and Planned Future Uses of Surface Waters Directly Impacted by the Site

Due to low rainfall and high evaporation, surface water at HAFB is limited and, therefore, is not used for domestic or municipal purposes nor is it used for recreation or agriculture. The ponds in the southern part of the Base receive effluent from the National Pollution Discharge Elimination System (NPDES) permitted WWTP and are saline (normally about half the salinity of seawater), sulfate-rich, and very rich in nutrients. These ponds provide habitat for numerous plant and wildlife species, so water quality of these receiving waters is important.

4.3 Potential Human Receptors

The most likely human receptors include (i) a current and future commercial/industrial worker, (ii) a future resident, and (iii) a current and future construction worker. Based on the land use in the vicinity of AOC-U, the commercial/industrial worker is considered a current and future receptor. Additionally, assuming that the future land use is residential, the future resident will also be considered as a receptor. This is a very conservative assumption since it is highly unlikely that AOC-U would become residential in the future. The construction worker is also considered a receptor for both current and future conditions. Human use facilities primarily consist of residential housing and industrial/operational facilities. While groundwater is not locally extracted for use, human exposure to pollutants may result from dermal contact or incidental ingestion from physical contact with contaminated soils or groundwater.

4.4 Potential Biological Receptors

Potential receptors include the flora and fauna of the surrounding ecosystem, as described in the following subsections. This information was generated in 2005 by Bhate during development of the Environmental Assessment (EA) for the wastewater utility privatization evaluation (Bhate, 2006a).

4.4.1 Flora

HAFB flora is dominated by xerophytic shrubland and grassland communities having plant assemblages biogeographically related to the Great Basin and Chihuahuan Desert. Other plant communities on the installation include those that are located in brackish marshes and riparian and/or wetland areas, such as those south of the WWTP.

4.4.2 Fauna

A wide variety of fauna can be found at HAFB as it provides a relatively diverse range of habitats for both aquatic and terrestrial species. Habitats found on the installation provide ideal environments for a variety of reptiles and amphibians, mammals, and birds. Available habitats include upland grasslands, xerophytic shrublands, brackish marshlands, playas, and surface water habitats. Additionally, the area south of the WWTP also offers a relatively extensive amount of shoreline/edge habitat along Lakes Holloman and Stinky, the stormwater drainage canal, Lagoon G, and associated constructed wetlands.

Previously performed wildlife inventories have identified numerous species of wildlife throughout the installation. Major groups of fauna are discussed below.

4.4.2.1 Invertebrates

Though invertebrates are an important feature of the desert ecosystem, little is known about their diversity in arid lands. Invertebrates play important roles as beneficial pollinators, parasites, predators, detritivores, and as prey for small mammals, reptiles, fish, and birds. To date, there have been no base-wide studies at HAFB to determine invertebrate species diversity.

However, studies on reptiles, birds, and mosquitofish (*Gambusia affinis*) habitat suggest that the roles taken by invertebrates contribute to ecosystem function. For example, it has been found that the animals on the installation consume insects such as grasshoppers (*Orthoptera*), butterflies and moths (*Lepidoptera*), beetles (*Coleoptera and Bledius*), adult chironomids (*Diptera*), and corixids (aquatic *Hemiptera*).

A total of 26 different aquatic invertebrate taxa have been identified in the area south of the WWTP (Freehling, et al., 1999) and certain fish populations located in Lost River and Malone Draw feed on mosquitoes, amphipods, and annelid worms (Suminski, 1977; Turner, 1987). Some of the invertebrate species that have been identified on the installation include harvester ants (*Pogonomyrmex* spp.), honeypot ants (*Myrmecocystus*), and grasshoppers (*Orthoptera*).

4.4.2.2 Reptiles and Amphibians

Two herpetofauna species surveys have been performed at HAFB: (1) along roads for the Texas horned lizard (*Phrynosoma cornutum*) (Mehlhop, et al., 1998), and (2) at the cinetheodolite missile towers (Johnson, et al., 1997a). The Texas horned lizard survey was conducted on the Main Base and the Boles Wells Water System Annex. The Texas horned lizard, formerly a Category 2 species for federal listing as endangered or threatened, was reclassified February 28, 1996, as a species of concern (United States Department of Interior, 1996). This lizard appears to be abundant on HAFB (Mehlhop, et al., 1998) and was found within the major plant community types on the Main Base.

Other reptiles and/or amphibians that may occur at HAFB that are not listed above include rat snakes (*Elaphe* spp.), rattlesnakes (*C. molossus*), and the greater earless lizard (*Cophosaurus texanus*).

4.4.2.3 Mammals

The most common mammals at HAFB consist of various rodent species and the black-tailed jackrabbit (*Lepus californicus*), found throughout the Great Basin Desert Shrub habitats in New Mexico (Frey and Yates, 1996). Numerous small colonies of bats that forage for insects at the numerous playas, wetlands, and riparian habitats (Johnson et al., 1997a) can be found on the installation. Bats on HAFB roost in abandoned and inhabited buildings and culverts.

Fourteen species of rodents have been identified on the dune periphery of the installation. The Ord's Kangaroo Rat (*Dipodomys ordii*), Desert Pocket Mouse (*Chaetodipus penicillatus*), and the Plains Pocket Mouse with the lighter pelage (*Perognathus flavescens gypsi*) were found primarily within the dunes; others were found equally distributed or too few were captured to determine the habitat affinity (Root and Demarais, 1997; Johnson et al., 1997a; Johnson, et al., 1997b).

At least five mammalian species that have been or could be observed on HAFB have been introduced by man. These five species include the house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), horse (*Equus caballus*), barbary sheep (*Ammotragus lervia*), and gemsbok (*Oryx gazella*). The latter two species were introduced by the New Mexico Department of Game and Fish in the late 1960s. Native big game mammals are uncommon in the project area and include mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*). Predators include bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), and coyote (*Canis latrans*). Badger (*Taxidea taxus*) and striped skunk (*Mephitis mephitis*) are uncommon predators and omnivores, respectively.

4.4.2.4 Birds

The complex of constructed wetlands south of the WWTP provides important habitat for a number of bird species. Bird censuses are ongoing at HAFB and a complete list of birds can be found in the HAFB Integrated Natural Resource Management Plan (INRMP) (USACE, 2001). The HAFB INRMP further details the relationship between habitat at HAFB and the bird species found there.

4.5 Endangered or Threatened Species

4.5.1 Endangered Species

Although not noted as being observed at HAFB, the Aplomado falcon (*Falco femoralis)* is known to be present in the HAFB area. The Aplomado falcon ranges from northern Mexico (and very rarely into southern Texas and New Mexico) southward to the southern tip of South America. In this huge range the species may be common or very rare depending upon habitat and location. This species sometimes hunts over grassland fires and feeds on small birds and/or insects fleeing the flames.

While still legally protected from hunting, the Aplomado falcon is not protected by Endangered Species Act requirements to preserve habitat and the like. It is believed that mainly habitat destruction caused the species' (near-)disappearance from the U.S. and hinders reestablishment of a wild breeding population; thus, a coalition of environmental groups is attempting to have full protection restored so as not to jeopardize the success of the expanding wild population and the reintroduction efforts (Associated Press, 2006).

4.5.2 Threatened Species

4.5.2.1 White Sands Pupfish

The White Sands Pupfish (*Cyprinodon tularosa*) is endemic to the Tularosa Basin of New Mexico and is considered a Species of Concern by the USFWS and a Threatened Species by the NMDGF (NMAC 19.33.6). Currently White Sands Pupfish populations occur in four detached habitats within the Tularosa Basin, one of which is the Lost River Basin on HAFB. Although not native to the Lost River Basin (population transplanted there in 1970), the White Sands Pupfish essential habitat is protected within the Basin due to the species' extremely limited remaining distribution. Threats to the White Sands Pupfish include introduction of nonnative fishes, dewatering, chemical contamination of aquatic habitats, and habitat degradation caused by feral horses and off-road vehicle use (Pittenger and Springer, 1999).

4.5.2.2 Burrowing Owl

Although not noted as being observed at HAFB, the burrowing owl (*Athene cunicularia*; formerly *Speotyto cunicularia)* is known to be present in the HAFB area. The burrowing owl is a grassland bird historically found in vast numbers across the prairies of the western Great Plains. While the formal environmental status of the burrowing owl varies based on geography, there is an overall decline of this species, particularly where burrowing owls are strongly associated with prairie dog towns. They are listed as endangered, threatened, or a species of special concern in most states and provinces where they occur. The primary threats across its North American range are habitat loss and fragmentation due to the incursion of agriculture and urban encroachment, suppression of naturally occurring fire, and habitat degradation from the extermination of small mammals like prairie dogs and squirrels. Increases in predators such as foxes, badgers, and coyotes are also taking a toll (The Nature Conservancy, 2007; The Owl Pages, 2005).

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5 INITIAL CONCEPTUAL SITE MODEL

5.1 Initial CSM Development

The previous sections have presented a detailed history of the environmental data collected within AOC-U (Lost River Basin) and the surrounding ERP sites. This section presents the initial CSM which will evolve as more data is generated regarding the soil and groundwater conditions present in the Lost River Basin. The CSM provides a framework for the entire project, and, in particular, can help identify specific data needs required to move forward with remedial activities, risk assessment, and obtaining NFA status for AOC-U. The CSM is an important communication tool for regulators, responsible parties, and stakeholders.

AOC-U is a major surface drainage feature in the northern portion of HAFB. Rocket, missile, and aircraft engine testing and maintenance activities have been ongoing in the vicinity of AOC-U for over 50 years, and future activities are expected to remain the same. No structures are located within AOC-U (Figure 1-3) and the Basin is off limits to heavy equipment and wheeled vehicles.

5.1.1 Summary of Previous Investigative Data

Previous investigative activities conducted within the Lost River Basin, and the adjacent ERP sites were described in Section 1.7 of this Work Plan. Perchlorate, TCE, and arsenic have been detected in the groundwater along the western end of the Basin. It appears that perchlorate and TCE contamination originates from SS-39. Other source area(s) of the contamination within the Basin have not been identified through previously conducted investigations around the perimeter of the Basin.

5.1.1.1 AOC-U Groundwater Conditions

The base is serviced by a public water supply. Groundwater at the site and across the base is not used as drinking water due to high concentrations of total TDS, which generally exceeds the NMWQCC drinking water standard of 1,000 mg/L. TDS concentrations greater than 10,000 mg/L exceed the NMWQCC limit as potable water and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, USEPA guidelines (USEPA, 1986) have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L. Occurrence of TDS concentrations below 10,000 mg/L is primarily due to anthropogenic activities including irrigation and leaks from water lines. Static groundwater levels within the Lost River Basin are between 0.5 and 5 ft bgs. No record of hydraulic gradient has ever been calculated for groundwater within AOC-U.

Aquifer tests to determine the hydraulic conductivity of the shallow water-bearing zone have not been conducted within AOC-U.

The groundwater flow direction along the perimeter of the Lost River Basin is different than the south-southwest Basewide flow direction at HAFB (Figure 2-2). The Lost River Basin is a large surface drainage feature, therefore surface and groundwater in the areas bordering AOC-U flow directly into the Basin. Once groundwater has entered the Basin, it follows the path of the Lost River, generally to the west-southwest.

During the rainy season (late July though September) the Lost River Basin is filled with water from surface runoff and groundwater migration. During the dry season (late January through May) the Lost River ceases to flow and water that infiltrates the soil becomes below surface interflow (groundwater flow). During the dry season there are typically a few isolated pools of surface water within the Lost River Basin with groundwater (interflow) to the west-southwest within the boundary of the basin (Figure 2-2).

Groundwater samples from within the Lost River Basin have been collected during previous investigations of Site SS-39. Groundwater sampling locations within AOC-U from the *Draft Final Phase I RCRA Facility Investigation Report, Table 2 Solid Waste Management Units* (Radian, 1994) investigation of Site SS-39 which contained concentrations exceeding current NMWQCC standards (NMAC 20.6.2.3103) and/or EPA MCLs (USEPA, 2009b) are presented on Figure 5-1. Groundwater sampling locations within AOC-U from the *Results of Additional Groundwater Sampling at Site SS-39* (GTI, 1998) which contained concentrations exceeding current NMWQCC standards and/or EPA MCLs are presented on Figure 5-2. Groundwater sampling locations within AOC-U from the *Supplemental RCRA Facility Investigation DP-30/SD-33 (SWMU 113B), SS-39 (SWMUs 165, 177, 179, and 181) and SD-27 (SWMU 141)* (HGL, 2007) which contained concentrations exceeding current NMWQCC standards, EPA MCLs, EPA Secondary Drinking Water Standards (USEPA, 2009b), and/or EPA Interim Drinking Water Advisory for Perchlorate (USEPA, 2008) are presented on Figure 5-3. Historically, perchlorate and TCE are the most frequently detected compounds above groundwater action levels within AOC-U. Historical groundwater concentrations of perchlorate and TCE have been detected as high as 130 and 324 µg/L respectively within the Basin (HGL, 2007).

5.1.1.2 AOC-U Soil Conditions

The central portion of AOC-U generally has a thin (approximately 1/8-inch) layer of evaporite gypsum at the surface during its dry season. Subsurface soil conditions within the Lost River Basin consist primarily of silty-sands with occasional thin bands of clay from the surface to a depth of approximately 2 ft bgs. A silty-clay with interbedded clay lenses occurs from 2 ft bgs to approximately 8 ft bgs.

Soil sampling for chemical analysis within AOC-U has been performed on a limited basis during previous investigation of peripheral ERP sites. Although 14 historical soil borings have been advanced within AOC-U, only 7 of these borings had soil samples submitted for chemical analysis. Of the soil samples from the seven borings submitted for chemical analysis, arsenic, detected in four borings, was the only analyte which exceeded NMED residential SSLs.

5.1.2 Contaminants of Concern

5.1.2.1 Soil

The primary contaminants of concern detected in the soil at ERP sites upgradient of AOC-U, above NMED residential SSLs, include VOCs (TCE, PCE), metals (arsenic, chromium, lead, cadmium), and total petroleum hydrocarbons. All of these exceedences were detected in soil samples obtained from several of the ERP sites surrounding the boundary of the Lost River Basin.

5.1.2.2 Groundwater

Contaminants of concern detected in groundwater at ERP sites upgradient of AOC-U, and within the Basin itself include, volatile organic compounds (TCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, carbon tetrachloride), metals (arsenic, lead, cadmium, antimony, selenium), and perchlorate which were all detected in groundwater above the current USEPA MCLs and/or the NMWQCC standards. In addition to the compounds listed above, total petroleum hydrocarbons are considered a contaminant of concern in groundwater due to the current and historical land use in the area surrounding AOC-U which included the testing and maintenance of rocket, missile, and aircraft engines. The primary contaminants of concern detected in groundwater are perchlorate and TCE. One historical use of perchlorate was as a component of solid rocket fuel.

5.1.3 Source Area Characterization

As stated in Section 1 of this RFI Work Plan, there are six known upgradient ERP sites which may have impacted AOC-U via runoff from surface water tributaries. The size of the area contributing to the Lost River Basin lends itself to the potential for multiple source areas contributing to the groundwater contamination within the Basin. Currently, the nature and extent of soil and groundwater contamination resulting from historical releases from the upgradient ERP sites into the Lost River Basin have not been completely defined.

The sampling plan outlined in Section 6 of this Work Plan illustrates the quantity and location of subsurface soil, surface soil, and groundwater sampling to be conducted during this investigation. Groundwater sampling locations have been strategically arranged to intercept groundwater flow entering the Lost River Basin from adjacent ERP sites, and to intercept groundwater flow within the Basin itself. Soil sampling locations have been chosen to intercept any potential impacts to the Basin from the ERP sites which surround AOC-U.

5.1.4 Release Mechanisms/Contaminant Fate and Transport

Contaminant releases from ERP sites surrounding the Lost River Basin could have been through a number of different release mechanisms including; direct surficial discharge, disposal areas, and drainage pipes. The nature and subsequent transport of contaminants is dependent on environmental conditions such as depth to groundwater, hydraulic gradient, and nature of the contaminants discussed above.

5.1.5 Potential Exposure Pathways and Receptors

Potential exposure pathways to humans present onsite include dermal contact and inhalation of fugitive dust. Potential exposure pathways to wildlife include; ingestion of fugitive dust, ingestion of surface water, incidental ingestion of soil, incidental dermal contact with water, dermal contact with soil, and ingestion of plants. Possible human receptors include (i) a current and future commercial/industrial worker, (ii) a future resident, and (iii) a current and future construction worker. Possible biological receptors include the flora and fauna of the surrounding ecosystem. Section 4 of this Work Plan provides a detailed discussion of potential receptors present on HAFB.

5.1.6 Existing Data Gaps

Based on information currently available regarding AOC-U, the following are data gaps that need to be filled to complete the CSM:

1. Collection of additional soil and groundwater analytical data to identify source area(s), and

2. Collection of soil samples for geotechnical parameter analysis to support a risk based evaluation (human health and ecological).

5.1.6.1 Data Acquisition

Due to the presence of perchlorate and TCE detected in groundwater within AOC-U (downgradient of SS-39), additional groundwater sampling upgradient, downgradient, and within the Basin itself is planned to ensure the horizontal delineation of groundwater is complete. Coupled with the delineation of the horizontal extent of contamination, this additional groundwater sampling will also aid in the identification of potential perchlorate source area(s). Subsurface soil sampling will also be performed along the boundary of the Basin, and within the Basin itself to delineate the extent of soil contamination, and to aid in the identification of potential perchlorate and VOC source area(s). Surface soil sampling will be performed along the perimeter of AOC-U in ephemeral arroyos downgradient of existing ERP sites surrounding the Basin. Additionally, six soil samples will be collected within AOC-U for geotechnical analysis to assist with evaluating the site-specific level of risk present to human health and the environment. Additionally, it has been reported that surface water may be found within three areas of the Lost River Basin during dry season. If surface water is available during the implementation of this RFI Work Plan (conducted during the dry season) surface water samples will also be collected for offsite analysis. Proposed data collection activities at AOC-U are presented in Section 6 of this Work Plan.

5.1.6.2 Data Evaluation

All detected soil and groundwater data collected during the AOC-U RFI will be evaluated and compared with the current New Mexico and Federal action levels for each medium. The project specific applicable or relevant and appropriate requirements (ARARs) for the AOC-U RFI data evaluation are completely described in Section 6.2.1 of this Work Plan.

5.1.7 Risk Assessment

Subsequent to the collection of chemical and geotechnical data, a risk-based evaluation will be performed to ensure that the potential risks to future receptors are acceptable within the Lost River Basin. A description of the risk assessment approach to be utilized, is provided in Section 7 of this Work Plan.

The CSM described in the previous paragraphs summarizes a generalized rendering of AOC-U. This section has presented a synopsis of the current conceptual understanding of the Site, decision information requirements, status of information gathering, and actions required to obtain information. It is important to re-emphasize that the Initial CSM provides an informed hypothesis or set of hypotheses about the Site, thus, actual conditions at the Site may vary from those depicted in this section.

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6 SAMPLING AND ANALYSIS PLAN FOR CHARACTERIZATION OF RELEASES OF HAZARDOUS WASTE

This section presents the Sampling and Analysis Plan (SAP) for the Lost River Basin (AOC-U) RFI, including:

- Pre-Investigation Requirements
- Sampling Strategy
- Sampling Procedures
- Sample Analysis

The objectives of the SAP are threefold; first to identify potential releases to the soil and groundwater within the Lost River Drainage Basin from the six known upgradient SWMUs and AOCs; second, if detected, delineate the horizontal extent of VOCs, SVOCs, TPH, TAL metals, and perchlorate constituents detected above action levels in soil and groundwater samples; and third, collect sufficient analytical data to support a site-specific human health and ecological risk assessment.

Soil, groundwater, and surface water sampling procedures will utilize industry standard methods to ensure sample quality and provide a platform for efficient collection. Sample analysis includes field screening methods and offsite analysis to provide an efficient means of identifying the current environmental conditions.

6.1 Pre-investigation Requirements

Prior to initiating field sampling activities, several pre-investigation and approval documents must be acquired. This includes the Air Force Form (AF Fm) 332, the HAFB dig permit (for utility clearances), site security measures, and notifying the applicable facility manager. NationView will coordinate all pre-investigation project requests for Base installation support services through the 49th Civil Engineering Squadron/Environmental Asset Management Flight (CES/CEA). If required, a pre-investigation meeting and site walk-through will be conducted with the USACE representative, HAFB personnel, and the NationView Site Manager, to inspect site conditions for site/equipment access, equipment staging, decontamination area(s), potential site hazards, and emergency evacuation routes. Also reviewed at this time will be project procedures in accordance with the schedule and planned activities.

6.1.1 AF Form 332

Prior to initiating drilling activities, a completed and approved AF Fm 332, will be obtained by the 49th CES/CEA. This form authorizes construction work at HAFB and is required for the initiation of any construction work. This is a work order that describes what activities will take place at the Lost River Basin during this investigation.

6.1.2 Dig Permit/Utility Clearances

Prior to the submittal of the dig permit (AF Fm 103), the sampling locations will be clearly delineated with marker flags, or stakes. Utility clearance approvals will be completed by the appropriate HAFB utility office (e.g., telephone, sewer, water, natural gas etc.). Upon receipt of the approved dig permit (AF Fm 103) with the utility clearances, the NationView Site Manager or other authorized project personnel will complete a site walk-through confirming the dig permit authorizations and make any required changes.

6.1.3 Site Security

Site security is concerned with safety at the site during all soil and groundwater sampling activities, and areas surrounding the investigation activities, and will be addressed as outlined in the *Basewide Health and Safety Plan* (HASP) (Bhate, 2003b). At a minimum, an exclusion zone will be secured with caution tape, and traffic cones will surround the perimeter of the site. The size of the exclusion zone will be determined by the size of the sampling and support equipment, and the prevailing site conditions. Open boreholes will not be left unattended without first securing the immediate area surrounding the borehole, and covering the opening so that it does not become a hazard.

6.2 Sampling Strategy

The primary sampling strategy for this RFI is to characterize the potential releases into the Lost River Basin from upgradient ERP sites (OT-04, OT-37, OT-38, SS-39, LF-40, and DP-62), characterize the current soil groundwater and surface water (if available) conditions within the basin, and to collect sufficient data to support a human health and ecological risk assessment. Proposed sampling locations, quantities, and location rationale are presented in Section 6.2.2 of this Work Plan.

The Lost River Basin (AOC-U) is an intermittent drainage with three reaches that may have permanent surface water year round. During the rainy season (mid-summer monsoonal season [July through August]), these reaches become inter-connected. The seasonal surface water fluctuation at AOC-U is documented in photographs SS39-01 and SS39-02 (Appendix B-6-4). Photo SS39-01 was taken in June 2006 (looking south-

southeast across the Basin) shows the typical dry nature of the Basin. Photograph SS39-02 (taken from the same vantage point in September 2006), shows the Basin filled with water after the mid-summer monsoonal season. Based on the seasonal flux of surface water flow within the Basin, the AOC-U RFI sampling activities must be conducted between late February and early June.

Additionally, in a *Memorandum for Record; Subject: Soil and water characterization through bore sampling in Lost River drainage*, from HAFB 49 CES/CEAN, the Lost River Basin has been identified as refuge for the White Sands Pupfish (Appendix C). A figure attached to the memorandum identified restricted areas where there are known White Sands Pupfish populations within the Basin. As a result, the proposed RFI sampling locations were located to avoid disturbance of the White Sands Pupfish habitat (Appendix C). In a follow up email, dated April 17, 2009 (Appendix C), Mr. Lonnie Britton, a Natural Resources Planner with the HAFB 49 CES/CEAN, approved all the proposed AOC-U RFI surface soil and subsurface soil/groundwater sampling locations. The approval states that all the RFI sampling activities will be limited to foot traffic only to maintain the ecological health and sustainability of this species of concern. Therefore, as described in Section 6.3 of this Work Plan, hand auger sampling techniques will be utilized to collect samples during the RFI field work, as follows:

- Soil samples will be collected via hand auger using a stainless steel hand auger tooling.

- Permanent monitoring well installations are not permitted within the Lost River Basin, therefore, grab water samples will be collected from open hand auger boreholes or small diameter groundwater well points consisting of 1-inch diameter PVC pre-packed well screens installed into open boreholes. In order to minimize any impact to the White Sands Pupfish habitat within the Basin, the small diameter well points will be abandoned immediately after sample collection.

A complete list of Standard Operating Procedures and details regarding all sampling activities proposed for the AOC-U RFI are presented in Section 6.3 of this Work Plan.

6.2.1 Use of Applicable or Relevant and Appropriate Requirements

All of the analytical data collected during this RFI will be compared to their respective ARARs (action levels) that are specified in Appendix 4-F *Action Levels and Cleanup Levels* of the HAFB Hazardous Waste Permit No. NM6572124422. The soil and groundwater data evaluation will consist of a direct comparison to the applicable action level screening criteria. The applicable screening criteria will be presented on the analytical data summary tables for the analytes and media of concern in the RFI report. The following sections present the regulatory criteria that will be used to evaluate the analytical data.

6.2.1.1 Soils

VOCs, SVOCs, and TAL Metals

The residential SSLs established in NMEDs *Technical Background Document for Development of Soil Screening Levels* (NMED, 2006a) will be used as the primary action levels for VOCs, SVOCs, and TAL Metals. As per the HAFB Permit, Appendix 4-F V.1 (NMED, 2004); if a NMED soil cleanup level has not been established for a particular chemical (e.g. 2-methylnapthalene) that constituent will be compared to the USEPA Region 6 Human Health Medium Specific Screening Level (HHMSSL). However, under a recent USEPA Interagency Agreement, the Region 6 HHMSSLs have been revised and renamed. As a result of this agreement, the USEPA Region 3 Risk Based Concentration (RBC) Table, the Region 6 HHMSSL Table, and the Region 9 Preliminary Remediation Goal (PRG) Table have been combined into the Regional Screening Level (RSL) Table (USEPA, 2009a). Additionally, all detected TAL metals will be compared their respective HAFB Background, Composite Soil, UTL (pending NMED approval of the *Basewide Background Study Report, Holloman Air Force Base, New Mexico* [NationView|Bhate JV III, 2009]).

Total Petroleum Hydrocarbons

The action levels for TPH are established in the *New Mexico Environment Department TPH Screening Guidelines* (NMED, 2006b). Based on the historical use of JP-4 jet fuel at the upgradient ERP sites, the TPH screening guideline (residential direct exposure), for kerosene and jet fuel (940 mg/kg) (Table 2b, NMED, 2006b) will be used as the action level for total TPH concentrations (combined GRO, DRO, and ORO).

Perchlorate

Currently, the NMED has not established a soil clean up level or SSL for perchlorate; therefore, the USEPA Region 6 RSL of 55 mg/kg (USEPA, 2009a) will be utilized as the action level for perchlorate detections in soil.

6.2.1.2 Groundwater

VOCs, SVOCs, and TAL Metals

There are two applicable standards for groundwater: NMWQCC groundwater standards for contaminants (NMAC 20.6.2.3103) and the USEPAs National Priority Drinking Water Regulations (USEPA, 2009b) MCLs. The lower of the two standards will be used as action levels for VOCs, SVOCs, and TAL Metals in groundwater. Additionally, all detected TAL metals will be compared to their respective HAFB Background, Dissolved Metals UTLs (pending NMED approval of the *Basewide Background Study Report, Holloman Air Force Base, New Mexico* [NationView|Bhate JV III, 2009]).

Total Petroleum Hydrocarbons

The action levels for TPH are established in the *New Mexico Environment Department TPH Screening Guidelines* (NMED, 2006b). The NMED TPH screening guideline for kerosene and jet fuel (15 mg/L) will be the action level that will be compared to total TPH concentrations (GRO, DRO, and ORO) detected in groundwater (NMED, 2006b).

Perchlorate

As per the HAFB Hazardous Waste Facility Permit, Section III.1.2, NMED has adopted the USEPA drinking water reference dose as an interim groundwater clean up level. In December 2008, the USEPA issued an Interim Drinking Water Health Advisory for exposure to perchlorate of 15 µg/L in water (USEPA, 2008), which will serve as the action level for perchlorate detections in groundwater.

Total Dissolved Solids

There are two applicable standards for TDS detected in groundwater: NMWQCC groundwater standards for contaminants (NMAC 20.6.2.3103) and the *USEPAs National Priority Drinking Water Regulations* (USEPA, 2009b) secondary MCLs. The lower of the two standards will be used as the action level for TDS. Additionally, TDS concentrations will be compared to the HAFB Background, Groundwater UTL (pending NMED approval of the *Basewide Background Study Report, Holloman Air Force Base, New Mexico* [NationView|Bhate JV III, 2009]).

6.2.1.3 Surface Water

According to the HAFB Hazardous Waste Facility Permit number NM6572124422, Appendix 4-F, Section IV.1 (Surface Water Cleanup Levels), HAFB shall comply with surface water quality standards outlined in the Clean Water Act (33 United States Code [U.S.C.] § 1251 et seq. 1972), the New Mexico Water Quality Control Commission Regulations (20.6.1 NMAC), and the State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC). The lower of the three standards will be used as the action levels for any detected compounds in surface water.

6.2.2 Field Sampling Location Plan Design Basis

A design basis was used to develop the AOC-U RFI field sampling location plan. Locations for the proposed subsurface hand auger soil borings, surface soil samples, and groundwater sample locations are illustrated on Figures 6-1, 6-2, and 6-3, respectively. Sampling locations were selected to intercept potential contamination from six adjacent upgradient ERP Sites (OT-04, OT-37, OT-38, SS-39, LF-40, and DP-62) that may have impacted the Basin. Historical environmental data collected from the

Lost River Basin (AOC-U) and the referenced upgradient ERP sites was obtained from the Holloman Administrative Record. The benefits of this historical information include identifying the sensitive White Sands pupfish population habitats, soil conditions, contaminants of concern, groundwater depth, and groundwater flow directions.

The AOC-U RFI sampling locations were selected to avoid impacting the habitats of the White Sands pupfish. Soil lithology within the Lost River Basin consists of silty to clayey sands, which allows utilization of hand auger sampling techniques. Contaminants of concern in groundwater include VOCs (TCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, and carbon tetrachloride), metals (arsenic, lead, cadmium, antimony, and selenium), TPH, and perchlorate. The depth to groundwater based on previous drilling activity at or nearby AOC-U, is generally one to five feet bgs. The Lost River Basin trends to the southwest across the base, with groundwater flow direction from the adjacent potential source area sites flowing into the basin. Therefore, the small diameter groundwater well points will be spaced to intercept groundwater flow downgradient of the six ERP sites that may have impacted the AOC-U drainage basin.

6.2.2.1 AOC-U Subsurface Hand Auger Soil Boring Locations

One hundred subsurface hand auger soil borings (AOCU-HA01 through AOCU-HA100) will be hand drilled throughout the Lost River Basin (Figure 6-1). The hand auger soil borings will be advanced along the perimeter and across several transects of AOC-U to delineate the horizontal extent of any potential impacts that may have occurred. All hand augered soil borings will be lithologically logged. Additionally, the depth to water and headspace readings will be noted on the drill log. One subsurface soil sample will be collected from each of the hand augered soil borings. Additionally, grab groundwater samples will be collected from 50 of the open hand auger soil borings. If a hand auger soil boring exhibits a slow recharge or an insufficient volume for sampling, a small 1-inch PVC groundwater well point will be installed for the collection of grab groundwater samples.

6.2.2.2 AOC-U Surface Soil Sampling Locations

Twenty surface soil samples (AOCU-SS01 through AOCU-SS20) will be collected from the mouth of arroyos that are located downgradient from the six ERP sites. The 20 surface soil samples will be collected from 0 to 1 ft bgs. The proposed locations of the surface soil samples are presented on Figure 6-2.

6.2.2.3 AOC-U Groundwater Sampling Locations

As shown on Figure 6-3, groundwater samples will be collected from 50 pre-selected hand augered boreholes located within the Lost River Basin and in arroyos that are downgradient of ERP sites OT-04, OT-37, OT-38, SS-39, LF-40, and DP-62. Some of the groundwater sampling locations are situated to intercept any potential groundwater contamination migrating from upgradient sites into the Lost River Drainage Basin. In the event a borehole does not produce sufficient groundwater for sampling, the soil boring will be converted into a 1-inch diameter PVC groundwater well point. The purpose of the groundwater samples is to delineate the nature and horizontal extent of potential groundwater contamination within the Basin.

6.2.2.4 AOC-U Surface Water Sampling Locations

There are reportedly three reaches within the Lost River Basin that may contain surface water during the late dry season (April through July) when the AOC-U RFI would be implemented. The exact location of these reaches is currently unknown, however if surface water is encountered during implementation of this RFI Work Plan a maximum of three surface water samples will be collected.

6.3 Sampling Procedures

This section describes the sampling procedures and technologies to be used during the project. References are made to documents describing standard methodologies from a variety of sources including:

- *Final Basewide Quality Assurance Project Plan* (Bhate, 2003a)
- HAFB Standard Operating Procedures (SOPs) from Appendix A of the HAFB Basewide QAPP (e.g., SOP HAFB-#)
- SOPs prepared by equipment manufacturers (e.g., AMS® Inc., Soil Core Sampler, Technical Data Sheet)

The specific HAFB SOPs for this sampling event are listed below:

HAFB SOP-1 Documentation, Sample Handling, Chain-of Custody, and Shipping
HAFB SOP-2 Sampling Equipment Documentation
HAFB SOP-3 Staking, Utility Clearance, and Permitting
HAFB SOP-5 Soil Sampling for Chemical Analysis
HAFB SOP-6 Procedure for Field Screening of Volatile Organics
HAFB SOP-7 Lithologic Description and Geotechnical Sampling
HAFB SOP-9 Field Management of Investigation-Derived Waste
HAFB SOP-10 Borehole Abandonment and Site Restoration

The following sections describe the locations and procedures for hand auger soil sampling and the groundwater well point installation, sampling, and analysis to be performed.

6.3.1 Environmental Media to be Sampled

Three environmental media (matrices) will be sampled during the RFI, as follows:

- Soil – subsurface hand auger and surface soil sampling
- Groundwater – grab groundwater samples from the hand augered borehole or small diameter groundwater well points
- Surface water – if surface water is encountered up to three grab samples will be collected

6.3.2 Soil Sampling Activities

As described in Section 6.2.2 of this RFI Work Plan, soil sampling will be conducted at 100 hand auger subsurface soil boring locations and 20 surface soil locations. Each location will be cleared for subsurface utilities in accordance with HAFB SOP-3 in the HAFB Basewide QAPP (Bhate, 2003a). Due to the presence of the White Sands Pupfish in the Lost River Drainage System, access to the Basin is restricted to foot traffic, and the use of mechanical sampling (i.e., samples collected with a drill rig) is forbidden (see Appendix C of this Work Plan). Therefore, all subsurface soil samples will be collected using hand auger sampling techniques. Each hand auger boring will be visually classified and lithologically described by a qualified geologist in accordance with HAFB SOP-7 and the Unified Soil Classification System (USCS) (American Society for Testing and Materials [ASTM] D 2487-92 and ASTM D 2488-90) (ASTM 2006a and 2006b). The specific locations of the subsurface soil borings may be modified based on site-specific field conditions. Additionally, the surface soil samples will be collected with a disposable plastic scoop that will be discarded after each sample is collected.

Each subsurface hand auger soil core will be field screened every 2 feet with a photoionization detector (PID). Soil samples with the highest PID readings will be retained for offsite laboratory analysis. Notation will also be made of any visual (discoloration) and/or aromatic observations that are indicative of potential contamination. In the absence of elevated PID readings observed in the field, soil samples will be obtained from the capillary fringe interface (approximately 5 ft bgs). Soil sampling will follow HAFB SOP-5 of the HAFB Basewide QAPP (Bhate, 2003a).

One hundred subsurface soil samples (AOCU-HA01 through AOCU-HA100) and 20 surface soil samples (AOCU-SS01 through AOCU-SS20) will be collected at the locations shown on Figures 6-1 and 6-2. A total of 144 soil samples including 12 duplicate samples, 6 matrix spike (MS) samples, and 6 matrix spike duplicate (MSD) samples will be collected for chemical analysis. Each soil sample will be analyzed by an offsite laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), TAL metals, and perchlorate. Samples selected for laboratory analysis will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1. The soil samples will be shipped to Accutest Laboratories (Accutest) in Orlando, Florida for chemical analysis as summarized in Table 6-1.

Additionally, six undisturbed geotechnical samples will be collected from three of the subsurface hand auger soil boring locations. The specific geotechnical soil locations will be selected in the field in areas representing background soil conditions at AOC-U. The geotechnical soil boring samples will be collected in thin walled samplers (AMS® Soil Core Sampler). Two geotechnical samples will be obtained from each geotechnical soil boring, one sample within the vadose zone and one sample within the saturated zone, to define geotechnical conditions in both soil types. The six soil samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content (Table 6-1) and will be shipped to Accutest for analysis.

6.3.2.1 Subsurface Hand Auger Soil Sampling Procedures

Subsurface soil samples will be collected using hand auger sampling methods. Subsurface soil sampling will be accomplished using a 2.25 inch outer diameter (OD) stainless steel AMS® Inc., Hand Auger sampling bucket (coring tool). Subsurface soil samples will be collected from the hand auger tool for offsite analysis. The 100 subsurface hand auger locations will be advanced to a depth of approximately 7 to 10 feet bgs. The stainless steel coring tool will be removed from the ground and the soil will be extracted at the ground surface and placed on clean plastic sheeting for lithologic logging, headspace readings (PID), and sampling for offsite chemical analysis.

Assuming that a risk assessment is required, geotechnical data is necessary for understanding the physical aspects of the environment which would affect the migration and fate of the release and identification of exposure pathways for both humans and non-human receptors. The six soil samples collected for geotechnical analysis will be obtained between ground surface and top of water table as well as below the water table within saturated soils. These samples will be collected in a thin walled tube sampler in accordance with the Standard Operating Procedure (AMS® Inc., Soil Core Sampler, Technical Data Sheet) with tube ends capped and the top and bottom ends of the tube labeled with depths.

6.3.2.2 Surface Soil Sampling Procedures

Surface soil samples will be collected using a disposable PVC scoop for all AOC-U surface sample locations. Surface soil samples will be collected from a depth of 0 to 1 ft bgs in locations along the perimeter of the Lost River Basin within ephemeral arroyos that are downgradient of ERP sites. A disposable PVC scoop will be used to collect 20 surface soil samples and the soil will be put directly into the sampling containers.

Headspace screening of soils will be performed with a PID prior to sample collection for offsite analysis.

6.3.3 Groundwater Sampling Activities

Grab groundwater samples will be collected from 50 pre-determined hand augered soil borings during this investigation. The AOC-U small diameter groundwater well point network shown on Figure 6-3 was designed to characterize and delineate the horizontal extent of groundwater contamination throughout the Basin.

6.3.3.1 Groundwater Sampling Locations

As illustrated on Figure 6-3, grab groundwater samples will be collected downgradient of ERP sites OT-04, OT-37, OT-38, SS-39, LF-40, and DP-62 to determine any potential impact to groundwater within the Lost River Basin from these SWMUs and AOCs. Grab groundwater samples will also be collected throughout the Lost River Basin to delineate the horizontal extent of potential contamination. As shown on Figure 6-3 the proposed grab groundwater sample network comprises the entire basin for determining the potential extent of contamination. The proposed grab groundwater sampling network will characterize the current groundwater conditions throughout the Basin and the downgradient conditions from each known SWMU and AOC.

6.3.3.2 Small Diameter Groundwater Well Point Installation

In the event that a hand auger borehole does not produce sufficient groundwater for sampling, the soil boring will be converted into a small diameter well point. Based upon the depth to groundwater determined from the soil borings, the small diameter groundwater well points will be installed to a depth of approximately 10 ft bgs. Each small diameter groundwater water well point will extend to a minimum depth of 5 feet below the water table and will be completed with 1-inch inner diameter (ID), PVC, pre-packed well screen. Upon reaching the total depth (7 to 10 ft bgs) the coring bucket will then be removed, leaving an open borehole for installing the well point. Each well point will be completed with 5 feet of 1-inch ID 0.010-inch slotted PVC pre-packed screen. The screen will be lowered to the bottom of the open borehole and be connected to 1-inch, ID PVC flush joint riser pipe in 5 foot length sections to the ground surface. A 1-inch locking cap will be secured at the top of each well point.

Once the screen and riser are in place in the bottom of the borehole below the water table, additional sand pack consisting of 10/20 Colorado Silica Sand will be placed around the well screen to a height of 2 feet above the top of the screened interval. A granular bentonite seal will be placed above the sand filter pack to ground surface and hydrated. The well points will be left as stick-up well completions with approximately 2 ft of PVC exposed above the ground surface.

6.3.3.3 Groundwater Sampling

Grab groundwater samples will be collected from 50 of the hand auger soil boring locations (and small diameter well points if necessary) using a disposable Teflon bailer. As these are grab groundwater samples, field sampling parameters (potential of hydrogen [pH], conductivity, dissolved oxygen, and temperature) will not be collected prior to sampling. A new factory wrapped bailer will be used to sample each borehole or well point.

A total of 61 grab groundwater samples including 5 duplicate samples, 3 MS samples, and 3 MSD samples will be collected from the 50 well points and analyzed by an offsite laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), TAL metals, perchlorate, and TDS. Groundwater samples will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1. The groundwater samples which will be submitted for chemical analysis are summarized in Table 6-2.

6.3.3.4 Borehole and Well Point Abandonment

After each of the hand augered boreholes have been completed and sampled (soil and groundwater), the borehole will be backfilled to the surface with granular bentonite. After sampling, the small diameter groundwater well points will be immediately abandoned. The PVC screen will be removed from the ground and the open borehole will be backfilled with hydrated granular bentonite per HAFB SOP-10, *Borehole Abandonment and Site Restoration.*

6.3.4 Surface Water Sampling Activities

As previously discussed, surface water may be present within three reaches of the Lost River Basin. If surface water is encountered, a maximum of six grab surface water samples including one duplicate, one MS and one MSD sample will be collected and analyzed by the offsite laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), TAL metals, perchlorate, and TDS. Surface water samples will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1. The surface water samples which may be submitted for chemical analysis are summarized in Table 6-3.

Additionally, the surface water samples will also be analyzed for pH and hardness (Table 6-3) to support the ecological risk assessment. If surface water bodies are discovered, the location and dimensions of each surface water body will be documented in the field logbook and photographed to verify the types of vegetation surrounding the water body.

Surface water samples will be collected mid-depth from the center of each area of pooled water (a maximum of thee samples). Surface water samples will be collected by standing on an adjacent bank. Surface water samples will be grab samples collected directly into the sample container. If the sample bottles are pre-preserved, a non-preserved laboratory clean jar will be used as the sample transfer device to transfer the sample from the pond to the actual sample jar.

6.3.5 Surveying

A qualified Surveyor will survey the 100 hand auger (including the 50 grab groundwater locations), 20 surface soil, and 3 surface water locations (if surface water is encountered) using a Global Positioning System (GPS) in accordance with methods described in the Basewide QAPP (Bhate, 2003a). Horizontal locations will be relative to the State Plane Coordinate System, New Mexico Central and surveyed to an accuracy of +/- 1.0 ft. Vertical elevations will be referenced to the North American Datum (NAD) 1983. During this investigation, the potential source areas will be mapped to scale showing ancillary structures, sampling locations, buildings, roads, sidewalks, paved and unpaved areas. Additionally, all maps will include a coordinate system (e.g., latitude/longitude) and the site boundaries.

6.3.6 Documentation

Documentation, sample handling, chain-of-custody, and shipping will be managed in accordance with HAFB SOP-1 of the HAFB Basewide QAPP (Bhate, 2003a).

Sampling personnel will use a bound field log book with moisture resistant pages to record pertinent sampling information with waterproof ink in addition to any forms provided in, or specified by applicable SOPs. The log book will identify project name, project number, project manager and telephone number, and principal street address or geographic location of the site. Daily field activities and sampling information will be entered in the log book on dated, initialed, and serially-numbered pages. Corrections will be made to entries by initialed and dated line-out deletions. A diagonal line will be drawn across the remaining blank space of the last page of each day's entry. Each day's entry will be signed and dated by the author.

The date and time of sample preparation, collection, and personnel who conducted sampling will be recorded with the sample identification number in the field log book and on the chain-of-custody (COC) form. The names of visitors and any other persons on site will also be recorded in the field log book. Sampling personnel will record the ambient weather conditions and other conditions at the sampling location that may affect sample collection, the apparent representativeness of the sample, or sample analysis.

Sample nomenclature and labeling requirements are described in Section 8.2.1 of this Work Plan.

6.3.7 Decontamination

The hand auger coring tool will be decontaminated as described in HAFB SOP-2 of the HAFB Basewide QAPP (Bhate, 2003a). The hand auger coring tool will be washed and scrubbed with phosphate-free, Liqui-Nox® detergent and potable water. No equipment will require steam cleaning during this RFI field effort, as all sampling activities will be conducted by hand. An equipment rinsate sample from the decontaminated hand auger tool will be collected daily to ensure that effectiveness of the decontamination. Equipment rinsate blanks are not required for disposable sampling equipment (Teflon bailers and plastic scoops) that will be discarded after each sample is collected.

6.3.8 Management of Investigation-Derived Waste

Investigation-derived waste (IDW) will be managed and characterized in accordance with HAFB SOP-9 of the HAFB Basewide QAPP (Bhate, 2003a). Whenever possible, waste minimization techniques will be used to reduce the amount of IDW. IDW generated by installing the new small diameter well points and subsequent groundwater sampling activities will be managed and characterized according to the following guidelines. Solid waste such as empty sand and bentonite bags, personal protective equipment (PPE), and used tubing, etc., will be placed in trash bags and disposed of in dumpsters on site for ultimate disposal as non-hazardous sanitary waste.

Excess soils from sampling will be very minimal due to the use of hand auger sampling techniques. Any excess soils will be visually assessed for staining and screened with a PID. If the soils are visibly stained or if they have PID headspace readings above background, they will be contained and temporarily staged at the FT-31 Landfarm pending receipt of sample analytical results. If analytical results indicate contaminants present at concentrations above the landfarm's acceptance levels, the material will be properly disposed offsite. If the analytical results indicate contaminants present at levels below the landfarm's acceptance levels, the material will be land-farmed. If none of the visual, screening, or analytical results based conditions are met, the material will be used as backfill or spread around borehole locations as described in HAFB SOP-9 of the HAFB Basewide QAPP (Bhate, 2003a).

Decontamination water will be locally contained in 5 gallon pails and conveyed to a 1,000-gallon portable storage tank. The 1,000-gallon portable storage tank will be maintained by NationView until disposal through the HAFB WWTP, pending laboratory analysis. Other liquid wastes, such as decontamination rinses, are anticipated to be non-hazardous and as such, can be disposed of through the HAFB WWTP.

6.4 Sample Analysis

This section describes the objectives and procedures associated with the analytical program. The analytical strategies for the Lost River Basin (AOC-U) RFI have been designed with past investigations in mind.

6.4.1 Data Quality Objectives

The analytical methods outlined in Tables 6-1, 6-2, and 6-3 of this Work Plan were selected based on their ability to provide reliable results which can be used to determine whether a given contaminant (or contaminant class) is present at concentrations:

- Above reporting limits (RLs),
- Above RLs and below its respective ARAR action level criteria, or
- Above its respective ARAR action level criteria.

In several cases, laboratory MDLs will be used to compare to ARARs. Concentrations that fall between the practical quantitation limits (PQL) and the MDL will be qualified accordingly.

The selectivity and accuracy of the selected offsite analytical methods have all been adequately proven by virtue of being an accepted USEPA method. The screening methods (PID headspace readings) will be used to provide near-real-time data and will be supported by offsite definitive analytical methods.

Analytical chemistry data will be reviewed according to latest revision of the USEPA *Contract Laboratory Program National Function Guidelines for Inorganic Data Review* (USEPA, 2004c) and *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1999). One hundred percent (100 %) of the analytical data will be subjected to review modeled after the USEPA Tier I guideline (USEPA Region I, 1996). The Tier I review will include a review of completeness. In addition, as specified by the Project Chemist, the definitive data may also be subjected to review modeled after the USEPA Tier II guideline (USEPA Region I, 1996). This review will compare selected QC parameters (holding time, laboratory control sample [LCS], method blanks, field blanks, surrogates, MS/MSD/laboratory duplicate [LD], and field duplicates) and DQOs with the acceptance criteria described in the HAFB Basewide QAPP (Bhate, 2003a) and the QAPP Addendum (see Appendix A of this work plan).

Qualifiers may be applied to data that fails to satisfy the acceptance criteria as detailed in the HAFB Basewide QAPP (Bhate, 2003a). Unless otherwise noted, all data validated using the methods noted above will be considered suitable for use in meeting the objectives of this investigation.

6.4.2 Laboratory Analytical Methods

Accutest in Orlando, Florida (Accutest) will be completing all analyses of both soil and groundwater. The soil, groundwater, and surface water samples will be analyzed as follows:

- VOCs by USEPA SW-846 Method 8260B (soil and water)
- SVOCs by USEPA SW-846 Method 8270C (soil and water)
- Perchlorate by USEPA Method 314 (soil and water)
- TPH (GRO, DRO, ORO) by USEPA SW-846 Method 8015B (soil and water)
- TAL Metals by USEPA SW-846 Method 6010B/7470A/7471A (soil and water)
- TDS by USEPA Method 2540C (water only)
- Moisture content by USEPA Method 2540B (subsurface soil geotechnical only)
- Dry bulk density by ASTM Method D2937 (subsurface soil geotechnical only)
- Specific gravity by ASTM Method D1429-86 (subsurface soil geotechnical only)
- Fractional organic carbon content by ASTM Method D2974 (soil geotechnical only)
- pH by USEPA Method SM19 4500 (surface water only)
- Hardness USEPA Method SM19 2340B (surface water only)

SOPs for the analytical methods are not physically included as part of this Work Plan, however, the SOPs have been reviewed and can be made available by the laboratory upon request. Table 6-4 presents a summary of the analytical methods, sample containers, and the holding time requirements per sample media.

The analytical requirements, including preparation methods, analytical methods, and various QA/QC parameters, for soil and groundwater samples are summarized in the HAFB Basewide QAPP (Bhate, 2003a) in:

- Table 3-1 - Project Data Quality Objectives
- Table 10-1 - Sample Containers, Preservatives, and Holding Times
- Table 13-1 - Extraction and Digestion Procedures
- Table 13-2 - Analytical Procedures

The definitive data, additional investigation field QC samples, and laboratory QC limits for soil and groundwater samples are summarized in the QAPP Addendum (Appendix A) in:

- Table 3-2 - Summary of Definitive Data
- Table 4-1 - Summary of Additional Investigation Field QC Samples
- Table 4-2 - Summary of Laboratory QC Limits

As noted previously, for several compounds, MDLs will be used to meet the respective ARARs. Where concentrations fall between the PQLs and the MDLs, the data will be qualified accordingly.

Samples selected for laboratory analysis will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1 of the HAFB Basewide QAPP (Bhate, 2003a). Each cooler containing samples to be shipped for offsite VOC analysis will require a trip blank. The samples will be placed on ice and shipped under strict chain-of-custody to Accutest Laboratories in Orlando, Florida.

Accutest will provide Level II laboratory deliverables which consist of an analytical report with results and QA/QC summaries. Internal QC results, not included as part of the Level II package, will be retained on file at each of the offsite laboratories.

Results for all samples will be presented in hard copy Form-1 and Electronic Data Deliverable (EDD) formats. Electronic data shall be delivered in an appropriate format such that the data can be uploaded to the project database for subsequent manipulation and presentation.

Standard turnaround times (TAT) of 2 weeks will be expected for all organic and inorganic results.

7 RISK ASSESSMENT APPROACH

The primary objective of this RFI is to evaluate the potential impact to the soil and groundwater within the Lost River Basin from six known upgradient SWMUs and AOCs. The collection of soil and groundwater samples will provide the sufficient analytical data to support a site-specific risk assessment of the exposure pathways present for both human and non-human receptors. Data collected during this RFI will be evaluated based upon the DQOs for the project. If the completed evaluation indicates an acceptable risk, the site can be considered for closure with no further action. The risk assessment methodology consists of the following elements:

1. Compilation of data;
2. Identification of contaminants of concern;
3. Development of exposure model;
4. Identification of target levels;
5. Calculation of representative concentrations; and
6. Comparison of representative concentrations with target levels.

Each of these steps is generally described below.

7.1 Evaluation of Contaminants of Concern

All contaminants of concern (VOCs, SVOCs, TAL metals, TPH, PCBs, and perchlorate) that are detected in the soil and groundwater samples collected during this RFI will be compared to the analyte specific ARARs that are presented in Section 6.2.1 of this Work Plan. Furthermore, all inorganic constituents (e.g., TAL metals) detected in the soil samples will be compared to HAFB Background, Composite Soil UTLs (pending NMED approval of the *Basewide Background Study Report, Holloman Air Force Base, New Mexico* [NationView|Bhate JV III, 2009]). Additionally, all inorganic constituents (e.g., TAL metals) detected in the groundwater samples will be compared to the HAFB Background, Dissolved Metals Groundwater UTLs (pending NMED approval of the *Basewide Background Study Report, Holloman Air Force Base, New Mexico* [NationView|Bhate JV III, 2009]).

7.2 Risk Based Evaluation

Subsequent to the investigative activities detailed in this Work Plan, a risk based evaluation will be performed to ensure that the risks to future receptors are acceptable at AOC-U. The risk based evaluation will be included in the submittal of the AOC-U RFI Completion Report. The following sections present the various steps that will be included in the risk evaluation.

7.2.1 Review of Available Analytical Data

As a first step in the risk evaluation process, soil and groundwater data produced by this RFI will be combined with useable historical data. The data will then be reviewed to determine (i) the most probable source(s) of contamination, (ii) that soil and groundwater impacts have been adequately delineated, and (iii) if any additional chemicals were detected that were not previously of concern at the site. Additionally, the data will be evaluated to ensure it meets standards for data quality established in the NMED *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, 2006a).

7.2.2 Revision of the Conceptual Site Model

Following a review of AOC-U RFI data, the CSM may need to be revised. This includes (i) re-assessing the distribution of contaminants of concern in soil and groundwater, (ii) verifying current and future land use, and (iii) verifying site stratigraphy and hydrogeology. To date, contaminants of concern identified in soil at ERP sites upgradient of AOC-U, above action levels include; VOCs (TCE, PCE), metals (arsenic, chromium, lead, cadmium), and total petroleum hydrocarbons. Contaminants of concern identified in groundwater at ERP sites upgradient of AOC-U include; VOCs (TCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, carbon tetrachloride), metals (arsenic, lead, cadmium, antimony, selenium), and perchlorate. However, additional contaminants of concern may be identified during the review of data collected during the AOC-U RFI.

7.2.3 Development of the Exposure Model

Once the conceptual site model has been refined, an exposure model will be developed. The exposure model is based on the CSM, and identifies the following:

- Media of concern
- Current and future receptors
- Complete and incomplete exposure pathways

The media of concern includes surficial soil, subsurface soil, soil to depth of construction, and groundwater. Based on current information available for AOC-U, receptors include (i) a current and future commercial/industrial worker, (ii) a future resident, and (iii) a current and future construction worker. Complete routes of exposure for each media of concern/contaminant of concern/receptor combination will be identified based on the above information.

7.2.4 Preliminary Screening Evaluation

As a first step, maximum concentrations for each contaminant of concern in soil will be compared with the specific ARARs described in Section 6.2.1.1 of this Work Plan. Likewise, the maximum concentrations for each contaminant of concern in groundwater will be compared with the specific ARARs presented in Section 6.2.1.2 of this work Plan and the maximum concentrations for each contaminant of concern in surface water will be compared with the specific ARARs presented in Section 6.2.1.3 of this Work Plan. If the maximum concentration of each contaminant of concern in soil, groundwater, and surface water is below its respective ARAR, no additional analysis will be performed, and the findings will be reported to NMED. Depending on the results of the screening evaluation, site-specific screening levels may be developed for all complete routes of exposure identified in the exposure model. Development of site-specific screening levels is described below.

7.2.5 Calculation of Site-Specific SSLs

Parameters required for the calculation of site-specific SSLs include:

- Carcinogenic toxicity values (Slope Factors)
- Non-carcinogenic toxicity values (Reference Doses)
- Exposure Factors
- Fate and Transport Parameters

Default toxicity values and exposure factors will be obtained from Tables C-1 and B-1 (respectively) of the *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, 2006a). As described in Section 6.3.2.1 of this Work Plan, site-specific fate and transport parameters will be obtained from 6 geotechnical soil samples collected from within AOC-U during this RFI. Using the above information, site-specific screening levels will be calculated using equations presented in the *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, 2006a). The maximum detected concentration for each contaminant that is detected above the reporting limit will be used to determine the site hazard index (HI). All constituents which have an HI greater than 1 will be evaluated in the site specific risk assessment.

7.2.6 Site-Specific Screening Level Evaluation

The site-specific screening levels will be compared with the representative concentration of each contaminant of concern in each media of concern. If any contaminant of concern exceeds its respective site-specific screening level, target levels for the contaminant of concern will be developed during the risk-based evaluation. The Johnson & Ettinger (J&E) model (USEPA, 2004a) will be used to develop the target levels for the indoor inhalation of vapors from subsurface soil and groundwater. The use of the J&E model is required because the NMED *Technical Background Document for Development of Soil Screening Levels* (NMED, 2006a) does not have an indoor inhalation pathway. Additionally, target levels for dermal contact with soil and groundwater will be developed as per the *Risk Assessment Guidance for Superfund Volume I, Part E Supplemental Guidance for Dermal Risk Assessment* (USEPA, 2004b).

8 DATA MANAGEMENT PLAN

This section describes the overall data management strategy and plan for the Lost River Basin (AOC-U) RFI Work Plan.

8.1 Data Management System and Strategy

The data management plan will be used to accommodate and manage fixed-based laboratory generated data at standard TAT (2 weeks). Data to be generated includes chemical analytical data, as well as spatial and features information, hydrogeologic data, and various supporting data, such as photographs and standard daily forms information. The data management system is comprised of the central project reporting database.

8.2 Data Type

Analytical data will be generated by onsite field screening, as well as by offsite laboratory analysis. Analytical data generated by the offsite laboratory will be initially managed by the laboratory's information management system (LIMS) and transferred to the project team for use via EDD and hard copy. Prior to project startup, formats for the offsite laboratory EDDs will be approved to ensure smooth transfer and importation of the data into the central project database upon receipt.

Upon project completion, the data management system will be used to perform final spatial analysis, as well as to support tabular and graphic report development for deliverables and miscellaneous project communications as needed.

8.2.1 Sample Identification System

Each environmental, geotechnical, and QA/QC sample collected will be identified on the sample label and COC records, regardless of type. Sample documentation, handling, and shipping will be in accordance with HAFB SOP-1. Table 6-4 provides the sample collection information inclusive of the container type, holding time, and quantity for the soil, groundwater, and surface waters samples collected during the investigation at AOC-U. The sample nomenclature for soil samples collected from hand auger boreholes will be as follows:

AOCU-HA01-7-a

Site alpha-numeric identifier: AOCU = Lost River Basin

Sample type identifier: HA = hand auger boring

Sequential hand auger boring number: 01, 02, etc.

Ending depth of sample interval: 7

Reserved for QA sample identifiers: a = field duplicate, EB = equipment blank, TB = trip blank, MS = matrix spike, MSD = matrix spike duplicate

The sample nomenclature for soil samples collected from surface soil sampling locations will be as follows:

AOCU-SS01-2-a

Site alpha-numeric identifier: AOCU = Lost River Basin

Sample type identifier: SS = surface soil sample

Sequential hand auger boring number: 01, 02, etc.

Ending depth of sample interval: 2

Reserved for QA sample identifiers: a = field duplicate, TB = trip blank, MS = matrix spike, MSD = matrix spike duplicate

The sample identification nomenclature for groundwater grab samples collected from monitoring points will be as follows:

AOCU-GW01-a

Site alpha-numeric identifier: AOCU = Lost River Basin

Sample type identifier: GW = groundwater grab sample

Corresponding hand auger soil boring number: 01, 02, etc.

Reserved for QA sample identifiers: a = field duplicate, TB = trip blank, MS = matrix spike, MSD = matrix spike duplicate

The sample identification nomenclature for surface water grab samples collected from pooled areas with the Lost River Basin (if available) will be as follows:

AOCU-SW01-a

Site alpha-numeric identifier: AOCU = Lost River Basin

Sample type identifier: SW = surface water grab sample

Corresponding surface water location: 01, 02, etc.

Reserved for QA sample identifiers: a = field duplicate, TB = trip blank, MS = matrix spike, MSD = matrix spike duplicate

8.2.2 Data Recording

The following paragraphs describe the data recording activities that will be performed for field data, offsite laboratory analytical data, and photographs.

8.2.2.1 Field Data

All information pertinent to a field and/or sampling survey will be recorded on appropriate data sheets, or in the project field logbook as described Section 10.5 of the HAFB Basewide QAPP (Bhate, 2003a). Specific data sheets are required by certain SOPs. Samplers will use a bound field logbook with consecutively numbered pages. Entries in the logbook will be made using indelible ink and will include at a minimum the following information:

- Name and address of the field contact (on logbook cover),
- Date of entry,
- Names and companies of personnel on site,
- General descriptions of each day's field activities,
- Documentation of weather conditions during field activities,
- Documentation of surface water body location and dimensions (if encountered)
- Location of sampling (e.g., monitoring well),
- Data points for field equipment derived during calibration procedures,
- Observation of sample or collection environment,
- Identification of sampling device,
- Any field measurements made,
- Sequence of collection of environmental samples,
- Type of sample matrix (e.g., soil, groundwater, etc.),
- Date and time of environmental sample collection,
- Field sample identification number,
- Sample distribution (e.g., which laboratory shipped to for analysis),
- Sampler's name,
- Sample type (e.g., composite, normal, duplicate, other QC, etc.),
- For groundwater samples, which samples were filtered if any and filter size and type, and
- Preservative used, if applicable, for the environmental sample.

If an error is made on the document or in the logbook, corrections will be made simply by crossing a line through the error in such a manner that the original entry can still be read, and the correct information added as the change. All corrections will be initialed by the author and dated.

Each page in the logbook will be signed or initialed by the person making the entries. In addition to the information entered into the logbook, the appropriate data forms must be filled out as each activity is completed.

8.2.2.2 Laboratory Analytical Data

The offsite laboratory shall maintain electronic and hardcopy records sufficient to recreate each analytical event conducted. The minimum records the laboratory shall keep include the following:

- COC forms,
- Initial and continuing calibration records including standards preparation traceable to the original material and lot number,
- Instrument tuning records (as applicable),
- Method blank results,
- Internal standard results,
- Surrogate spiking records and results (as applicable),
- Spike and spike duplicate records and results,
- Laboratory records,
- Raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports,
- Corrective action reports,
- Other method and project required QC samples and results, and
- Laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of project sample analysis.

8.2.2.3 Photographs

Any photographic documentation will be recorded in the appropriate logbook. Information to be recorded includes:

- Camera make and model,
- Time and date,
- Photographer,
- Details for the location of the photograph,
- Direction of photograph, preferably measured with field compass,
- Subject of the photograph,
- Significant or relevant features, and
- Names of any personnel included in photograph.

8.3 Data Reporting

Data obtained during sampling activities will be reported according to the Basewide QAPP (Bhate, 2003a). In accordance with the USACE *Chemical Quality Assurance for HTRW Projects Manual* EM 200-1-6, October 1997, the investigative data is classified as definitive data. The data will be generated using rigorous, analyte-specific analytical methods where analyte identifiers and quantitations are confirmed and QA/QC requirements have been satisfied. For this project, regular, field duplicate, and MS and MSD samples are to be collected concurrently. The data will meet the objectives of the project for level of accuracy and precision required, intended use of the data, analytical methods, time constraints, and allowable decision errors. Risk evaluation and sampling results will be tabulated and summarized in the RFI report for the site. An Environmental Restoration Program Information Management System (ERPIMS) submittal is not required for this investigation at AOC-U.

8.3.1 Tabular Displays

All analytical chemistry data will be presented as either Form 1 reports and/or summary reports. The Form 1 analytical reports will contain the following:

- Laboratory Name, address, telephone number, contact person, and location where the test was carried out if different from the fixed laboratory address,
- Unique Laboratory Project Number,
- Total number of pages (report must be paginated),
- Client Project Number (if applicable),
- Laboratory Sample Identification (if applicable),
- Client Sample Identification,
- Test Method,
- Matrix and/or description of sample,
- Dates: sample collection, collection time, sample receipt, preparation, and/or analysis date,
- Definition of data qualifiers,
- Reporting units,
- Solid samples: indicate dry or wet weight, and
- Indication by flagging where results are reported below the quantitation limit.

Offsite laboratories shall provide data deliverables within the standard time specified. Analytical results for all samples will be presented in hard copy Form-1 and EDD formats. Electronic data shall be delivered in an appropriate format such that the data can be uploaded to the project database for subsequent manipulation and presentation.

Tabular summary reports listing non-chemical, field measurement data will also be generated as part of this project. These summary reports will be created on an as-needed basis to support field sampling efforts and/or final project reporting.

8.3.2 Graphical Displays

During the AOC-U RFI field effort, Figures 6-1, 6-2, and 6-3 will be used by the field teams to guide their sampling activities. Staff will hand-annotate these maps for interim documentation of notable spatial information, such as:

- Indicating which locations have been sampled,
- Documenting in-field sample location adjustments,

Administrators will perform data input and changes, as well as work with the report development team to generate requested graphical and tabular reporting documents. Creation of presentation quality maps, as well as complex map layouts, and other complex displays, analysis, and processing of spatial data, will be performed using desktop Geographical Information System (GIS) software (such as Environmental Systems Research Institute's [ESRI's] ArcGIS program suite). The desktop GIS software will be used to produce maps intended for use in reports, as well as all plate-sized map prints.

8.4 Data Archiving

Hardcopy and electronic data shall be archived in project files and on electronic archive media for the duration of the project and for a minimum of 5 years, whichever is longer.

9 HEALTH AND SAFETY REQUIREMENTS

Project Health and Safety practices will adhere to the *Basewide Health and Safety Plan* (Bhate, 2003b) and the Site Specific Addendum to the Basewide HASP, as included in Appendix D of this Work Plan for investigation activities. All work must be conducted in accordance with the USACE *Safety and Health Requirements Manual, EM 385-1-1*, 15 September 2008. It is anticipated that no greater than level D PPE will be required to complete the site sampling activities. This includes: Occupational Safety and Health Administration (OSHA) approved safety shoes, American National Standards Institute (ANSI) approved safety glasses (Z87.1) and hard hat (Z89.1-1997: Type I), sleeved shirt and long pants, and as required, hearing protection, leather work gloves, and/or nitrile gloves during sampling.

Site security is part of safety at the site for the investigation. Items of concern include the proper designation and demarcation of the investigation boundaries (i.e., Support Zone, Contaminant Reduction Zone, and Exclusion Zone) as appropriate. Likewise, compliance with any intrusive work requirements, posting of potential hazards, and control of un-authorized site personnel will be completed. This is discussed in the Basewide HASP (Bhate, 2003b).

At a minimum, the site will be secured with caution tape surrounding the perimeter of the site delineating the outer boundary of the Support Zone. This is essential in the utility clearance process and it will serve as the demarcation of the site for both project and non-project persons. A Contaminant Reduction Zone and/or Exclusion Zone will be established as guided by the HASP and site prevailing conditions.

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10 PROJECT MANAGEMENT PLAN AND SCHEDULE OF IMPLEMENTATION

This section presents the project management plan (PMP) to be used during the performance of the AOC-U RFI.

10.1 Management Control Structure

During the implementation of the field activities for the AOC-U RFI, Mr. Jim Moore will serve as the NationView Site Manager and Field Team Leader, overseeing and directing all investigation sampling activities. Mr. Moore will also provide on-site management of any sub-contractors for the project. Mr. Frank Gardner will serve as the NationView Project Manager. Mr. David Martin is the NationView Corporate Sponsor and will ensure required project documents, permits, contractual agreements, and other program tasks are completed. Key project personnel and their responsibilities are listed in Table 10-1. The RFI field activities are anticipated to begin in the late winter or spring of 2010 and will last approximately 3 weeks.

10.2 Reporting

A variety of reporting mechanisms will be utilized throughout the AOC-U RFI to facilitate communication between HAFB, USACE, NMED, and Contractors. These reporting mechanisms will include the standard quality control and progress reports outlined in the HAFB Basewide QAPP, as well as the Draft and Final AOC-U RFI Reports.

Each of these reports will be instrumental in maintaining and documenting the continuing communication between various entities involved in the project.

A Draft AOC-U RFI Report will be prepared and undergo a series of internal reviews prior to submission to the HAFB 49th CES/CEA and the USACE Albuquerque District, as the agency service provider, prior to revision and submission to the NMED Hazardous Waste Bureau for review. Upon receipt of NMED comments, the AOC-U RFI Report will be revised to the Final format accordingly. As needed, a meeting may be requested to address any issues of significance that are not readily resolved through standard revision-level processes. The NationView Team will be responsible for resolving any issues that rise to that level of discourse.

Specifically, the AOC-U RFI Report(s) will include the following elements:

- Introduction
- Environmental Setting
- Source Characterization
- Sampling and Analysis Results

- Data Quality Assurance/Data Quality Control Review
- Conclusions
- Recommendations

10.3 Records Management

Project files will contain the following information:

- Correspondence
    a. External and internal correspondence
    b. Personnel, organization, and responsibilities
    c. Planning and scheduling
    d. QA auditing and inspection reports
- All Field Generated Data
- Contractual Documentation
    a. Prime Contract
    b. Delivery Orders / Task Orders
    c. Change Orders
    d. Subcontracts
    e. Competitive bid evaluations
- Laboratory Analytical Data
- Submittals/Reports
- Miscellaneous project information as required

Project files will be maintained by Project Management and Quality Assurance personnel, as supported by designated document control personnel.

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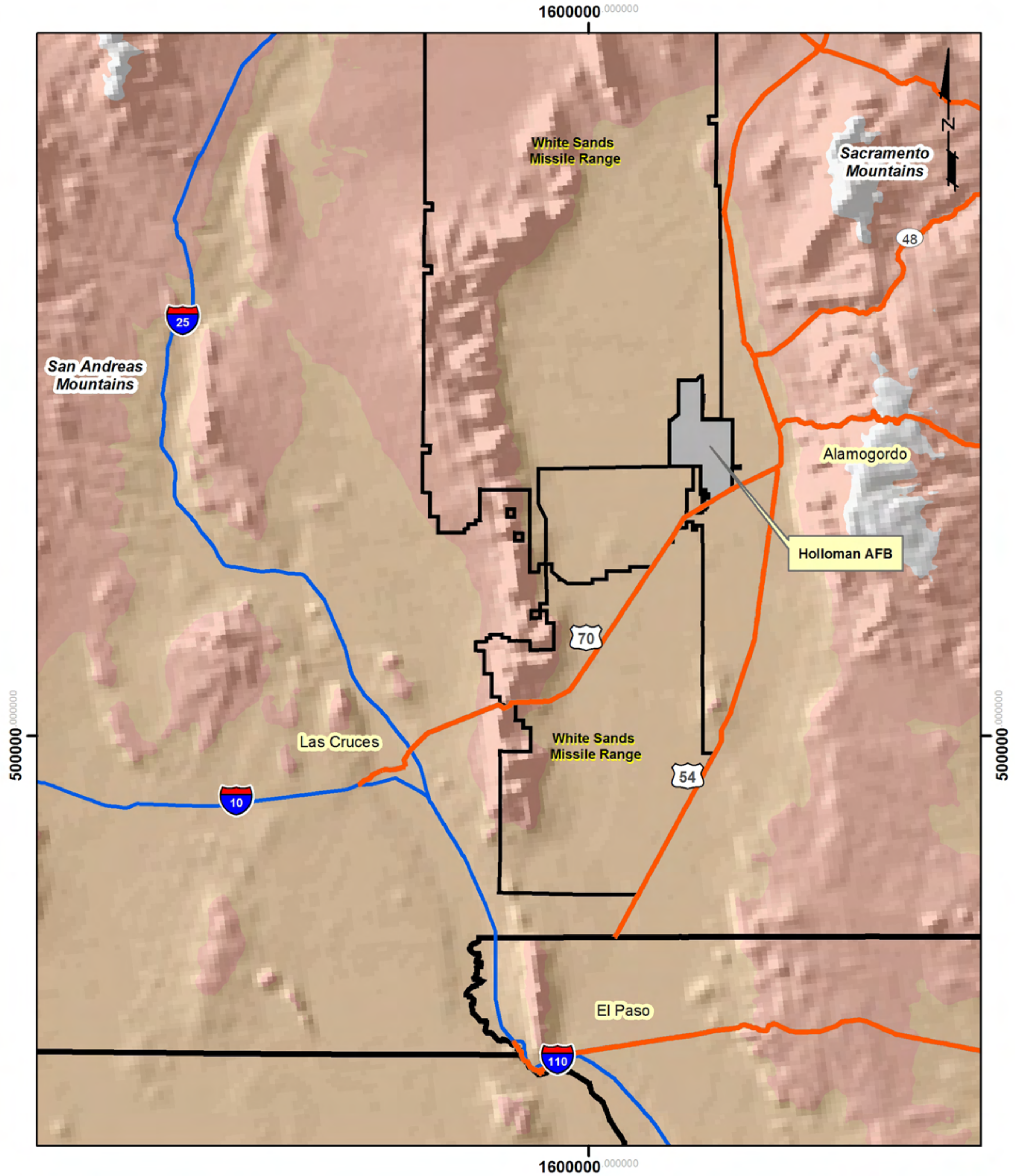
FIGURES



Note: Projection-New Mexico State Plane Coordinate System, Central Zone, North American Horizontal Datum 1983 (feet)

NATIONVIEW

Holloman AFB, New Mexico
Location Map

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
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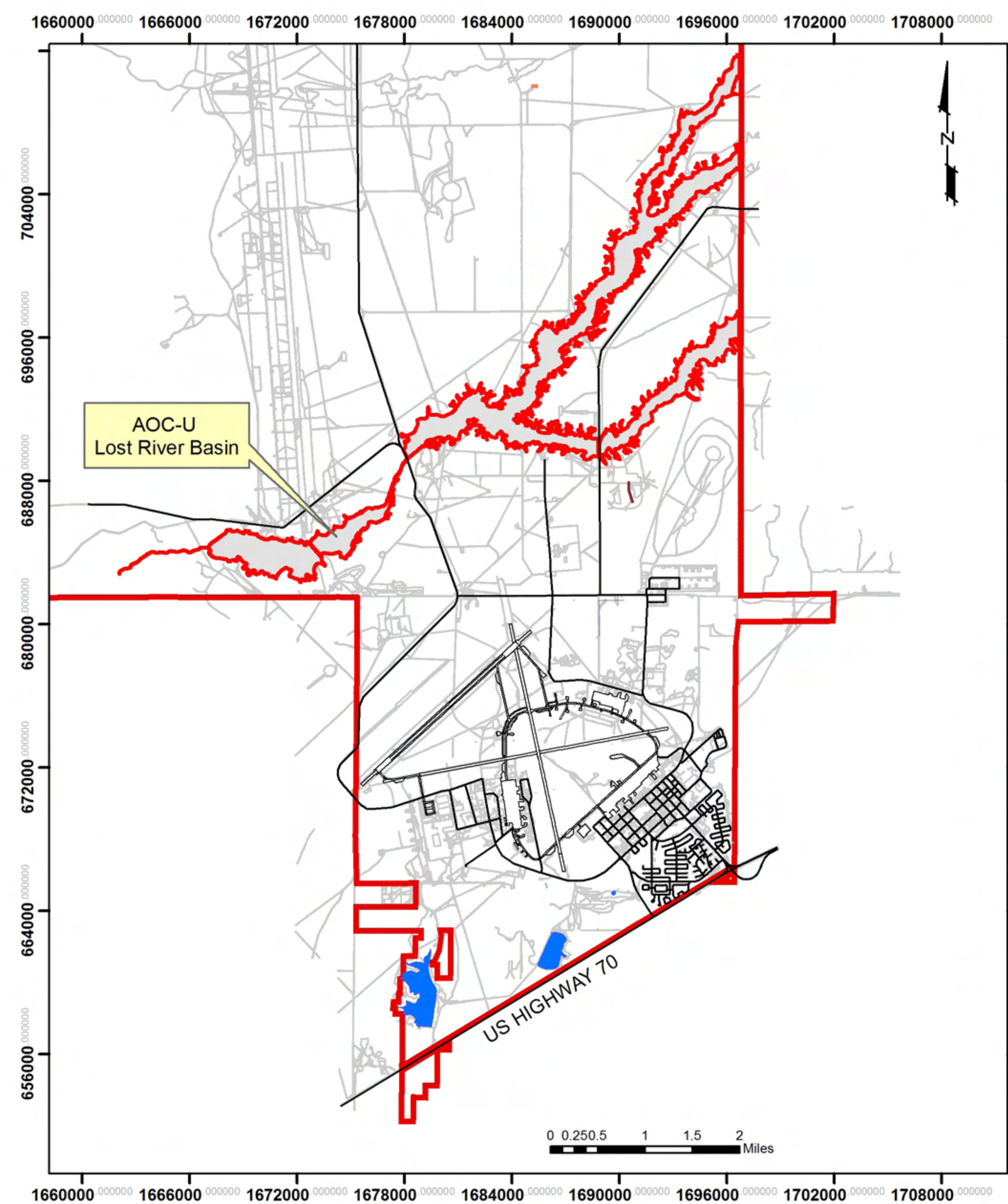
AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 1-1



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NATIONVIEW

AOC-U
Site Location Map

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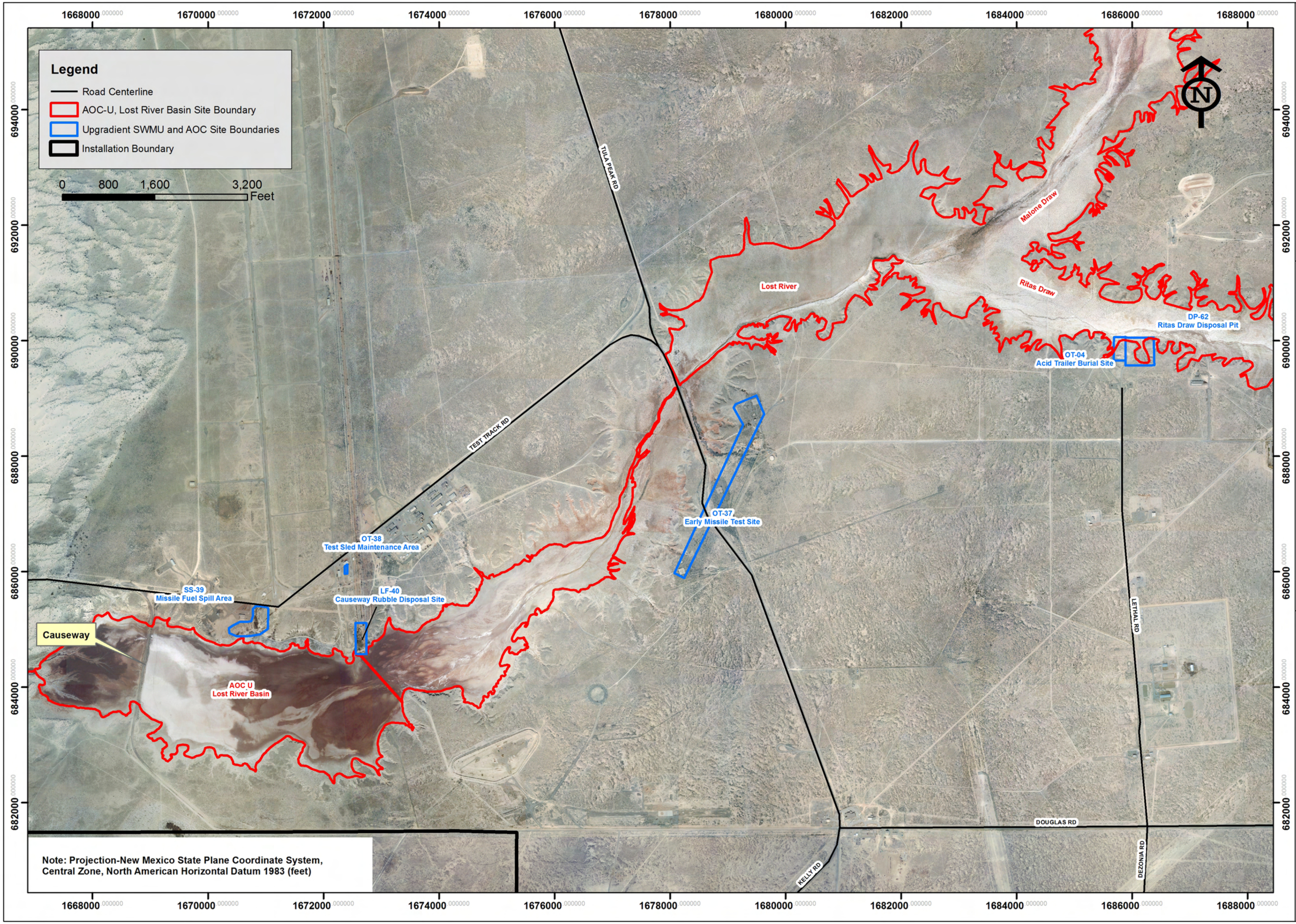
AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 1-2



AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 1-3

AOC-U Site Map Showing Upgradient SWMUs and AOC Locations

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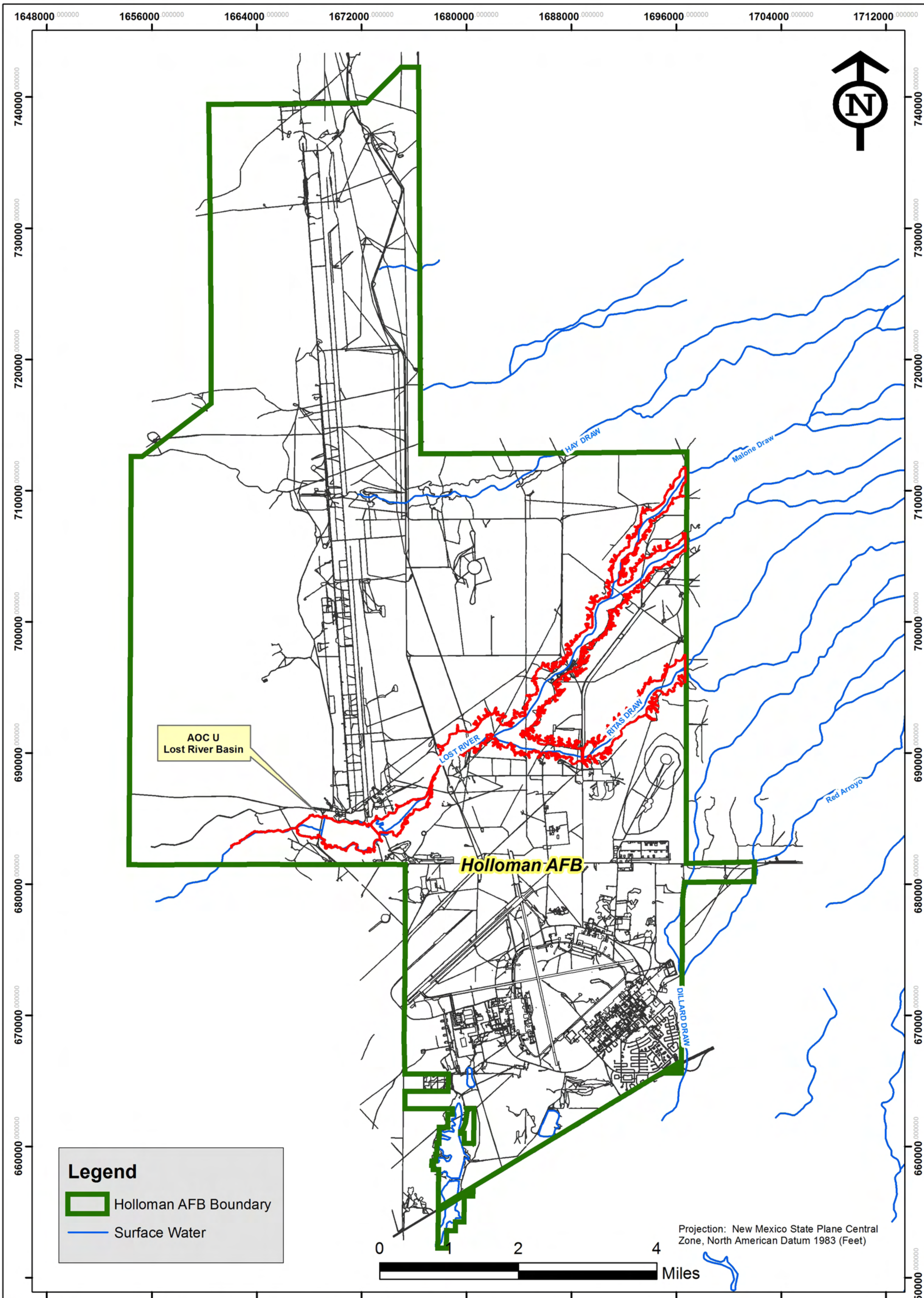
PROJECT NO.	8090006

NATIONVIEW



NATIONVIEW

Surface Drainages
Holloman AFB

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
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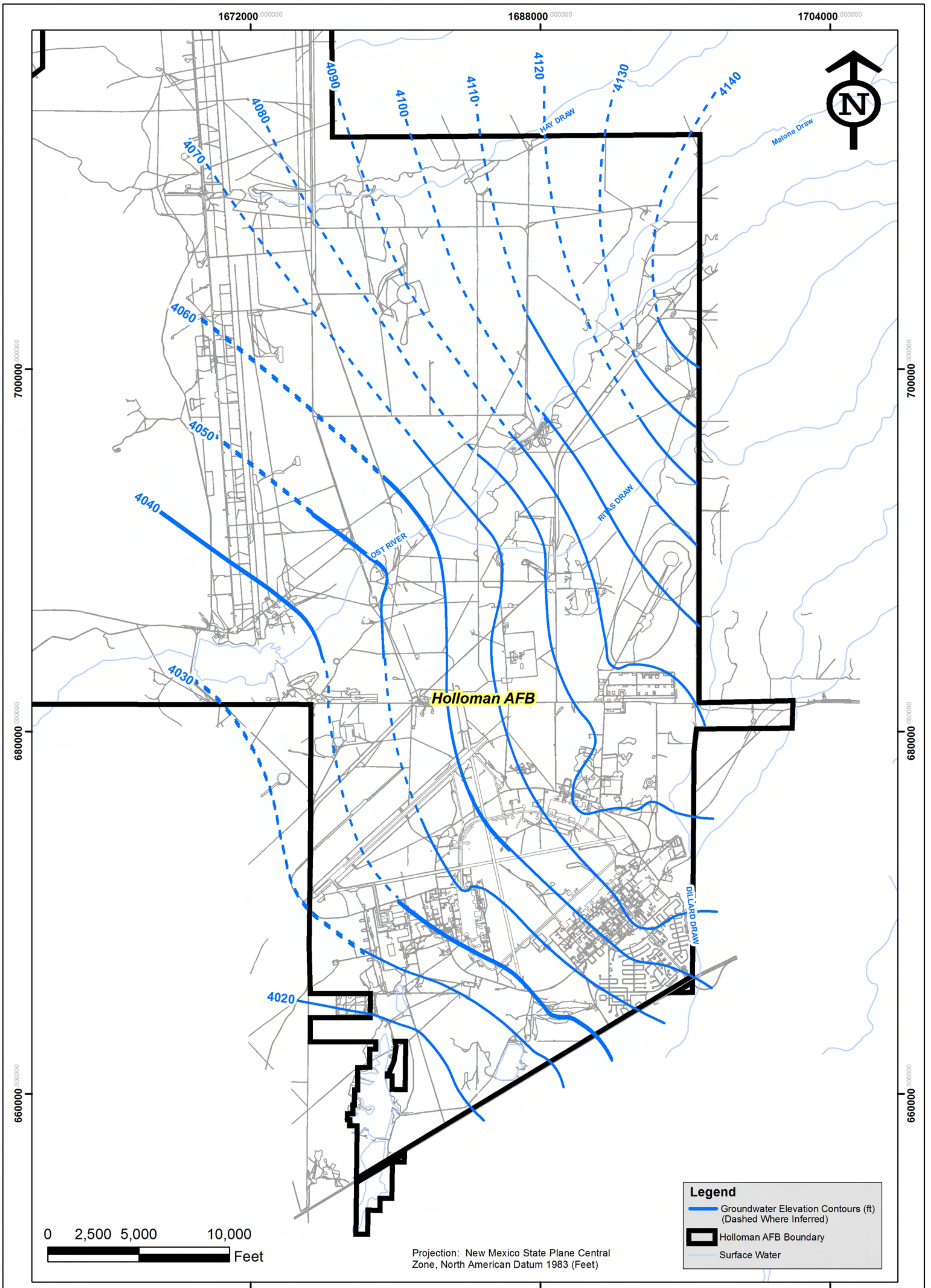
AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 2-1



NATIONVIEW

Groundwater Contour Map
Holloman AFB

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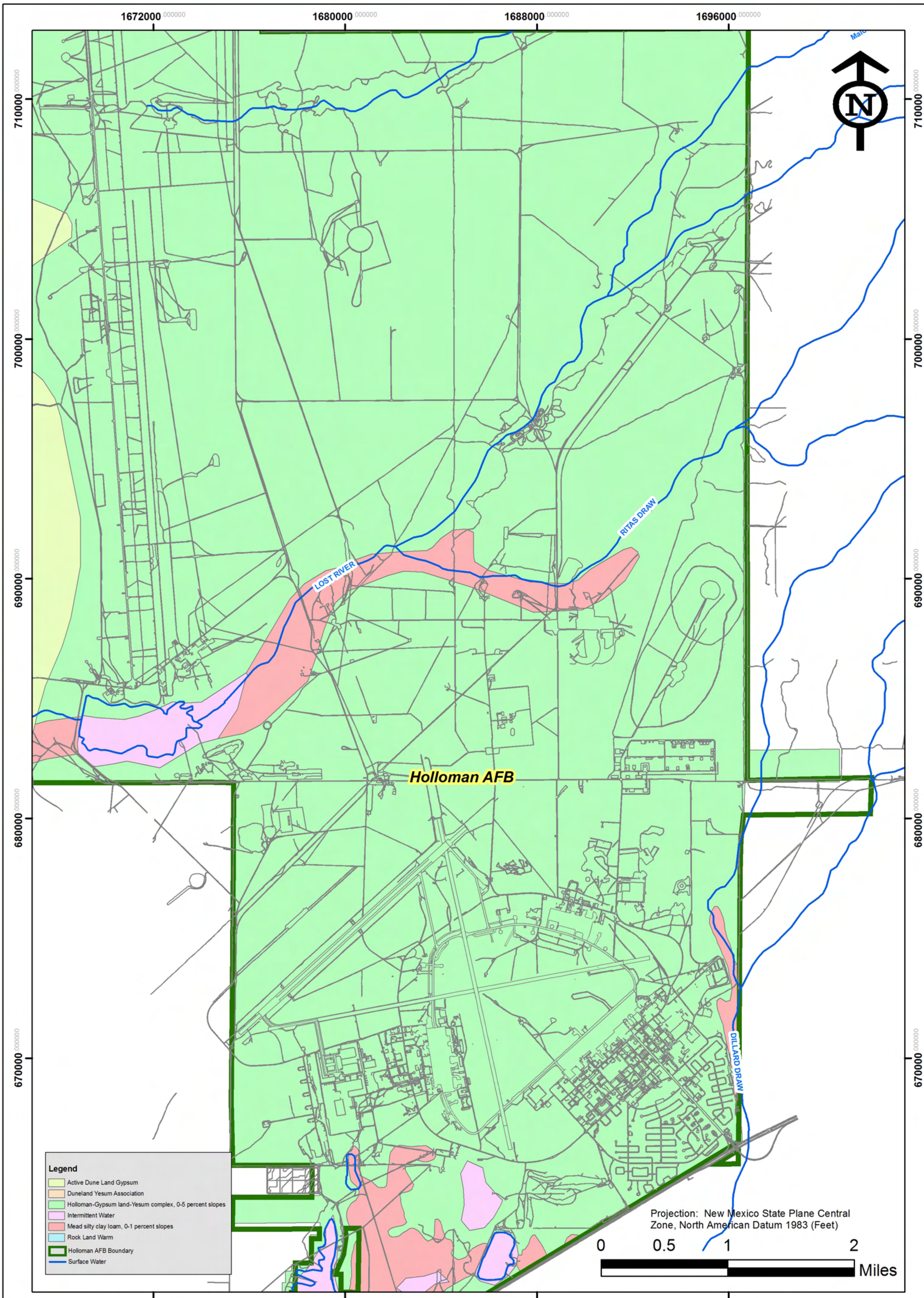
AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 2-2



NATIONVIEW

Soil Map
Holloman AFB, New Mexico

PROJECT NO.	SCALE	DATE	DRAWN BY:
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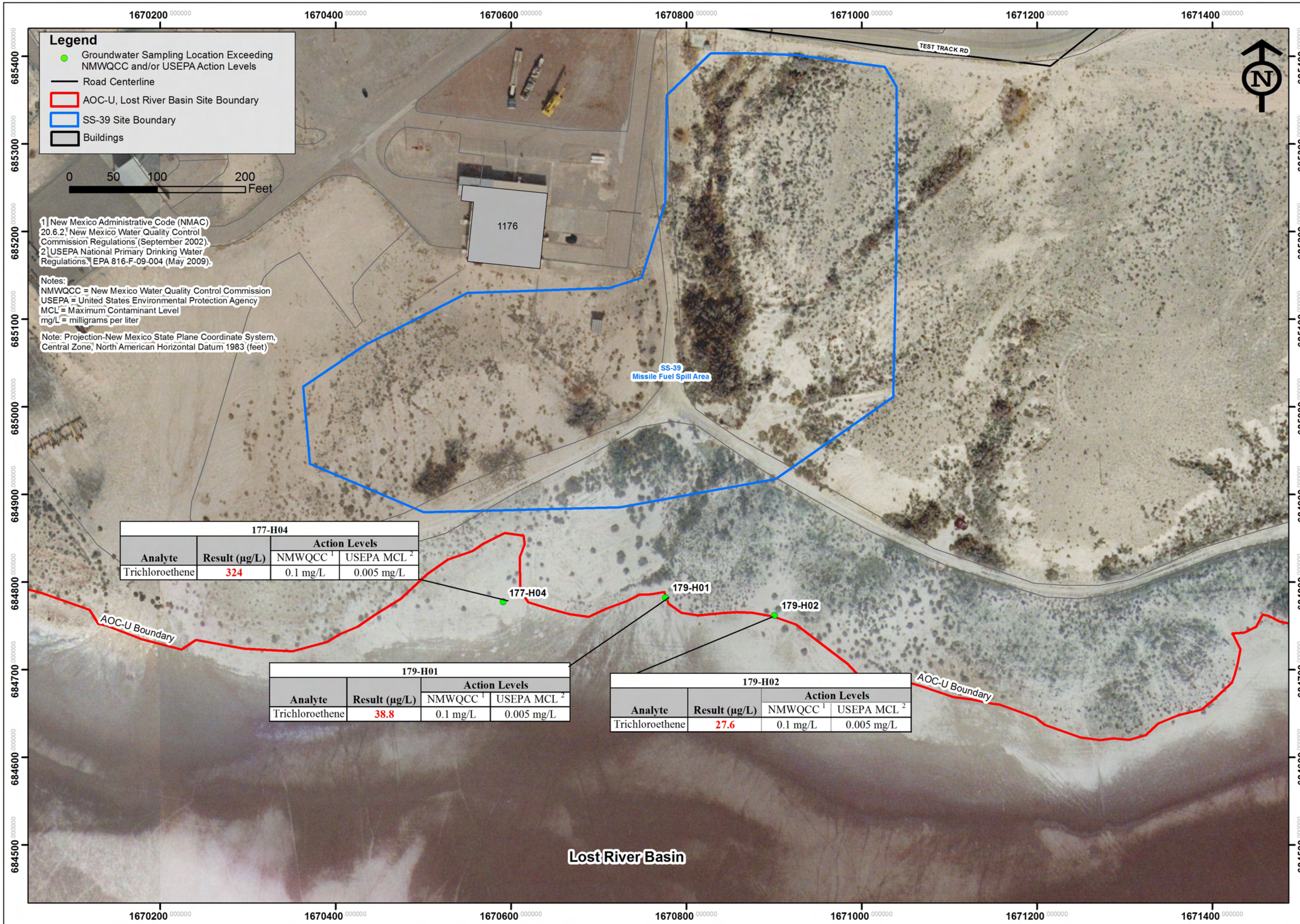
AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 2-3



177-H04

Analyte	Result (µg/L)	Action Levels NMWQCC [1]	Action Levels USEPA MCL [2]
Trichloroethene	324	0.1 mg/L	0.005 mg/L

179-H01

Analyte	Result (µg/L)	Action Levels NMWQCC [1]	Action Levels USEPA MCL [2]
Trichloroethene	38.8	0.1 mg/L	0.005 mg/L

179-H02

Analyte	Result (µg/L)	Action Levels NMWQCC [1]	Action Levels USEPA MCL [2]
Trichloroethene	27.6	0.1 mg/L	0.005 mg/L

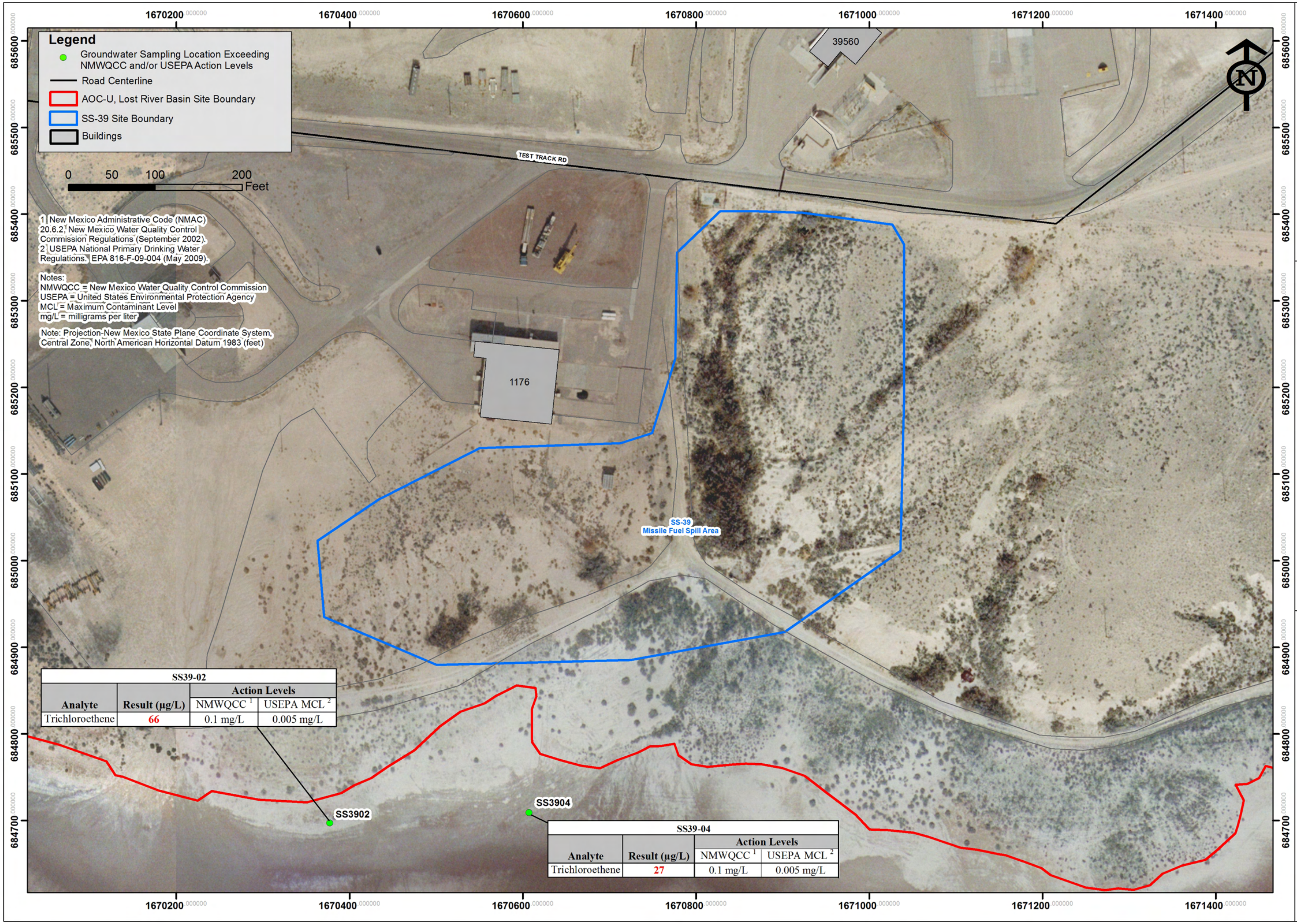
AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 5-1

Groundwater Analytical Results Above NMWQCCand/or USEPA Action Levels (Radian 1993)

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
8090006	1"=100'	6/26/09	cm	Figure 5-1

NATIONVIEW



SS39-02

Analyte	Result (µg/L)	Action Levels	
		NMWQCC [1]	USEPA MCL [2]
Trichloroethene	66	0.1 mg/L	0.005 mg/L

SS39-04

Analyte	Result (µg/L)	Action Levels	
		NMWQCC [1]	USEPA MCL [2]
Trichloroethene	27	0.1 mg/L	0.005 mg/L

AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 5-2

Groundwater Analytical Above Results NMWQCC and/or USEPA Action Levels (Groundwater Technology Government Services Inc., 1998)

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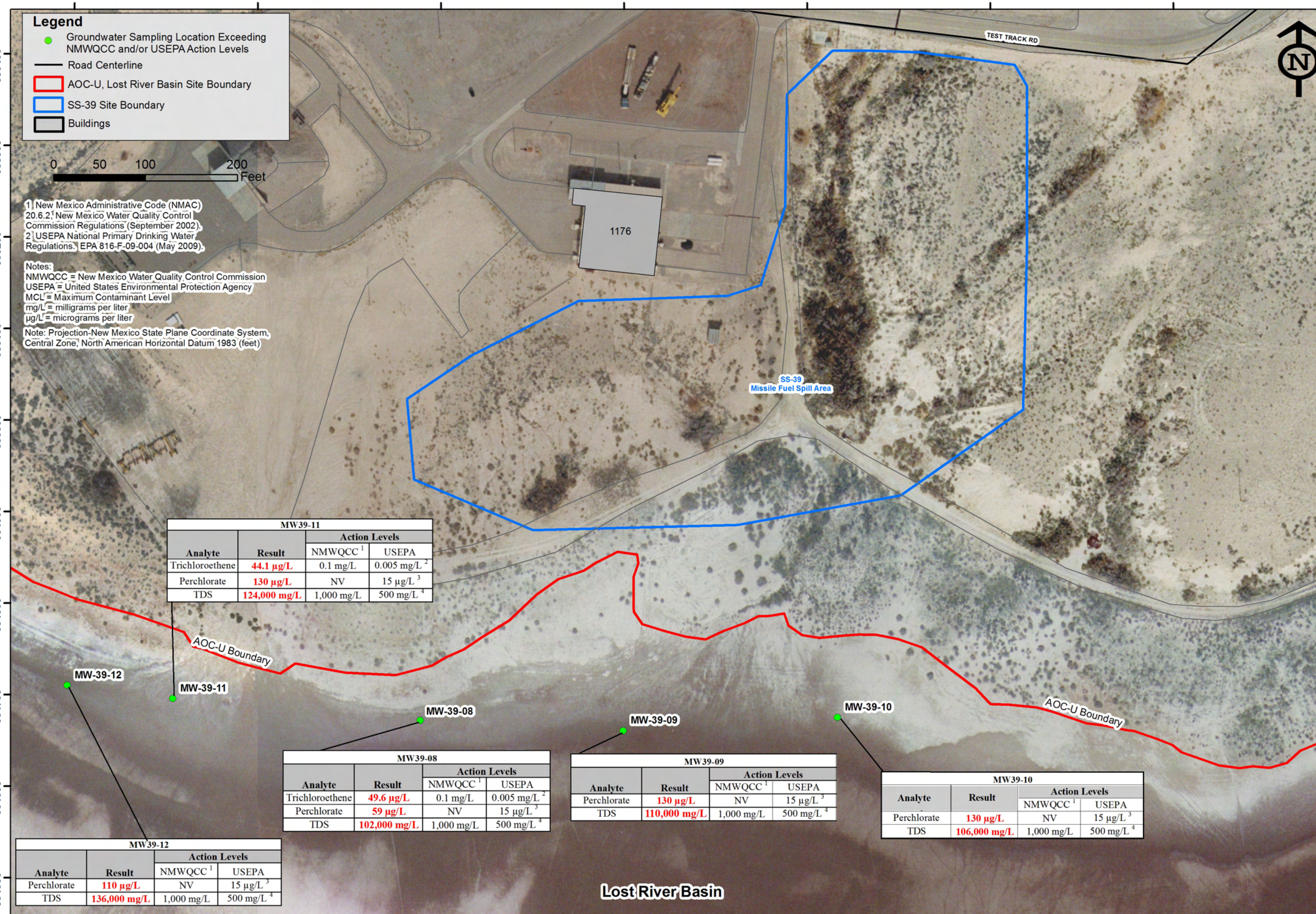
DRAWING NO:	Figure 5-2
DATE	6/26/09
SCALE	1"=100'
PROJECT NO.	8090006

NATIONVIEW



MW39-11

Analyte	Result	Action Levels NMWQCC [1]	USEPA
Trichloroethene	44.1 µg/L	0.1 mg/L	0.005 mg/L [2]
Perchlorate	130 µg/L	NV	15 µg/L [3]
TDS	124,000 mg/L	1,000 mg/L	500 mg/L [4]

MW39-08

Analyte	Result	Action Levels NMWQCC [1]	USEPA
Trichloroethene	49.6 µg/L	0.1 mg/L	0.005 mg/L [2]
Perchlorate	59 µg/L	NV	15 µg/L [3]
TDS	102,000 mg/L	1,000 mg/L	500 mg/L [4]

MW39-09

Analyte	Result	Action Levels NMWQCC [1]	USEPA
Perchlorate	130 µg/L	NV	15 µg/L [3]
TDS	110,000 mg/L	1,000 mg/L	500 mg/L [4]

MW39-10

Analyte	Result	Action Levels NMWQCC [1]	USEPA
Perchlorate	130 µg/L	NV	15 µg/L [3]
TDS	106,000 mg/L	1,000 mg/L	500 mg/L [4]

MW39-12

Analyte	Result	Action Levels NMWQCC [1]	USEPA
Perchlorate	110 µg/L	NV	15 µg/L [3]
TDS	136,000 mg/L	1,000 mg/L	500 mg/L [4]

AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 5-3

Groundwater Analytical Above Results NMWQCC and/or USEPA Action Levels (Hydrogelogic, Inc., 2006)

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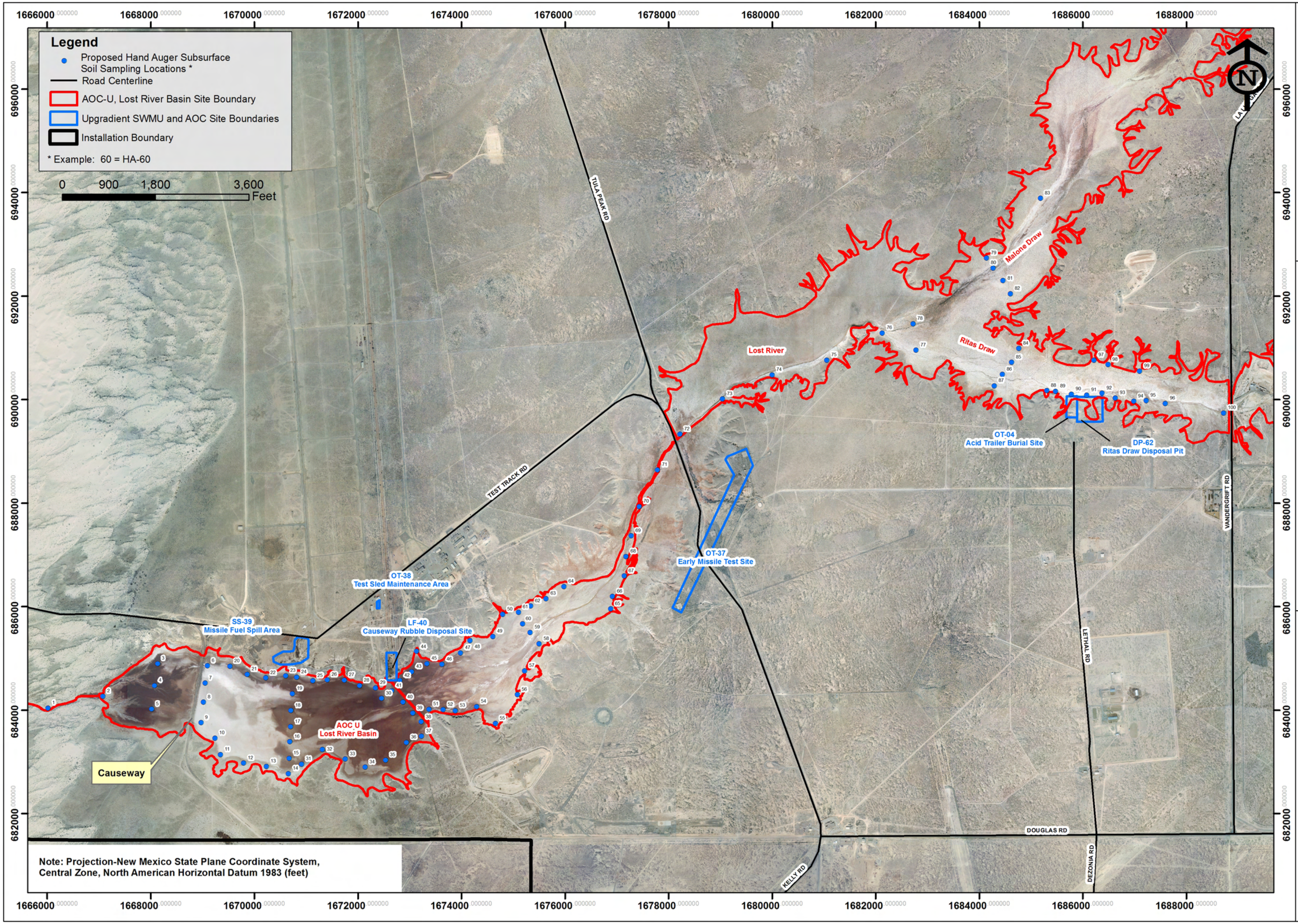
DRAWING NO:	Figure 5-3
DATE	6/26/09
SCALE	1"=100'
PROJECT NO.	8090006

NATIONVIEW



AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

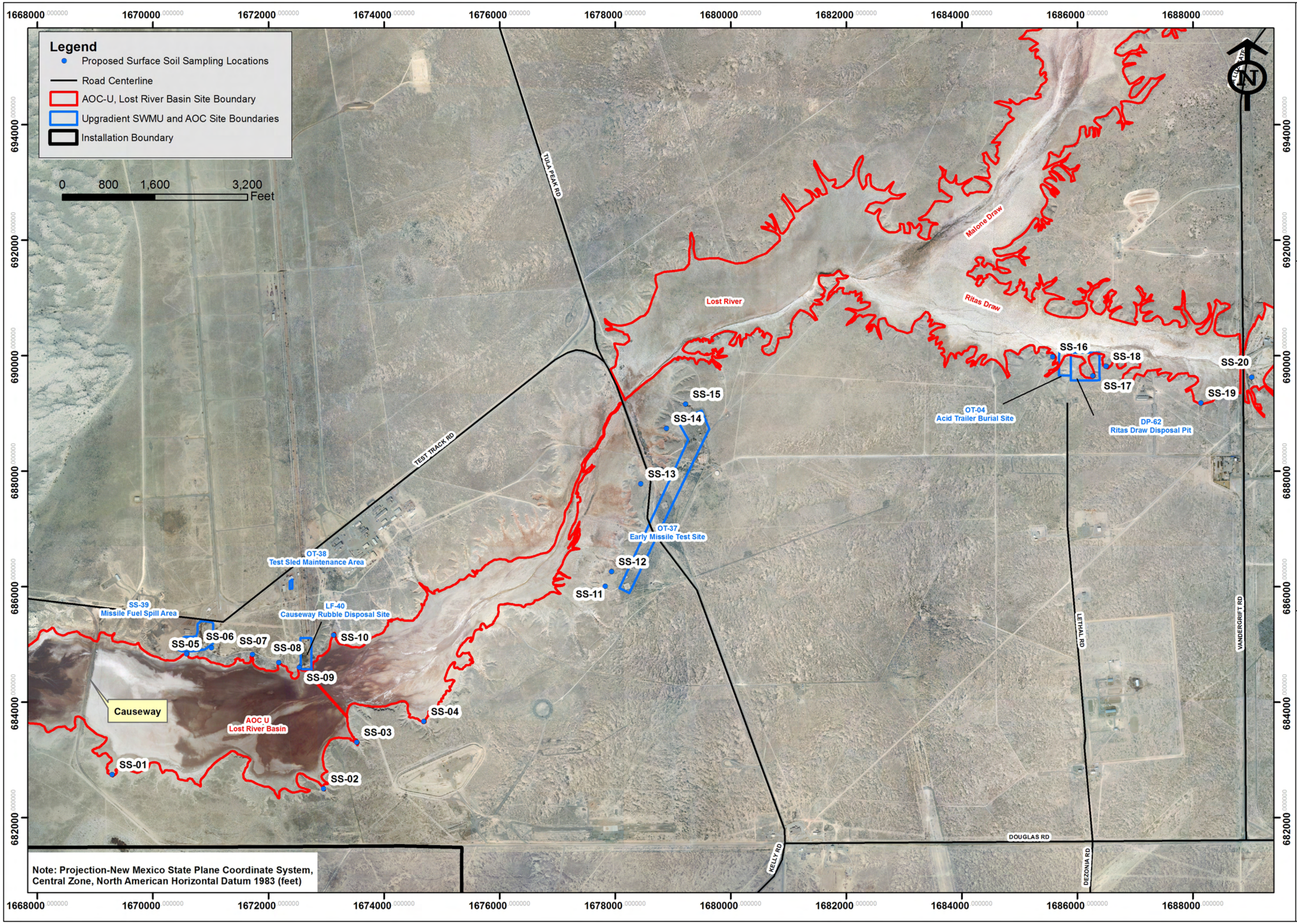
Figure 6-1

AOC-U
Proposed Hand Auger Subsurface
Soil Sampling Locations

DRAWN BY:	DRAWING NO.:
cm	Figure 6-1

PROJECT NO.	SCALE	DATE
8090006	Shown	5/18/09

NATIONVIEW



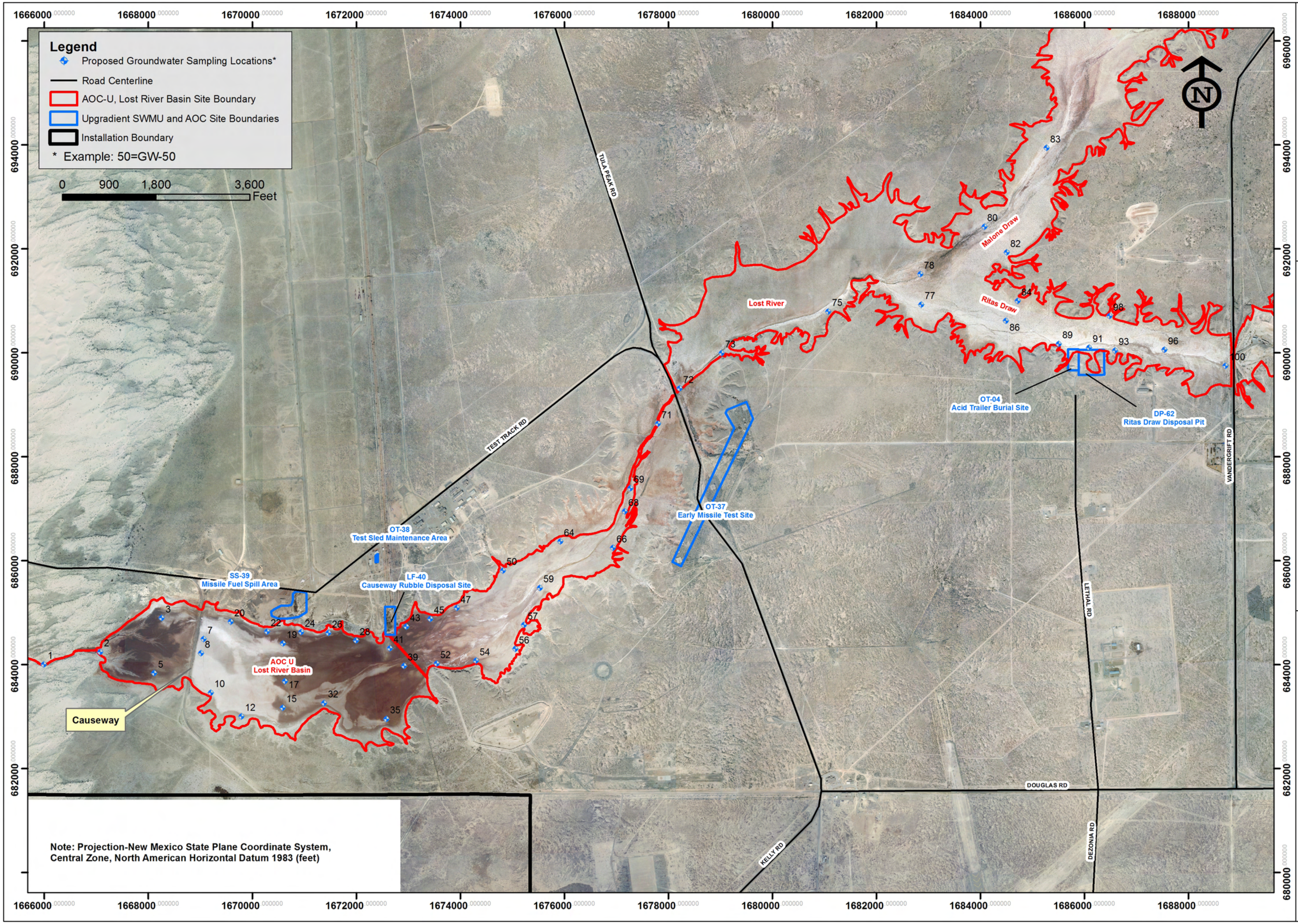
AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 6-2

AOC-U
Proposed Surface Soil Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
8090006	1"=1500'	5/18/09	cm	Figure 6-2

NATIONVIEW



AOC-U, Lost River Basin
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico

Figure 6-3

AOC-U
Proposed Groundwater Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
8090006	Shown	5/18/09	cm	Figure 6-3

NATIONVIEW

TABLES

Table 6-1
Subsurface and Surface Soil Sampling and Analysis
AOC-U RFI Work Plan
Holloman AFB, New Mexico
NationView Project No. 8090006.01.01

Analysis	Method	Primary	Duplicates [1]	MS [2]	MSD [3]	Trip blanks [4]	Equipment Blanks [5]	Total
VOC	USEPA SW846 Method 8260B	120	12	6	6	20	20	184
SVOC	USEPA SW846 Method 8270C	120	12	6	6	0	20	164
TAL Metals	USEPA SW846 Methods 6010B/7471A	120	12	6	6	0	20	164
TPH GRO	USEPA SW846 Method 8015B	120	12	6	6	0	20	164
TPH DRO	USEPA SW846 Method 8015B	120	12	6	6	0	20	164
TPH ORO	USEPA SW846 Method 8015B	120	12	6	6	0	20	164
Perchlorate	USEPA Method 314	120	12	6	6	0	20	164
Moisture Content	USEPA SM18 Method 2540B	6	0	0	0	0	0	6
Dry Bulk Density	ASTM Method D2937	6	0	0	0	0	0	6
Specific Gravity	ASTM Method D1429-86	6	0	0	0	0	0	6
Fractional Organic Carbon Content	ASTM Method D2974	6	0	0	0	0	0	6
VOC (Field Sceening)	PID (Headspace)	520 [6]	0	0	0	0	0	520

Notes:

ASTM = American Society for Testing and Materials
USEPA = U.S. Environmental Protection Agency
MS = Matrix Spike
MSD = Matrix Spike Duplicate
VOC = Volatile Organic Compounds
SVOC = Semi-volatile Organic Compounds
TAL = Target Analyte List
TPH = Total Petroleum Hydrocarbons
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
PID = Photoionization Detector
SW = USEPA Office of Solid Waste
SM = Standard Methods

[1] Duplicate samples will be collected at a minimum frequency of 1 for every 10 primary samples collected
[2] MS samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[3] MSD samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[4] Estimated, one trip blank will accompany every shipment of VOC samples
[5] Estimated, one equipment rinsate blank will be collected per day
[6] Headspace readings collected continuously every 2 feet (estimated footage = 1,040 feet)

Table 6-2
Groundwater Sampling and Analysis
AOC-U RFI Work Plan
Holloman AFB, New Mexico
Nationview Project No. 8090006.01.01

Analysis	Method	Primary	Duplicates [1]	MS [2]	MSD [3]	Trip blanks [4]	Total
VOC	USEPA SW846 Method 8260B	50	5	3	3	20	81
SVOC	USEPA SW846 Method 8270C	50	5	3	3	0	61
TDS	USEPA SM18 Method 2540C	50	5	3	3	0	61
TAL Metals	USEPA SW846 Methods 6010B/7470A	50	5	3	3	0	61
TPH GRO	USEPA SW846 Method 8015B	50	5	3	3	0	61
TPH DRO	USEPA SW846 Method 8015B	50	5	3	3	0	61
TPH ORO	USEPA SW846 Method 8015B	50	5	3	3	0	61
Perchlorate	USEPA Method 314	50	5	3	3	0	61

Notes:
EPA = Environmental Protection Agency
MS = Matrix Spike
MSD = Matrix Spike Duplicate
VOC = Volatile Organic Compounds
SVOC = Semi-volatile Organic Compounds
TDS = Total dissolved solids
TAL = Target Analyte List
TPH = Total Petroleum Hydrocarbons
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
SW = USEPA Office of Solid Waste
SM = Standard Methods

[1] Duplicate samples will be collected at a minimum frequency of 1 for every 10 primary samples collected
[2] MS samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[3] MSD samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[4] Estimated, one trip blank will accompany every shipment of VOC samples

Table 6-3
Surface Water Sampling and Analysis
AOC-U RFI Work Plan
Holloman AFB, New Mexico
Nationview Project No. 8090006.01.01

Analysis	Method	Primary	Duplicates [1]	MS [2]	MSD [3]	Trip blanks [4]	Total
VOC	USEPA SW846 Method 8260B	3	1	1	1	1	7
SVOC	USEPA SW846 Method 8270C	3	1	1	1	0	6
TDS	USEPA SM18 Method 2540C	3	1	1	1	0	6
TAL Metals	USEPA SW846 Methods 6010B/7470A	3	1	1	1	0	6
TPH GRO	USEPA SW846 Method 8015B	3	1	1	1	0	6
TPH DRO	USEPA SW846 Method 8015B	3	1	1	1	0	6
TPH ORO	USEPA SW846 Method 8015B	3	1	1	1	0	6
Perchlorate	USEPA Method 314	3	1	1	1	0	6
pH	USEPA SM19 Method 4500	3	1	1	1	0	6
Total Hardness	USEPA SM19 Method 2340B	3	1	1	1	0	6

Notes:

EPA = Environmental Protection Agency
MS = Matrix Spike
MSD = Matrix Spike Duplicate
VOC = Volatile Organic Compounds
SVOC = Semi-volatile Organic Compounds
TDS = Total dissolved solids
TAL = Target Analyte List
TPH = Total Petroleum Hydrocarbons
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
pH = Potential of hydrogen
SW = USEPA Office of Solid Waste
SM = Standard Methods

[1] Duplicate samples will be collected at a minimum frequency of 1 for every 10 primary samples collected
[2] MS samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[3] MSD samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[4] Estimated, one trip blank will accompany every shipment of VOC samples

Table 6-4
Sample Containers and Holding Times by Sample Media
AOC-U RFI Work Plan
Holloman AFB, New Mexico
NationView Project No. 8090006.01.01

Media	Sample Collection Information	Analyte Group (Method)									
		VOCs (USEPA SW846 Method 8260B)	SVOCs (USEPA SW846 Method 8270C)	TPH-GRO (USEPA SW846 Method 8015B)	TPH-DRO/ORO (USEPA SW846 Method 8015B)	TAL Metals (USEPA SW846 Methods 6010B/ 7040A/7041A)	Perchlorate (USEPA Method 314)	Moisture Content (USEPA Method 2540B)	TDS (USEPA SM18 Method 2540C)	pH (USEPA SM19 Method 4500)	Hardness (USEPA SM19 Method 2340B)
Soil	Container Type	En Core	8 oz glass jar	En Core	8 oz glass jar	4 oz glass jar	4 oz glass jar	4 oz glass jar	NA	NA	NA
	Container Quantity	3	1	2	1	1	1	1	NA	NA	NA
	Holding Time	48 hours	14 days (extraction) 40 days (analysis)	48 hours	14 days (extraction) 40 days (analysis)	180 days (Mercury 28 days)	28 days	14 days	NA	NA	NA
Groundwater	Container Type	40-mL VOAs	1-L Amber	40-mL VOAs	1-L Amber	500-mL Poly	500-mL Poly	NA	500-mL Poly	NA	NA
	Preservative	HCL	NA	HCL	H_2SO_4	HNO_3	NA	NA	NA	NA	NA
	Container Quantity	3	2	3	2	1	2	NA	1	NA	NA
	Holding Time	14 days (preserved) 7 days (non preserved)	7 days (extraction) 40 days (analysis)	14 days (preserved) 7 days (non preserved)	7 days (extraction) 40 days (analysis)	180 days (Mercury 28 days)	28 days	NA	48 hours	NA	NA
Surface Water	Container Type	40-mL VOAs	1-L Amber	40-mL VOAs	1-L Amber	500-mL Poly	500-mL Poly	NA	500-mL Poly	500-mL Poly	500-mL Poly
	Preservative	HCL	NA	HCL	H_2SO_4	HNO_3	NA	NA	NA	NA	HNO_3
	Container Quantity	3	1	3	2	1	2	NA	1	1	1
	Holding Time	14 days (preserved) 7 days (non preserved)	7 days (extraction) 40 days (analysis)	14 days (preserved) 7 days (non preserved)	7 days (extraction) 40 days (analysis)	180 days (Mercury 28 days)	28 days	NA	48 hours	Analyze ASAP	180 days

Notes:
VOC = Volatile Organic Compounds
SVOC = Semi Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TDS = Total Dissolved Solids
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
TAL = Total Analyte List
USEPA = U.S. Environmental Protection Agency
SW = USEPA Office of Solid Waste

SM = Standard Method
NA = Not Applicable
oz = ounce
mL = milliliter
VOA = Volatile Organic Analysis (vial)
L = Liter
Poly = Polyethylene
H_2SO_4 = Sulfuric Acid
HNO_3 = Nitric Acid
HCL = Hydrochloric Acid
ASAP = As Soon As Possible

Table 10-1

Key Personnel and Responsibilities

AOC-U RFI Work Plan
Holloman AFB, New Mexico
NationView Project No. 9090006.01.01

Name	Project Title/Assigned Role	Phone Numbers
Mr. David Martin	Corporate Sponsor	Cell: (205) 908-0731
Mr. Frank Gardner, P.G.	Project Manager	Cell: (303) 386-6454
Mr. Jim Moore, P.G.	Field Team Leader/Sr. Geologist	Cell: (303) 929-4840
Mr. Dustin McNeil, P.G.	Project Geologist	Cell: (303) 895-1963
Mr. Zackary Beck, P.G.	Project Geologist	Cell: (575) 921-1736
Ms. Marcia Olive	Project Chemist	Office: (303) 597-2450
Mr. John Hymer	SSHO/Emergency Task Manager	Cell: (575) 491-9171
Ms. Sally Smith, MHS, CIH, CSP, CHMM	Health and Safety Manager	Office: (205) 918-4032

Notes:
P.G. = Professional Geologist
SSHO = Site Safety and Health Officer
CIH = Certified Industrial Hygienist
CHMM = Certified Hazardous Materials Manager
CSP = Certified Safety Professional
MHS = Masters of Health Sciences

APPENDIX A

HAFB BASEWIDE QUALITY ASSURANCE PROJECT PLAN ADDENDUM

FINAL

QUALITY ASSURANCE PROJECT PLAN ADDENDUM AOC-U, LOST RIVER BASIN RCRA FACILITY INVESTIGATION HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49 CES/CEA
Holloman Air Force Base
New Mexico

Under Contract To:

U.S. Army Corps of Engineers
Albuquerque District
HTRW Branch
4101 Jefferson Plaza NE
Albuquerque, New Mexico 87109-3435

Prepared By:

NATIONVIEW

NationView, LLC
1608 13th Avenue South, Suite 160
Birmingham, Alabama 35205
NationView Project No. 8090006.01.01

Contract No. W912PP-09-D-0003
Delivery Order No. 0003

July 2009

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM AOC-U, LOST RIVER BASIN RCRA FACILITY INVESTIGATION HOLLOMAN AIR FORCE BASE, NEW MEXICO

REVIEW SHEET

COMMITMENT TO IMPLEMENT THIS QUALITY ASSURANCE PROJECT PLAN ADDENDUM		
David D. Martin	David D. Martin	7-16-09
Corporate Sponsor	Signature	Date
Frank Gardner, P.G.	Frank Gardner	7/16/09
Project Manager	Signature	Date
Jim Moore, P.G.	JH Moore	7/16/09
Field Team Leader/Sr. Geologist	Signature	Date
Marcia Olive	Marcia Olive	7/16/09
Project Chemist	Signature	Date

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM AOC-U, LOST RIVER BASIN RCRA FACILITY INVESTIGATION HOLLOMAN AIR FORCE BASE, NEW MEXICO

TABLE OF CONTENTS

Tables

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LIST OF ACRONYMS

AFB	Air Force Base
AOC	Area of Concern
ASTM	American Society for Testing and Materials
Bhate	Bhate Environmental Associates, Inc.
DQO	Data Quality Objective
DRO	Diesel Range Organics
EDD	Electronic data deliverable
GRO	Gasoline Range Organics
HAFB	Holloman Air Force Base
LCL	Lower Control Limit
LCS	Laboratory Control Sample
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
ORO	Oil Range Organics
P.G.	Professional Geologist
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
SOPs	Standard Operating Procedures
SVOC	Semi-volatile Organic Compounds
SWMU	Solid Waste Management Unit
SSLs	Soil Screening Levels
TAL	Target Analyte List
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
UCL	Upper Control Limit
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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PREFACE

This Quality Assurance Project Plan Addendum (QAPP Addendum) has been developed to assure that sample collection, analyses, and evaluations are legally and scientifically defensible for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Lost River Basin (Area of Concern [AOC] - U), Holloman Air Force Base (HAFB), New Mexico. This document is an addendum to the *Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico* (Bhate Environmental Associates, Inc. [Bhate], November 2003) (Basewide QAPP) and must be used in conjunction with that document. This document contains the site specific information for the work at AOC-U, outlined in the *RCRA Facility Investigation Work Plan, AOC-U, Lost River Basin Holloman Air Force Base, New Mexico* (NationView, July 2009).

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1 INTRODUCTION

NationView, LLC, has been retained by the U.S. Army Corps of Engineers (USACE), under contract W912PP-09-D-0003, Delivery Order No. 0003 to conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Area of Concern (AOC) -U, Lost River Basin on Holloman Air Force Base (HAFB), New Mexico.

The primary project objectives of the AOC-U, Lost River Basin RFI are to:

1. Identify potential releases to the soil (surface and subsurface) and groundwater within the Lost River Basin from six known upgradient Solid Waste Management Units (SWMUs) and AOCs that may have impacted the Basin via runoff from surface water tributaries and/or groundwater infiltration.

2. Delineate the horizontal extent of Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), Total Petroleum Hydrocarbons (TPH), Target Analyte List (TAL) metals, and perchlorate detected above action levels in the soil and groundwater samples collected throughout the Lost River Basin during this RFI.

3. Collect sufficient analytical data to complete a site-specific risk assessment (human health and ecological) of the groundwater and soil exposure pathways.

4. Collect the proper data to meet the data quality objectives (DQOs) to support closure of this site based on guidance from the New Mexico Environment Department (NMED).

See the Basewide Quality Assurance Project Plan (QAPP) (Bhate Environmental Associates, Inc. [Bhate], 2003) and the AOC-U, Lost River Basin, RFI Work Plan (NationView, July 2009) for additional background information on HAFB and the AOC-U site.

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2 PROJECT LABORATORY

The analytical work for this project will be preformed by Accutest Southeast of Orlando, Florida (Accutest).

Accutest Southeast
4405 Vineland Road, Suite C-15
Orlando, FL 32811
Phone: (407) 425-6700
Fax: (407) 425-0707

The laboratory personnel who will be involved with this project include:

Ms. Jean Dent-Smith, Accutest Project Manager

Ms. Svetlana Izosimova, Accutest Quality Assurance Officer

Accutest is certified by the National Environmental Laboratory Accreditation Conference (NELAC) and validated by USACE and has extensive previous experience in working on USACE projects. The Accutest Quality Assurance Manual (QAM) and Standard Operating Procedures (SOPs) have been reviewed by NationView and found to meet all the requirements for this project. The QAM and SOPs are available for further review if required.

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3 DATA CATEGORIES

The data use determines the required levels of data quality. The two levels of data quality established by the USACE are screening and definitive. Under this QAPP Addendum, the data to be generated under each level in this investigation are presented in Table 3-1 (Screening) and Table 3-2 (Definitive). The screening data will be generated in the field using field instruments. The definitive data generated by the laboratory will be presented with limited data deliverables (i.e. Level II data packages), using a standard turn-around-time for soil and groundwater samples collected during the investigation. All definitive data produced by the laboratory will also be presented in an electronic data deliverable (EDD) format.

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4 DATA QUALITY ASSURANCE AND QUALITY CONTROL

The general data quality assurance (QA) and quality control (QC) requirements for HAFB are presented in the Basewide QAPP. The field QC requirements for this project are presented in Table 4-1. The project specific laboratory QC limits are listed in Table 4-2.

All final definitive data will be reviewed and validated by a NationView Senior Chemist based on the logic and guidelines of the United States Environmental Protection Agency (USEPA) National Functional Guidelines for Data Validation and the site specific laboratory QC limits presented in this QAPP Addendum.

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5 REFERENCES

Bhate, November 2003. *Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico.*

NationView, July 2009. *RCRA Facility Investigation Work Plan, AOC-U, Lost River Basin, Holloman Air Force Base, New Mexico.*

United States Environmental Protection Agency, October 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*.

United States Environmental Protection Agency, October 2004. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*.

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TABLES

Table 3-1
Summary of Screening Data

Parameter	Matrix	Testing Method
Volatile Organic Compounds (VOCs)	Soil	Organic Vapor Analyzer
Noticeable odors	Soil	Olfactory sense
Noticeable odors	Groundwater	Olfactory sense

Table 3-2
Summary of Definitive Data

Parameter	Matrix	Preparation Method	Analytical Method
Volatile Organic Compounds (VOCs)	Soil	USEPA SW846 Method 5035	USEPA SW846 Method 8260B
Semi-volatile Organic Compounds (SVOCs)	Soil	USEPA SW846 Method 3550B	USEPA SW846 Method 8270C
Total Petroleum Hydrocarbons (TPH)	Soil	USEPA SW846 Methods 5035/3550B	USEPA SW846 Method 8015B
Perchlorate	Soil	USEPA Method 314	USEPA Method 314
TAL Metals	Soil	USEPA SW846 Method 3050B	USEPA SW846 Methods 6010B and 7471A
Moisture Content	Soil	N/A	USEPA SM18 Method 2540B
Dry Bulk Density	Soil	N/A	ASTM Method D2937
Specific Gravity	Soil	N/A	ASTM Method D1429-86
Fractional Organic Carbon Content	Soil	N/A	ASTM Method D2974
VOCs	Groundwater	USEPA SW846 Method 5030B	USEPA SW846 Method 8260B
SVOCs	Groundwater	USEPA SW846 Method 3510C	USEPA SW846 Method 8270C
TPH	Groundwater	USEPA SW846 Method 3510C	USEPA SW846 Method 8015B
TAL Metals	Groundwater	USEPA SW846 Method 3010A	USEPA SW846 Methods 6010B and 7471A
Perchlorate	Groundwater	USEPA SW846 Method 314	USEPA Method 314
Total Dissolved Solids (TDS)	Groundwater	USEPA SM18 Method 2540C	USEPA SM18 Method 2540C
Total hardness	Surface Water	N/A	USEPA SM19 Method 2340B
pH	Surface Water	N/A	USEPA SM19 Method 4500

Notes:
USEPA = United States Environmental Protection Agency
ASTM = American Society for Testing and Materials
TAL = Target Analyte List
pH = Potential of hydrogen
N/A = Not Applicable
SM = Standard Method
SW = USEPA Office of Solid Waste

Table 4-1
Summary of Additional Investigation Field QC Samples

Matrix	Analysis	Number of Field Samples	Trip Blanks [1]	Field Duplicates [2]	Equipment Rinsate Blank [3]	MS [4]	MSD [5]	Total
Soil	VOCs per USEPA SW846 Method 8260B	120	20	12	20	6	6	184
	SVOCs per USEPA SW846 Method 8270C	120	0	12	20	6	6	164
	TPHs per USEPA SW846 Methods 8015B (GRO, DRO, ORO)	120	0	12	20	6	6	164
	Perchlorate per USEPA Method 314	120	0	12	20	6	6	164
	TAL Metals by USEPA SW846 Methods 6010B/7471A	120	0	12	20	6	6	164
	Moisture Content by USEPA SM18 Method 2540B	6	0	0	0	0	0	6
	Dry Bulk Density by ASTM Method D2937	6	0	0	0	0	0	6
	Specific Gravity by ASTM Method D1429-86	6	0	0	0	0	0	6
	Fractional Organic Carbon Content by ASTM Method D2974	6	0	0	0	0	0	6
Groundwater	VOCs per USEPA SW846 Method 8260B	50	20	5	0	3	3	81
	SVOCs per USEPA SW846 Method 8270C	50	0	5	0	3	3	61
	TPHs per USEPA SW846 Methods 8015B (GRO, DRO, ORO)	50	0	5	0	3	3	61
	Perchlorate per USEPA Method 314	50	0	5	0	3	3	61
	TAL Metals by USEPA SW846 Methods 6010B/7471A	50	0	5	0	3	3	61
	Total Dissolved Solids by USEPA SM18 Method 2540C	50	0	5	0	3	3	61
Surface Water	VOCs per USEPA SW846 Method 8260B	3	1	1	0	1	1	7
	SVOCs per USEPA SW846 Method 8270C	3	0	1	0	1	1	6
	TPHs per USEPA SW846 Methods 8015B (GRO, DRO, ORO)	3	0	1	0	1	1	6
	Perchlorate per USEPA Method 314	3	0	1	0	1	1	6
	TAL Metals by USEPA SW846 Methods 6010B/7471A	3	0	1	0	1	1	6
	Total Dissolved Solids by USEPA SM18 Method 2540C	3	0	1	0	1	1	6
	pH by USEPA SM19 Method 4500	3	0	1	0	1	1	6
	Total hardness by USEPA SM19 Method 2340B	3	0	1	0	1	1	6

Notes:

EPA = Environmental Protection Agency
ASTM = American Society for Testing and Materials
VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
TAL = Target Analyte List
TPH = Total Petroleum Hydrocarbons
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
pH = potential of hydrogen
SM = Standard Method
SW = USEPA Office of Solid Waste

[1] Estimated, one trip blank will accompany every shipment of VOC samples
[2] Duplicate samples will be collected at a minimum frequency of 1 for every 10 primary samples collected
[3] Estimated, one equipment rinsate blank will be collected per day
[4] MS samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[5] MSD samples will be collected at a minimum frequency of 1 for every 20 primary samples collected

Table 4-2
Summary of Laboratory QC Limits

Parameter	CAS No.	RL / Evaluation Criteria					LCS				Matrix Spike Water			Matrix Spike Soil		
		Water			Soil		Water		Soil		MS Recovery		MSD	MS Recovery		MSD
		RL	NMWQCC[1]	EPA MCL	RL	SSL[2]	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
VOCs per USEPA SW846 Method 8260B		µg/L	µg/L	µg/L	µg/kg	mg/kg	%	%	%	%	%	%	%	%	%	%
Acetone	67-64-1	25	NV	NV	50	28,100	59	134	61	144	59	134	14	61	144	29
Acetonitrile	75-05-8	20	NV	NV	50	870 [3]	57	123	59	139	57	123	15	59	139	30
Acrolein	107-02-8	20	NV	NV	25	0.206	33	157	27	156	33	157	21	27	156	39
Acrylonitrile	107-13-1	10	NV	NV	25	4.27	62	124	55	144	62	124	13	55	144	24
Allyl chloride	107-05-1	10	NV	NV	25	0.7 [3]	48	136	41	152	48	136	13	41	152	24
Benzene	71-43-2	1	10	5	5	10.3	83	124	78	130	83	124	11	78	130	25
Benzyl Chloride	100-44-7	1	NV	NV	5	1.1 [3]	61	118	74	130	61	118	12	74	130	28
Bromobenzene	108-86-1	1	NV	NV	5	37	83	115	78	123	83	115	10	78	123	30
Bromochloromethane	74-97-5	1	NV	NV	5	NV [4]	78	112	72	122	78	112	10	72	122	23
Bromodichloromethane	75-27-4	1	NV	NV	5	14.4	76	116	73	122	76	116	10	73	122	25
Bromoform	75-25-2	1	NV	NV	5	621	68	128	70	139	68	128	11	70	139	26
n-Butylbenzene	104-51-8	1	NV	NV	5	62.1	84	124	80	138	84	124	10	80	138	31
sec-Butylbenzene	135-98-8	1	NV	NV	5	60.6	86	127	82	132	86	127	10	82	132	29
tert-Butylbenzene	98-06-6	1	NV	NV	5	106	83	126	79	130	83	126	10	79	130	29
Chlorobenzene	108-90-7	1	NV	100	5	194	87	115	83	122	87	115	9	83	122	23
Chloroethane	75-00-3	2	NV	NV	5	63.3	54	166	61	153	54	166	20	61	153	31
Chloroform	67-66-3	1	100	NV	5	4	85	123	79	129	85	123	10	79	129	27
1-Chlorohexane	544-10-5	2	NV	NV	5	NV [4]	87	128	85	137	87	128	10	85	137	29
o-Chlorotoluene	95-49-8	1	NV	NV	5	202	84	121	77	123	84	121	10	77	123	31
p-Chlorotoluene	106-43-4	1	NV	NV	5	5,500 [3]	84	120	78	129	84	120	10	78	129	29
2-Chloroethyl vinyl ether	110-75-8	5	NV	NV	25	NV [4]	63	125	52	142	63	125	24	52	142	25
Carbon disulfide	75-15-0	2	NV	NV	5	460	67	147	61	142	67	147	12	61	142	27
Carbon tetrachloride	56-23-5	1	10	5	5	3.47	74	139	79	135	74	139	13	79	135	29
1,1-Dichloroethane	75-34-3	1	25	NV	5	1,400	82	127	77	132	82	127	10	77	132	26
1,1-Dichloroethylene	75-35-4	1	5	7	5	206	75	133	66	132	75	133	13	66	132	27
1,1-Dichloropropene	563-58-6	1	NV	NV	5	NV [4]	87	127	81	133	87	127	10	81	133	26
1,2-Dibromo-3-chloropropane	96-12-8	2	NV	0.2	5	1.84	61	118	67	129	61	118	15	67	129	29
1,2-Dibromoethane	106-93-4	1	0.1	0.05	5	0.504	80	115	77	126	80	115	10	77	126	24
1,2-Dichloroethane	107-06-2	1	10	5	5	6.04	76	122	78	129	76	122	11	78	129	24
1,2-Dichloropropane	78-87-5	1	NV	5	5	6	81	120	74	127	81	120	11	74	127	27
1,3-Dichloropropane	142-28-9	1	NV	NV	5	1,600 [3]	81	113	78	118	81	113	11	78	118	26
2,2-Dichloropropane	594-20-7	1	NV	NV	5	NV [4]	77	138	80	137	77	138	12	80	137	28
Dibromochloromethane	124-48-1	1	NV	NV	5	14.8	74	116	78	117	74	116	11	78	117	27
Dichlorodifluoromethane	75-71-8	2	NV	NV	5	161	34	158	35	162	34	158	22	35	162	30
cis-1,2-Dichloroethylene	156-59-2	1	NV	70	5	76.5	81	114	74	123	81	114	10	74	123	26
cis-1,3-Dichloropropene	10061-01-5	1	NV	NV	5	NV [4]	83	119	79	130	83	119	10	79	130	23
cis-1,4-Dichloro-2-Butene	1476-11-5	10	NV	NV	25	0.0021 [4]	41	130	71	126	41	130	33	71	126	28
m-Dichlorobenzene	541-73-1	1	NV	NV	5	32.6	86	115	82	126	86	115	9	82	126	29
o-Dichlorobenzene	95-50-1	1	NV	600	5	37.4	85	115	83	123	85	115	9	83	123	28
p-Dichlorobenzene	106-46-7	1	NV	75	5	39.5	87	113	84	124	87	113	10	84	124	28
trans-1,2-Dichloroethylene	156-60-5	1	NV	100	5	112	82	126	77	129	82	126	10	77	129	27
trans-1,3-Dichloropropene	10061-02-6	1	NV	NV	5	NV [4]	87	123	87	131	87	123	10	87	131	27
Ethylbenzene	100-41-4	1	750	700	5	128	87	118	82	124	87	118	10	82	124	25
Ethyl methacrylate	97-63-2	5	NV	NV	25	52.7	68	110	78	118	68	110	11	78	118	30
Freon 113	76-13-1	1	NV	NV	5	3,280	74	139	62	147	74	139	13	62	147	29
2-Hexanone	591-78-6	5	NV	NV	25	NV [4]	58	125	67	130	58	125	14	67	130	29
Hexachlorobutadiene	87-68-3	2	NV	NV	5	12.2	71	133	77	150	71	133	12	77	150	36
Hexane	110-54-3	2	NV	NV	5	38	71	134	65	147	71	134	11	65	147	27

Table 4-2
Summary of Laboratory QC Limits

Parameter	CAS No.	RL / Evaluation Criteria					LCS				Matrix Spike Water			Matrix Spike Soil		
		Water			Soil		Water		Soil		MS Recovery		MSD	MS Recovery		MSD
		RL	NMWQCC[1]	EPA MCL	RL	SSL[2]	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
VOCs per USEPA SW846 Method 8260B		µg/L	µg/L	µg/L	µg/kg	mg/kg	%	%	%	%	%	%	%	%	%	%
Isopropylbenzene	98-82-8	1	NV	NV	5	271	87	131	82	133	87	131	10	82	133	27
p-Isopropyltoluene	99-87-6	1	NV	NV	5	NV [4]	83	125	82	132	83	125	9	82	132	29
4-Methyl-2-pentanone	108-10-1	5	NV	NV	25	5,300 [3]	62	125	69	125	62	125	13	69	125	24
Methacrylonitrile	126-98-7	20	NV	NV	25	3.84	62	133	70	138	62	133	17	70	138	22
Methyl bromide	74-83-9	2	NV	NV	5	8.51	55	151	60	146	55	151	21	60	146	31
Methyl chloride	74-87-3	2	NV	NV	5	120 [3]	55	173	58	163	55	173	22	58	163	26
Methyl iodide	74-88-4	5	NV	NV	10	NV [4]	72	125	66	128	72	125	11	66	128	27
Methyl methacrylate	80-62-6	5	NV	NV	25	2,920	63	115	73	125	63	115	10	73	125	24
Methylene bromide	74-95-3	2	NV	NV	5	179	81	116	75	128	81	116	10	75	128	26
Methylene chloride	75-09-2	5	100	5	10	182	69	125	62	140	69	125	11	62	140	25
Methyl ethyl ketone	78-93-3	5	NV	NV	25	31,800	61	127	66	134	61	127	13	66	134	23
Methyl Tert Butyl Ether	1634-04-4	1	NV	NV	5	388	75	116	70	131	75	116	10	70	131	25
Naphthalene	91-20-3	5	30	NV	5	79.5	59	125	59	143	59	125	15	59	125	31
Pentachloroethane	76-01-7	10	NV	NV	25	5.4 [3]	82	111	64	156	82	111	8	64	156	37
Propionitrile	107-12-0	20	NV	NV	50	NV [4]	69	119	73	133	69	119	12	73	133	23
n-Propylbenzene	103-65-1	1	NV	NV	5	62.1	86	125	78	129	86	125	10	78	129	29
Styrene	100-42-5	1	NV	100	5	100	78	118	79	123	78	118	11	79	123	28
1,1,1,2-Tetrachloroethane	630-20-6	1	NV	NV	5	43.2	81	119	81	121	81	119	10	81	121	25
1,1,1-Trichloroethane	71-55-6	1	60	200	5	563	79	133	80	133	79	133	11	80	133	27
1,1,2,2-Tetrachloroethane	79-34-5	1	10	NV	5	5.55	71	120	70	128	71	120	11	70	128	30
1,1,2-Trichloroethane	79-00-5	1	10	5	5	11.9	80	114	76	118	80	114	11	76	118	28
1,2,3-Trichlorobenzene	87-61-6	1	NV	NV	5	NV [4]	64	126	78	136	64	126	16	78	136	34
1,2,3-Trichloropropane	98-18-4	2	NV	NV	5	0.0861	77	115	74	125	77	115	12	74	125	30
1,2,4-Trichlorobenzene	120-82-1	1	NV	70	5	69.3	68	123	82	137	68	123	11	82	137	32
1,2,4-Trimethylbenzene	95-63-6	2	NV	NV	5	58	82	120	77	129	82	120	10	77	129	29
1,3,5-Trimethylbenzene	108-67-8	2	NV	NV	5	24.8	83	123	79	129	83	123	10	79	129	31
Tetrachloroethylene	127-18-4	1	20	5	5	12.5	80	131	79	132	80	131	12	79	132	27
Toluene	108-88-3	1	750	1,000	5	252	86	116	80	123	86	116	10	80	123	26
Trichloroethylene	79-01-6	1	100	5	5	0.638	85	124	78	132	85	124	10	78	132	28
Trichlorofluoromethane	75-69-4	2	NV	NV	5	588	66	156	67	149	66	156	15	67	149	29
Trans-1,4-Dichloro-2-Butene	110-57-6	10	NV	NV	25	0.0073 [4]	51	137	74	138	51	137	24	74	138	30
Vinyl chloride	75-01-4	1	1	2	5	2.25	57	153	60	145	57	153	22	60	145	29
Vinyl Acetate	108-05-4	10	NV	NV	25	1,070	38	159	25	164	38	159	11	25	164	35
m,p-Xylene		2	620	10,000	10	82	86	121	82	128	86	121	10	82	128	25
o-Xylene	95-47-6	1	620	10,000	5	99.5	83	121	82	126	83	121	10	82	126	25
Dibromofluoromethane (surr)	1868-53-7	--	--	--	--	--	87	116	80	121	--	--	--	--	--	--
Toluene-D8 (surr)	2037-26-5	--	--	--	--	--	86	112	71	130	--	--	--	--	--	--
4-Bromofluorobenzene (surr)	460-00-4	--	--	--	--	--	84	120	59	148	--	--	--	--	--	--
1,2-Dichloroethane-D4 (surr)	17060-07-0	--	--	--	--	--	76	127	77	123	--	--	--	--	--	--

Table 4-2
Summary of Laboratory QC Limits

Parameter	CAS No.	RL / Evaluation Criteria					LCS				Matrix Spike Water			Matrix Spike Soil		
		Water			Soil		Water		Soil		MS Recovery		MSD	MS Recovery		MSD
		RL	NMWQCC[1]	EPA MCL	RL	SSL[2]	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
SVOCs by USEPA SW846 Method 8270C		µg/L	µg/L	µg/L	µg/kg	mg/kg	%	%	%	%	%	%	%	%	%	%
Benzoic Acid	65-85-0	25	NV	NV	830	240,000 [3]	10	50	44	116	10	50	40	44	116	36
2-Chlorophenol	95-57-8	5	NV	NV	170	166	44	103	54	97	44	103	29	54	97	31
4-Chloro-3-methyl phenol	59-50-7	5	NV	NV	170	NV [4]	53	105	59	102	53	105	24	59	102	27
2,4-Dichlorophenol	120-83-2	5	NV	NV	170	183	53	108	60	101	53	108	26	60	101	30
2,4-Dimethylphenol	105-67-9	5	NV	NV	170	1,220	37	91	49	89	37	91	28	49	89	31
2,4-Dinitrophenol	51-28-5	25	NV	NV	830	122	37	111	39	107	37	111	30	39	107	40
4,6-Dinitro-o-cresol	534-52-1	10	NV	NV	330	6.11	62	115	58	109	62	115	26	58	109	37
2-Methylphenol	95-48-7	5	NV	NV	170	3,100 [3]	35	91	53	94	35	91	30	53	94	29
3&4-Methylphenol	--	5	NV	NV	170	3,100 [3]	32	85	54	95	32	85	29	54	95	31
2-Nitrophenol	88-75-5	5	NV	NV	170	NV [4]	49	111	55	96	49	111	30	55	96	30
4-Nitrophenol	100-02-7	25	NV	NV	830	NV [4]	13	55	56	106	13	55	31	56	106	29
Pentachlorophenol	87-86-5	25	NV	NV	830	29.8	57	118	50	115	57	118	26	50	115	33
Phenol	108-95-2	5	NV	NV	170	18,300	13	54	55	99	13	54	34	55	99	28
2,4,5-Trichlorophenol	95-95-4	5	NV	NV	170	6,110	59	106	60	101	59	106	23	60	101	28
2,4,6-Trichlorophenol	88-06-2	5	NV	NV	170	6.11	58	107	60	100	58	107	24	60	100	27
Acenaphthene	83-32-9	5	NV	NV	170	3,730	58	106	59	97	58	106	21	59	97	29
Acenaphthylene	208-96-8	5	NV	NV	170	NV [4]	58	105	58	98	58	105	21	58	98	30
Anthracene	120-12-7	5	NV	NV	170	22,000	65	108	61	104	65	108	19	61	104	29
Benzidine	92-87-5	25	NV	NV	1700	0.0211	15	73	10	156	15	73	23	10	156	50
Benzo(a)anthracene	56-55-3	5	NV	NV	170	6.21	63	111	60	106	63	111	19	60	106	31
Benzo(a)pyrene	50-32-8	5	0.7	0.2	170	0.621	62	106	59	102	62	106	20	59	102	32
Benzo(b)fluoranthene	205-99-2	5	NV	NV	170	6.21	63	109	60	107	63	109	20	60	107	31
Benzo(g,h,i)perylene	191-24-2	5	NV	NV	170	NV [4]	61	111	56	103	61	111	21	56	103	32
Benzo(k)fluoranthene	207-08-9	5	NV	NV	170	62.1	64	111	61	107	64	111	20	61	107	30
4-Bromophenyl phenyl ether	101-55-3	5	NV	NV	170	NV [4]	64	107	60	104	64	107	20	60	104	26
Butyl benzyl phthalate	85-68-7	5	NV	NV	330	260 [3]	59	114	57	110	59	114	20	57	110	28
Benzyl Alcohol	100-51-6	5	NV	NV	170	31,000 [3]	34	98	51	102	34	98	27	51	102	34
2-Chloronaphthalene	91-58-7	5	NV	NV	170	3,990	54	105	57	95	54	105	24	57	95	28
4-Chloroaniline	106-47-8	10	NV	NV	330	2.4 [3]	53	103	19	85	53	103	22	19	85	34
Chrysene	218-01-9	5	NV	NV	170	615	64	111	60	107	64	111	19	60	107	31
bis(2-Chloroethoxy)methane	111-91-1	5	NV	NV	170	180 [3]	48	101	51	89	48	101	28	51	89	30
bis(2-Chloroethyl)ether	111-44-4	5	NV	NV	170	2.44	51	108	50	96	51	108	27	50	96	33
bis(2-Chloroisopropyl)ether	108-60-1	5	NV	NV	170	38.7	43	106	44	94	43	106	27	44	94	32
4-Chlorophenyl phenyl ether	7005-72-3	5	NV	NV	170	NV [4]	61	107	60	101	61	107	20	60	101	26
1,2-Dichlorobenzene	95-50-1	5	NV	600	170	37.4	41	102	47	91	41	102	28	47	91	35
1,3-Dichlorobenzene	541-73-1	5	NV	NV	170	32.6	38	100	45	86	38	100	28	45	86	36
1,4-Dichlorobenzene	106-46-7	5	NV	75	170	39.5	40	100	45	88	40	100	28	45	88	36
2,4-Dinitrotoluene	121-14-2	5	NV	NV	170	122	60	109	59	103	60	109	20	59	103	30
2,6-Dinitrotoluene	606-20-2	5	NV	NV	170	61 [3]	58	104	57	99	58	104	21	57	99	30
3,3'-Dichlorobenzidine	91-94-1	10	NV	NV	330	10.8	57	105	34	88	57	105	25	34	88	31
Dibenzo(a,h)anthracene	53-70-3	5	NV	NV	170	0.621	62	112	57	105	62	112	20	57	105	29
Dibenzofuran	132-64-9	5	NV	NV	170	142	61	108	58	103	61	108	20	58	103	27
Di-n-butyl phthalate	84-74-2	5	NV	NV	330	6,110	62	109	59	105	62	109	20	59	105	27
Di-n-octyl phthalate	117-84-0	5	NV	NV	330	NV [4]	60	120	59	117	60	120	24	59	117	28
Diethyl phthalate	84-66-2	5	NV	NV	330	48,900	62	109	59	106	62	109	19	59	106	27
Dimethyl phthalate	131-11-3	5	NV	NV	330	100,000	63	106	60	100	63	106	19	60	100	26
bis(2-Ethylhexyl)phthalate	117-81-7	5	NV	NV	330	347	59	116	57	111	59	116	21	57	111	29
Fluoranthene	206-44-0	5	NV	NV	170	2,290	65	114	60	110	65	114	21	60	110	32

Table 4-2
Summary of Laboratory QC Limits

Parameter	CAS No.	RL / Evaluation Criteria					LCS				Matrix Spike Water			Matrix Spike Soil		
		Water			Soil		Water		Soil		MS Recovery		MSD	MS Recovery		MSD
		RL	NMWQCC[1]	EPA MCL	RL	SSL[2]	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
SVOCs by USEPA SW846 Method 8270C		µg/L	µg/L	µg/L	µg/kg	mg/kg	%	%	%	%	%	%	%	%	%	%
Fluorene	86-73-7	5	NV	NV	170	2,660	61	106	60	99	61	106	19	60	99	30
Hexachlorobenzene	118-74-1	5	NV	1	170	3.04	62	107	58	103	62	107	20	58	103	27
Hexachlorobutadiene	87-68-3	5	NV	NV	170	12.2	38	107	49	95	38	107	30	49	95	33
Hexachlorocyclopentadiene	77-47-4	5	NV	50	170	366	19	84	36	94	19	84	35	36	94	41
Hexachloroethane	76-72-1	5	NV	NV	170	61.1	35	101	44	89	35	101	29	44	89	38
Indeno(1,2,3-cd)pyrene	193-39-5	5	NV	NV	170	6.21	61	113	57	104	61	113	20	57	104	33
Isophorone	78-59-1	5	NV	NV	170	5,120	56	111	58	97	56	111	26	58	97	30
2-Methylnaphthalene	91-57-6	5	NV	NV	170	310 [3]	56	112	57	103	56	112	26	57	103	32
2-Nitroaniline	88-74-4	10	NV	NV	330	180 [4]	60	109	53	106	60	109	20	53	106	29
3-Nitroaniline	99-09-2	10	NV	NV	330	NV [4]	52	107	29	85	52	107	21	29	85	31
4-Nitroaniline	100-01-6	10	NV	NV	330	24 [3]	59	111	49	104	59	111	21	49	104	31
Naphthalene	91-20-3	5	NV	NV	170	79.5	50	104	54	93	50	104	28	54	93	32
Nitrobenzene	98-95-3	5	NV	NV	170	22.8	52	105	53	92	52	105	28	53	92	32
N-Nitroso-di-n-propylamine	621-64-7	5	NV	NV	170	0.069 [3]	51	104	49	94	51	104	28	49	94	28
N-Nitrosodiphenylamine	86-30-6	5	NV	NV	170	993	57	110	53	107	57	110	19	53	107	28
Phenanthrene	85-01-8	5	NV	NV	170	1,830	65	108	61	103	65	108	20	61	103	32
Pyrene	129-00-0	5	NV	NV	170	2,290	60	113	58	109	60	113	20	58	109	33
1,2,4-Trichlorobenzene	120-82-1	5	NV	NV	170	69.3	45	104	52	93	45	104	28	52	93	32
2-Fluorophenol (surr)	367-12-4	--	--	--	--	--	19	90	45	114	--	--	--	--	--	--
Phenol-d5 (surr)	4165-62-2	--	--	--	--	--	10	68	44	124	--	--	--	--	--	--
2,4,6-Tribromophenol (surr)	118-79-6	--	--	--	--	--	36	137	50	128	--	--	--	--	--	--
Nitrobenzene-d5 (surr)	4165-60-0	--	--	--	--	--	49	119	41	123	--	--	--	--	--	--
2-Fluorobiphenyl (surr)	321-60-8	--	--	--	--	--	45	118	46	122	--	--	--	--	--	--
Terphenyl-d14 (surr)	1718-51-0	--	--	--	--	--	46	135	45	135	--	--	--	--	--	--
TAL Metals by USEPA SW846 Methods 6010B/7470A/7471A		µg/L	µg/L	µg/L	mg/kg	mg/kg	%	%	%	%	%	%	%	%	%	%
Aluminum	7429-90-5	100	NV	NV	10	77,800	87	111	82	116	83	119	25	50	200	30
Antimony	7440-36-0	10	NV	6	1.5	31.3	88	108	82	102	81	124	25	20	200	30
Arsenic	7440-38-2	15	100	10	2	3.9	88	109	85	104	84	124	25	76	111	30
Barium	7440-39-3	10	1,000	2,000	1	15,600	92	112	87	112	85	120	25	52	159	30
Beryllium	7440-41-7	5	NV	4	0.5	156	89	113	84	114	79	121	25	72	105	30
Cadmium	7440-43-9	5	10	5	0.5	39	88	111	87	107	82	119	25	40	130	30
Calcium	7440-70-2	200	NV	NV	20	NV [4]	90	111	82	114	48	153	25	43	165	30
Chromium	7440-47-3	10	50	100	1.5	234	90	113	84	114	73	135	25	70	200	30
Cobalt	7440-48-4	10	50	NV	1	1,520	89	111	87	108	82	119	25	72	106	30
Copper	7440-50-8	15	1,000	1,300	2	3,130	86	112	88	109	82	129	25	37	187	30
Iron	7439-89-6	100	1,000	NV	15	23,500	89	116	87	124	52	155	25	70	200	30
Lead	7439-92-1	9	50	15	0.8	400	89	109	86	107	89	121	25	70	200	30
Magnesium	7439-95-4	200	NV	NV	20	NV [4]	92	113	90	110	62	146	25	64	145	30
Manganese	7439-96-5	10	200	NV	1	3,590	90	110	88	109	79	121	25	40	200	30
Mercury	7439-97-6	0.2	2	2	0.033	6.11	88	111	88	111	88	111	10	88	111	30
Nickel	7440-02-0	40	200	NV	4	1,560	89	111	87	108	84	120	25	61	126	30
Potassium	7440-09-7	3,000	NV	NV	300	NV [4]	89	114	89	109	76	132	25	56	172	30
Selenium	7782-49-2	15	50	50	1.3	391	90	110	83	103	71	140	25	76	104	30
Silver	7440-22-4	10	50	NV	1	391	86	120	87	114	75	141	25	75	141	30
Sodium	7440-23-5	1,000	NV	NV	500	NV [4]	90	117	90	112	70	203	25	78	111	30
Thallium	7440-28-0	15	NV	2	1.20	5.16	88	108	84	106	90	116	25	78	101	30
Vanadium	7440-62-2	10	NV	NV	2	78.2	91	111	88	108	85	120	25	50	169	30
Zinc	7440-66-6	20	10,000	NV	3	23,500	84	111	76	114	60	137	25	70	200	30

Table 4-2
Summary of Laboratory QC Limits

Parameter	CAS No.	RL / Evaluation Criteria					LCS				Matrix Spike Water			Matrix Spike Soil		
		Water			Soil		Water		Soil		MS Recovery		MSD	MS Recovery		MSD
		RL	NMWQCC[1]	EPA MCL	RL	SSL[2]	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
Perchlorate by USEPA Method 314		**mg/L**	**µg/L**	**µg/L**	**µg/kg**	**mg/kg**	%	%	%	%	%	%	%	%	%	%
Perchlorate	7778-74-7	0.01	NV	15 [5]	1	55 [3]	85	115	85	115	80	120	15	80	120	15
TPH by USEPA SW846 Method 8015B		**µg/L**	**µg/L**	**µg/L**	**µg/kg**	**mg/kg**	%	%	%	%	%	%	%	%	%	%
TPH-Gasoline Range Organics (C6-C10)	--	0.25	NA[6]	NV	8.3	NA[6]	63	126	66	122	67	171	31	37	142	17
4-Bromofluorobenzene (surr)	460-00-4	--	--	--	--	--	62	135	62	135	--	--	--	--	--	--
aaa-Trifluorotoluene (surr)	98-08-8	--	--	--	--	--	65	118	65	118	--	--	--	--	--	--
TPH-Diesel Range Organics (C10-C22)	--	0.25	NA[6]	NV	8.3	NA[6]	50	150	50	150	50	150	30	50	150	30
TPH-Oil Range Organics (>C22-C36)	--	0.1	NA[6]	NV	5.0	NA[6]	50	150	50	150	50	150	30	50	150	30
o-Terphenyll (surr)	84-15-1	--	--	--	--	--	57	115	57	115	--	--	--	--	--	--
Total Dissolved Solids by USEPA SM18 Method 2540C		**mg/L**	**mg/L**	**mg/L**	**mg/kg**	**mg/kg**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Total Dissolved Solids	--	10	1,000	500 [7]	--	--	90	110	--	--	--	--	--	--	--	--

Notes:

µg/kg = Micrograms per kilogram
µg/L = Micrograms per liter
EPA = U.S. Environmental Protection Agency
LCL = Lower Control Limit
LCS = Laboratory Control Sample
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
TPH = Total Petroleum Hydrocarbons

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RL = Reporting Limit
RPD = Relative Percent Difference
UCL = Upper Control Limit
VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
TAL = Target Analyte List

NV = No Value
NA = Not Applicable
CAS No. = Chemical Abstract Number
NMED = New Mexico Environmental Department
SSL = Soil Screening Level
MCL = Maximum Contaminant Level
NMWQCC = New Mexico Water Quality Control Commission
SM = Standard Method

SW = USEPA Office of Solid Waste

[1]NMWQCC Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2]NMED, Technical Background Document for Development of Soil Screening Levels, Revision 4.0, June 2006 (Residential Soil)
[3]USEPA Region 3, 6, and 9 Regional Screening Level (RSL) (April 2009)
[4]No Value established for NMED Residential SSL (June 2006) and EPA Region 3, 6, and 9 RSL (April 2009)
[5]USEPA, Interim Drinking Water Health Advisory, for exposure to Perchlorate in water (December 2008)
[6]Combined TPH values (GRO/DRO/ORO) will be compared to the applicable petroleum products presented in the NMED, TPH Screening Guidelines, October 2006
[7]USEPA Secondary Drinking Water Standard

APPENDIX B

HISTORICAL DATA SUMMARIES

B-1

AOC-U

Appendix B-1-1

Portions of: *Draft Final Phase I RCRA Facility Investigation Report Table 2 Solid Waste Management Units*, Radian Corporation, October 1994

Headquarters, Air Combat Command
Langley Air Force Base,
Virginia

Draft Final

Phase I RCRA Facility Investigation Report

Table 2 Solid Waste Management Units

Volume I

October 1994

49th FIGHTER WING

49 CES/CEV
Holloman Air Force Base,
New Mexico

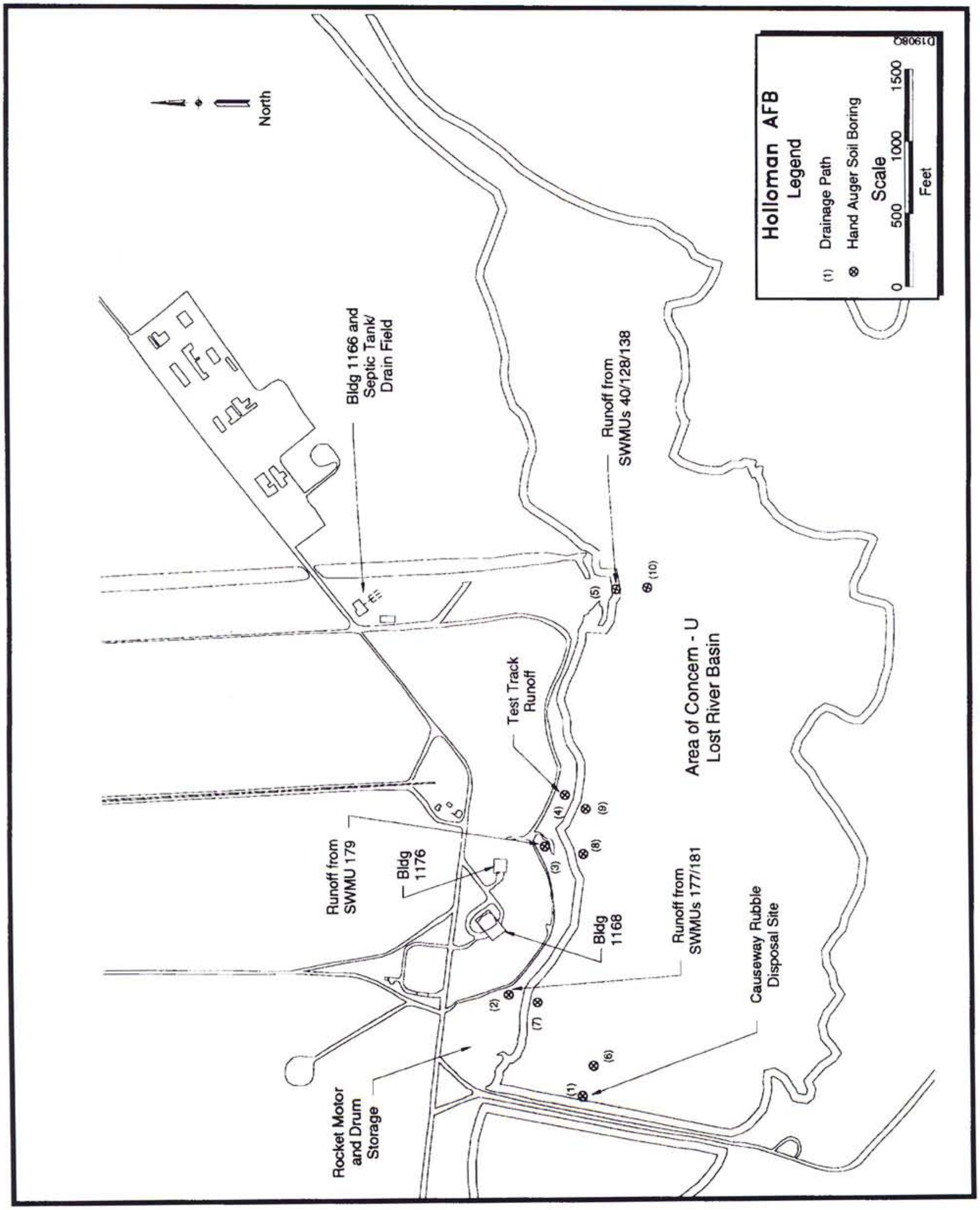

Figure 4.21-1. AOC-U Feature and Sampling Locations

Table 4.21-1
Analytical Results for Soil Samples—AOC-U

Location ID		AOC-U-A01		AOC-U-A01		AOC-U-A02		AOC-U-A02	
Sample ID		**AOC-U-A01-01-01**		**AOC-U-A01-02-01**		**AOC-U-A02-01-01**		**AOC-U-A02-02-01**	
Beg. Depth-End Depth (ft)		**0-2**		**2-4**		**0-2**		**2-4**	
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)									
Hydrocarbons	[1000]	NA		NA		< DL	(36.1)	< DL	(36.5)
SW8240 - Volatile Organics (μg/kg)									
Acetone	[8x10^{6}]	NA		NA		990	(29)	154	(5.8)
Carbon disulfide	[8x10^{6}]	NA		NA		< DL	(1.4)	< DL	(1.4)
Methylene chloride	[9.3x10^{4}]	NA		NA		6 B	(1.4)	5.7 B	(1.4)
Trichloroethene	[NS]	NA		NA		8.5	(2.9)	< DL	(2.9)
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	65.3	(0.0508)	29.8B	(0.0567)	34.7	(0.0576)	24.9	(0.0584)
Cadmium	[80]	0.392 B	(0.252)	< DL	(0.281)	0.304 B	(0.286)	< DL	(0.289)
Chromium	[6.6,8x10^{4}]	9.12	(0.239)	5.19	(0.268)	4.65	(0.272)	4.62	(0.275)
Silver	[0.73,400]	< DL	(0.16)	< DL	(0.179)	< DL	(0.182)	0.521 B	(0.185)
SW7060 - Arsenic (mg/kg)									
Arsenic	[6.88,24]	3.67	(0.323)	< DL	(0.376)	< DL	(0.402)	< DL	(0.376)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	20.1 S	(0.951)	1.85 S	(0.111)	5.18 S	(0.237)	0.557 S	(0.111)
SW7471 - Mercury (mg/kg)									
Mercury	[NS,24]	< DL	(0.0148)	< DL	(0.0171)	< DL	(0.0174)	< DL	(0.0176)
SW7740 - Selenium (mg/kg)									
Selenium	[10.53,400]	1.85 S	(0.244)	5.08 S	(0.285)	4.88 S	(0.304)	3.7 S	(0.285)

Location ID		AOC-U-A03		AOC-U-A03		AOC-U-A04		AOC-U-A04	
Sample ID		**AOC-U-A03-01-01**		**AOC-U-A03-02-01**		**AOC-U-A04-01-01**		**AOC-U-A04-02-01**	
Beg. Depth-End Depth (ft)		**0-2**		**0-2**		**0-2**		**0-2**	
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)									
Hydrocarbons	[1000]	NA		NA		< DL	(36.3)	< DL	(39.9)
SW8240 - Volatile Organics (μg/kg)									
Acetone	[8x10^{6}]	NA		NA		< DL	(5.9)	31.2	(6.1)
Carbon disulfide	[8x10^{6}]	NA		NA		< DL	(1.5)	< DL	(1.5)
Methylene chloride	[9.3x10^{4}]	NA		NA		5.6 B	(1.5)	5.2 B	(1.5)
Trichloroethene	[NS]	NA		NA		< DL	(2.9)	< DL	(3)
SW8270 - Semivolatile Organics TICs (μg/g)									
No other compounds detected	[NS]	–	0	–	0	–	0	–	0
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	37.5	(0.053)	31.9	(0.0577)	45.8	(0.0542)	32.5	(0.0561)
Cadmium	[80]	0.286 B	(0.263)	< DL	(0.286)	< DL	(0.269)	< DL	(0.278)
Chromium	[6.6,8x10^{4}]	5.79	(0.25)	3.48	(0.272)	5.67	(0.256)	3.83	(0.264)
Silver	[0.73,400]	0.4 B	(0.168)	< DL	(0.182)	< DL	(0.171)	< DL	(0.177)
SW7060 - Arsenic (mg/kg)									
Arsenic	[6.88,24]	< DL	(0.37)	< DL	(0.326)	1.72	(0.356)	< DL	(0.343)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	6.77 S	(0.218)	1.8 S	(0.0956)	1.57 S	(0.105)	0.929 S	(0.101)

Table 4.21-1 (Continued)

Location ID		AOC-U-A03		AOC-U-A03		AOC-U-A04		AOC-U-A04	
Sample ID		AOC-U-A03-01-01		AOC-U-A03-02-01		AOC-U-A04-01-01		AOC-U-A04-02-01	
Beg. Depth-End Depth (ft)		0-2		2-4		0-2		2-4	
SW7471 - Mercury (mg/kg)									
Mercury	[NS,24]	0.025 B	(0.0171)	0.0273 B	(0.0188)	< DL	(0.0174)	0.0437 B	(0.019)
SW7740 - Selenium (mg/kg)									
Selenium	[10.53,400]	3.08 S	(0.28)	3.55 S	(0.247)	1.75 S	(0.27)	2.05 S	(0.259)
Location ID		AOC-U-A05		AOC-U-A05		AOC-U-A06		AOC-U-A07	
Sample ID		AOC-U-A05-01-01		AOC-U-A05-02-01		AOC-U-A06-01-01		AOC-U-A07-01-01	
Beg. Depth-End Depth (ft)		0-2		2-4		0-2		0-2	
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)									
Hydrocarbons	[1000]	< DL	(38.3)	< DL	(42.7)	NA		< DL	(36.4)
SW8240 - Volatile Organics (μg/kg)									
Acetone	[8x10 ^{6}]	9.12 BJ	(22.5)	5.36 BJ	(25)	NA		40.8	(5.4)
Carbon disulfide	[8x10 ^{6}]	ND	(4.08)	ND	(4.53)	NA		< DL	(1.4)
Methylene Chloride	[9.3x10 ^{4}]	1.02 BJ	(3.2)	1.25 BJ	(3.55)	NA		4.7 B	(1.4)
Trichloroethene	[NS]	ND	(4.89)	ND	(5.42)	NA		< DL	(2.7)
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	36.8	(0.0541)	24.6	(0.0663)	139	(0.0484)	94.1	(0.0512)
Cadmium	[80]	< DL	(0.268)	< DL	(0.329)	< DL	(0.24)	0.266 B	(0.254)
Chromium	[6.6,8x10 ^{4}]	4.9	(0.255)	4.04	(0.313)	26.2	(0.228)	16.8	(0.241)
Silver	[0.73,400]	< DL	(0.171)	< DL	(0.21)	< DL	(0.153)	< DL	(0.162)
SW7060 - Arsenic (mg/kg)									
Arsenic	[6.88,24]	0.0925 SJ	(0.252)	1.27 S	(0.382)	6.99	(0.363)	6.39	(0.306)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	1.02	(0.0638)	< DL	(0.0968)	16.3 S	(0.427)	13.5 S	(0.36)
SW7471 - Mercury (mg/kg)									
Mercury	[NS,24]	< DL	(0.0185)	0.0424	(0.0203)	< DL	(0.0167)	< DL	(0.0174)
SW7740 - Selenium (mg/kg)									
Selenium	[10.53,400]	2.78 S	(0.225)	4.67 S	(0.342)	2.08 S	(0.274)	1.74 S	(0.231)

Table 4.21-1 (Continued)

Location ID		AOC-U-A08		AOC-U-A09		AOC-U-A10	
Sample ID		AOC-U-A08-01-01		AOC-U-A09-01-01		AOC-U-A10-01-01	
Beg. Depth-End Depth (ft)		0-2		0-2		0-2	
E418.1 - Total Recoverable Petroleum Hydrocarbons (mg/kg)							
Hydrocarbons	[1000]	NA		< DL	(34.5)	< DL	(34.5)
SW8240 - Volatile Organics (µg/kg)							
Acetone	[8x10⁶]	NA		3340	(6)	9.97 BJ	(20.3)
Carbon disulfide	[8x10⁶]	NA		25.4	(1.5)	ND	(3.67)
Methylene Chloride	[9.3x10⁴]	NA		5.6 B	(1.5)	1.19 BJ	(2.88)
Trichloroethene	[NS]	NA		< DL	(3)	ND	(4.4)
SW6010 - Metals (mg/kg)							
Barium	[84.36,5600]	143	(0.0575)	149	(0.057)	64.7	(0.054)
Cadmium	[80]	< DL	(0.285)	< DL	(0.283)	0.431 B	(0.267)
Chromium	[6.6,8x10⁴]	28.6	(0.271)	28.5	(0.269)	12.5	(0.254)
Silver	[0.73,400]	< DL	(0.182)	< DL	(0.18)	< DL	(0.171)
SW7060 - Arsenic (mg/kg)							
Arsenic	[6.88,24]	7.36	(0.28)	7.24	(0.373)	0.23 SJ	(0.267)
SW7421 - Lead (mg/kg)							
Lead	[12.3,500]	17.3 S	(0.826)	15.7 S	(0.44)	6.99	(0.271)
SW7471 - Mercury (mg/kg)							
Mercury	[-0.0006,24]	< DL	(0.0162)	< DL	(0.0167)	0.0486	(0.0167)
SW7740 - Selenium (mg/kg)							
Selenium	[10.53,400]	2.48 S	(0.212)	0.168 SJ	(0.282)	4.1 S	(0.239)

Note: The UTLs and the trigger criteria are presented, respectively, in brackets [ ]; [ ] = trigger criteria for organics; [,] = UTL, trigger criteria for inorganics.

( ) = Detection limit.
B = Analyte detected in associated blank analyses.
DL = Detection limit.
J = Estimated concentration, analyte detected at concentration below the detection limit.
NA = Not analyzed.
ND = Not detected.
NS = Not specified.
S = Analyte concentration obtained using the MSA.

B-2

OT-04 (SWMU 102)

Appendix B-2-1

Portions of: *Draft Final Remedial Investigation (RI) Report Investigation, Study and Recommendation for 29 Waste Sites Holloman Air Force Base, NM*, Radian Corporation, June 1992

DCN 92-269-004-16-07
RCN 269-004-16-06

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REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
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P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

June 1992

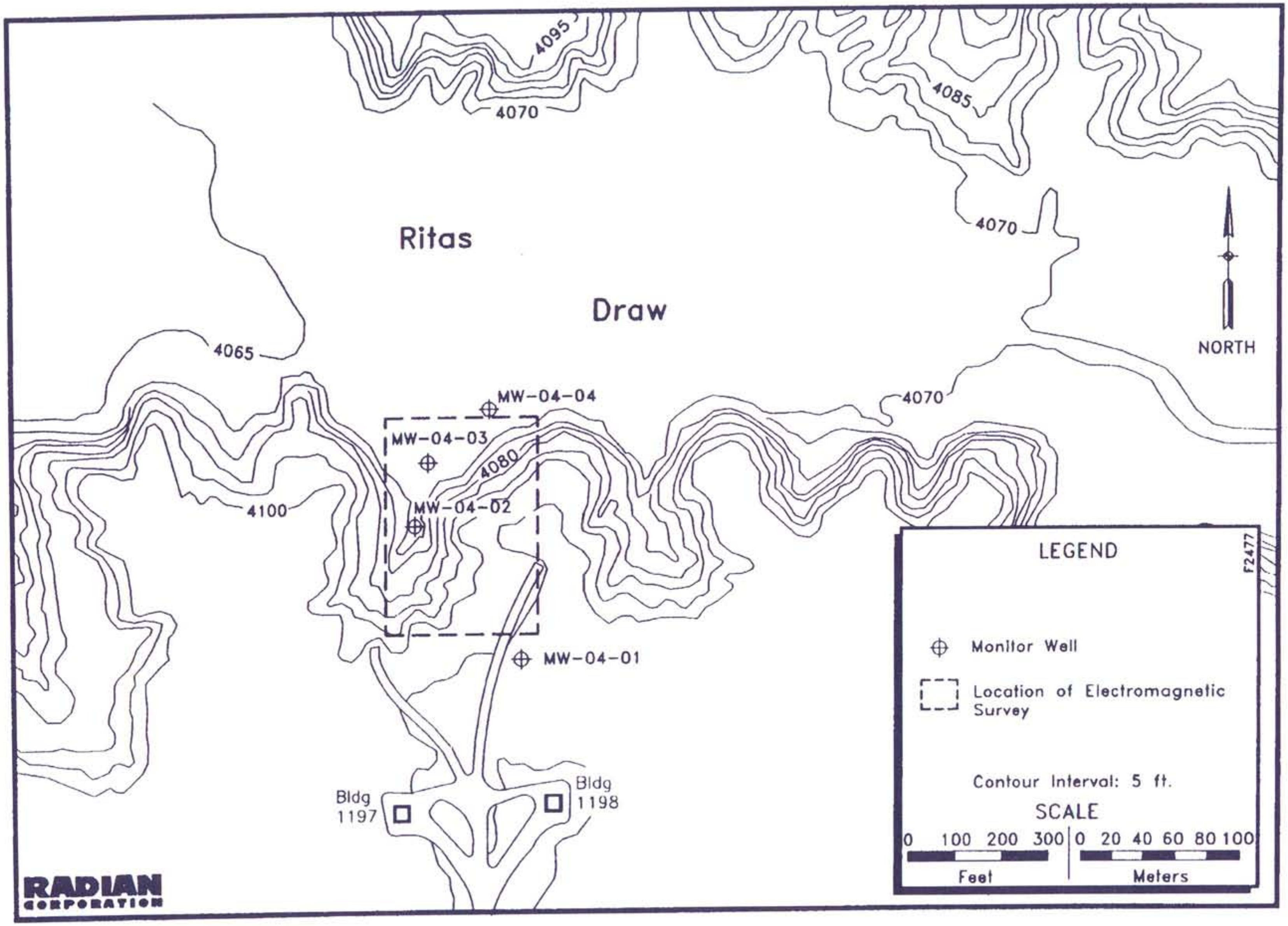


Figure 4-6. Boundary Map and Monitor Well Locations for Site 4

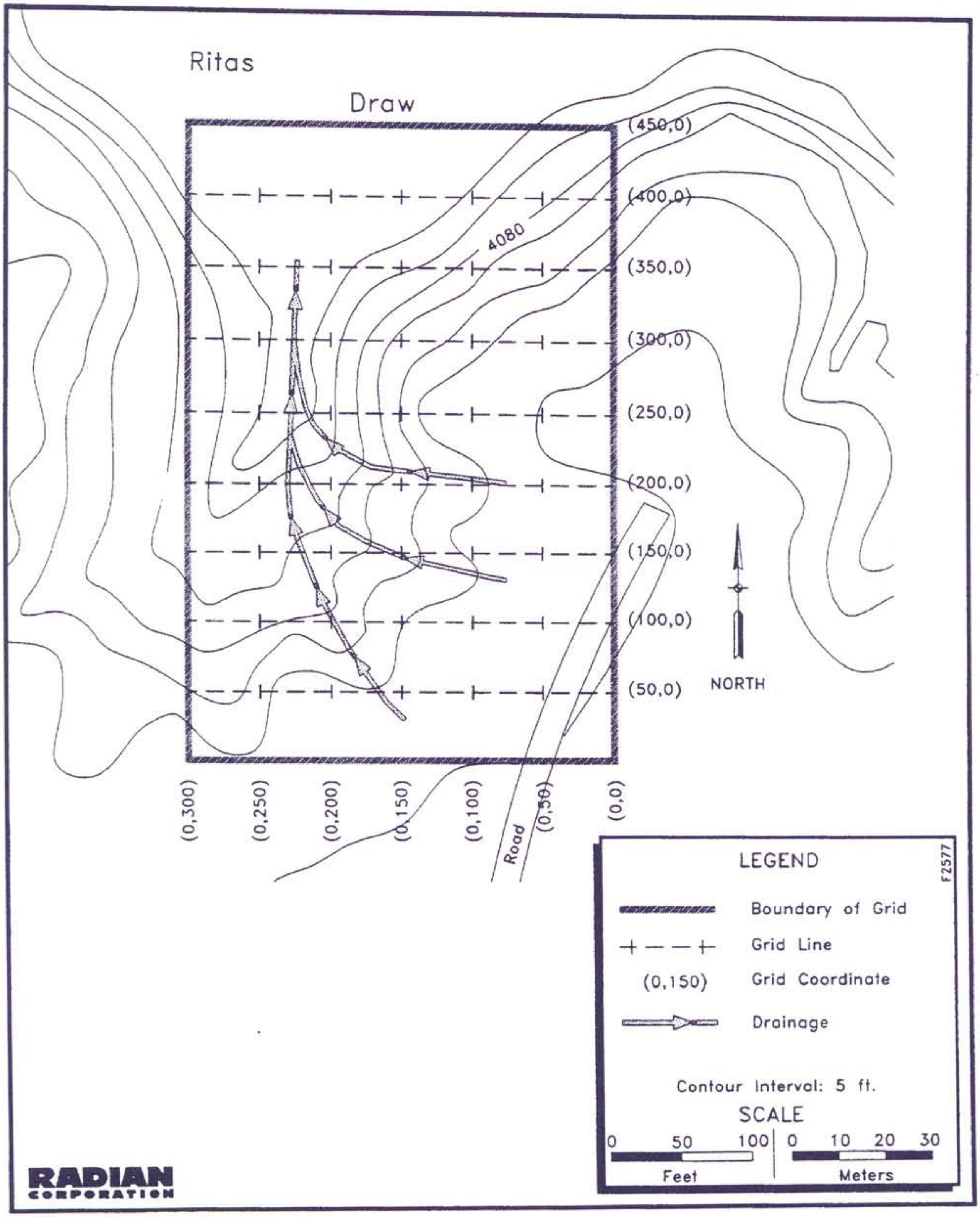


Figure 4-7. Location of EM Survey Grid and Drainages for Site 4

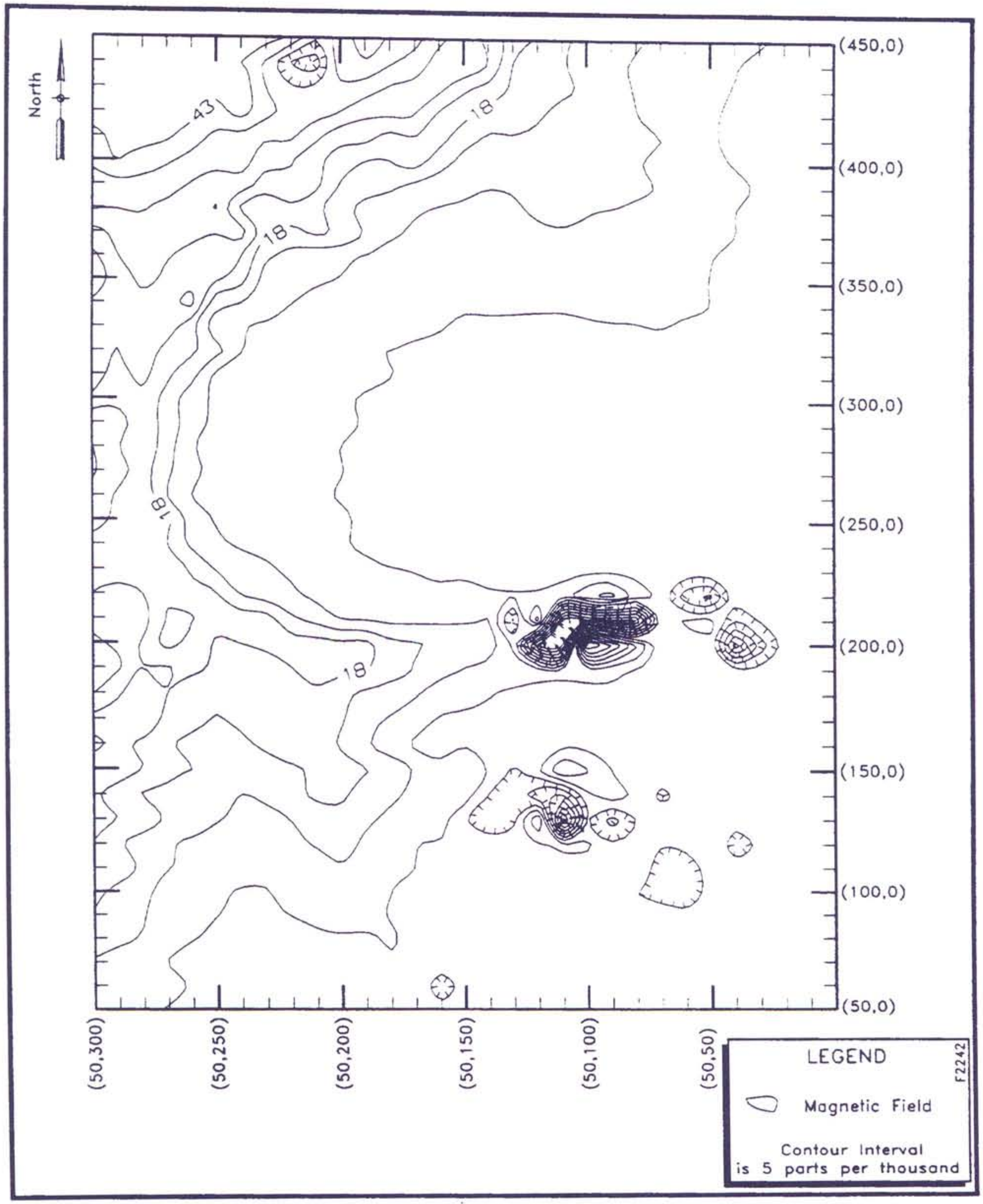


Figure 4-8. Magnetic Results of EM Survey for Site 4

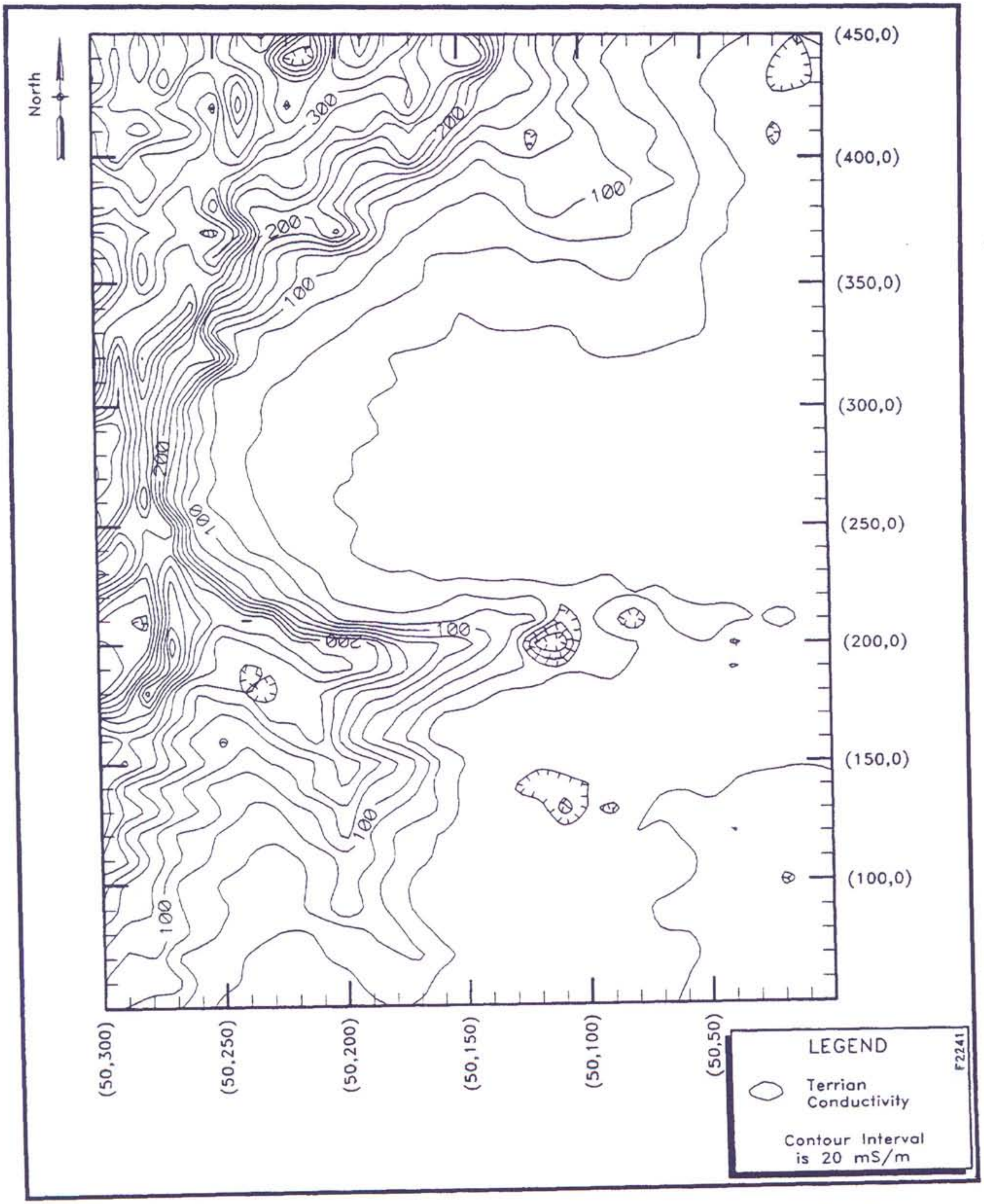


Figure 4-9. Terrain Conductivity Results of EM Survey for Site 4

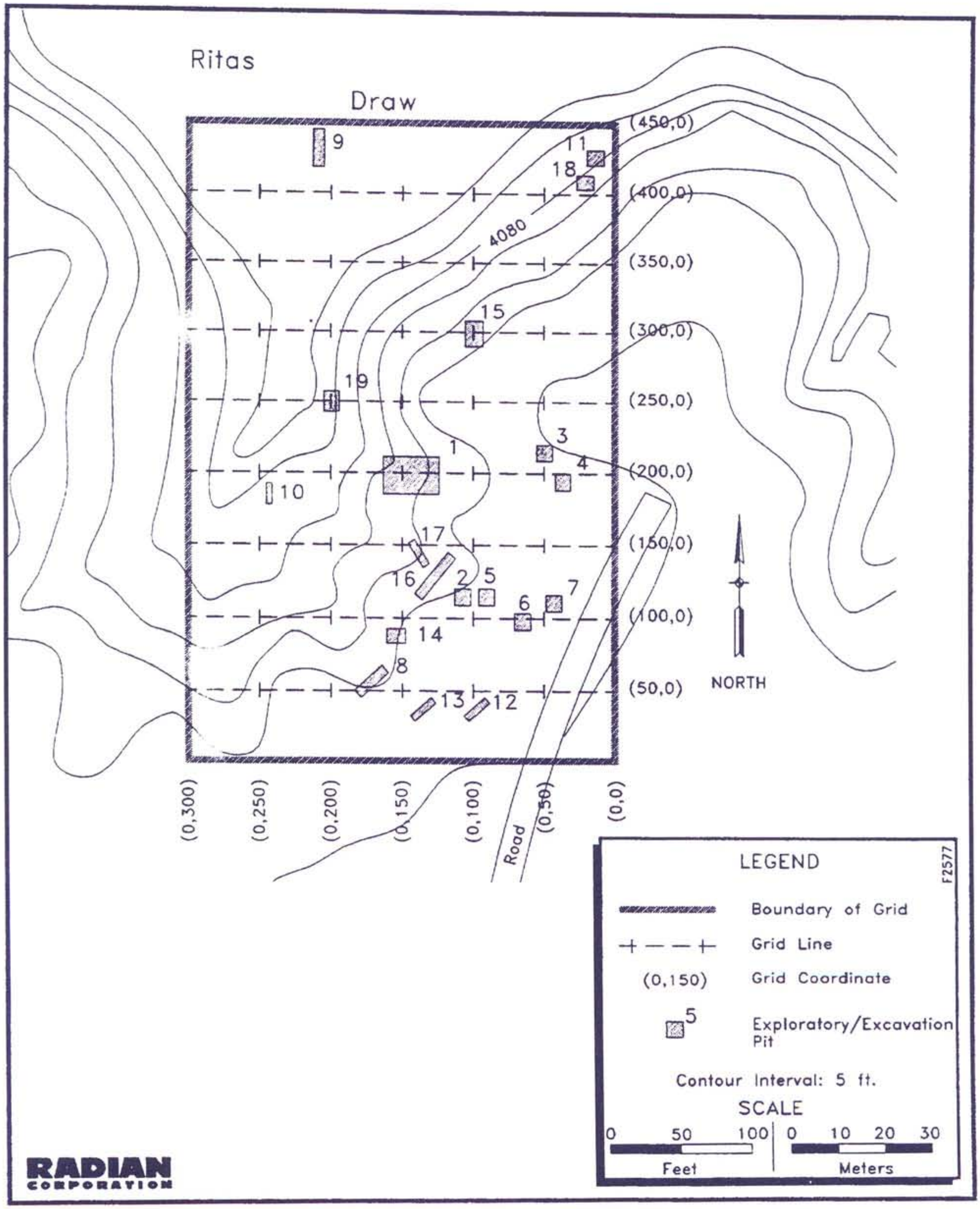


Figure 4-10. Location of Exploratory Pits at Site 4

Table 4-19

Location, Dimensions, and Contents of Exploratory Pits at Site 4

Pit Number	Coordinate	Pit Dimensions (ft)	Description of Waste in Pit
1	(210, 100)	10x40x10	Empty 1650 gallon acid trailer tank
2	(130, 110)	4x4x4	Unidentifiable metallic debris
3	(220, 50)	4x4x4	Three solid rocket boosters and metal scrap
4	(200, 40)	4x4x4	One solid rocket booster and metal scrap
5	(130, 90)	4x4x4	Lab equipment such as burners, piping, weights and balance, and fire extinguisher
6	(100, 65)	4x4x4	Metallic debris and solid rocket booster fuselage
7	(120, 40)	4x4x4	Metallic debris and solid rocket booster fuselage
8	(60, 160)	3x10x5	Fill
9	(440, 210)	5x4x6	Mound of reworked dirt
10	(240, 180)	2x6x2	Native soil
11	(430, 20)	4x4x4	Reworked soil containing asphalt
12	(40, 90)	3x10x5	Native soil and fill
13	(40, 110)	2x10x5	Soil is stained blue. No waste material.
14	(80, 170)	4x5x4	Background
15	(300, 100)	5x5x4	Background confirmation pit - native soil
16	(130, 120)	4x12x6	Six solid rocket boosters
17	(140, 150)	2x6x6	Boxes containing approximately 80 amber bottles filled with chemicals
18	(410, 20)	4x4x4	Reworked soil containing small amounts of asphalt
19	(250, 200)	4x4x4	Background confirmation pit - contained native soil

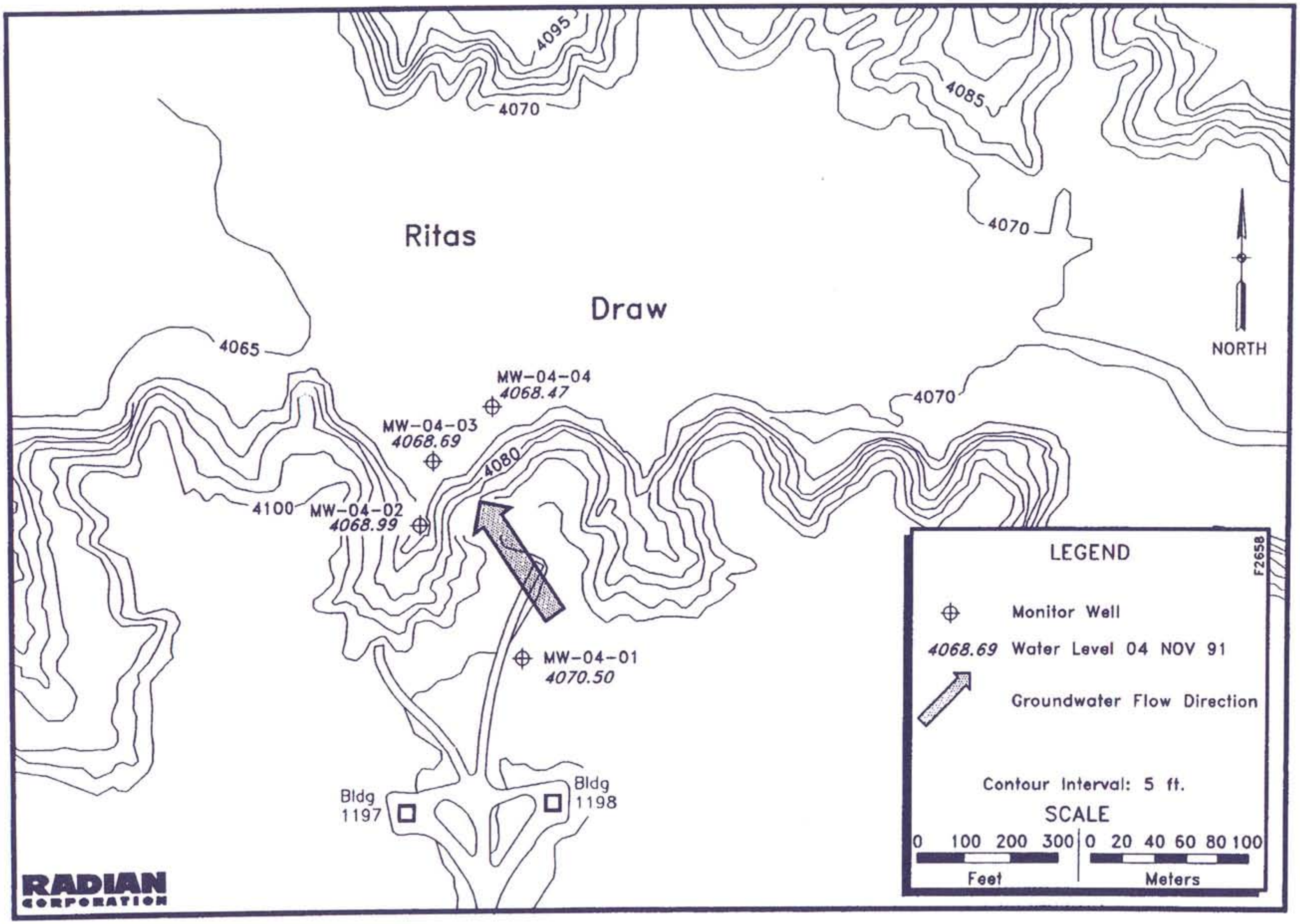


Figure 4-11. Monitor Well Locations and Groundwater Flow Direction for Site 4

Table 4-20

Concentrations of Inorganic Analytes in Site 4 Groundwater Samples

Location: Sample ID:	MW-04-01 04-01-01		MW-04-02 04-02-01		MW-04-03 04-03-01		MW-04-04 04-04-01	
Analytes	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 160.1 - Total Dissolved Solids (mg/L)	17000	(10)	30000	(10)	42000	(10)	66000	(10)
EPA 300.0 - Chloride (mg/L)	6800	(26)	11000	(26)	15000	(26)	30000	(52)
EPA 300.0 - Sulfate (mg/L)	3300	(5.0)	5800	(5.0)	7700	(50)	13000	(50)
EPA 340.2 - Fluoride (mg/L)	1.1	(0.10)	1.2	(0.10)	0.93	(0.10)	0.50	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	23	(0.44)	46	(1.1)	9.4	(0.11)	4.5	(0.11)
EPA 365.2 - Total Phosphorus (mg/L)	0.25	(0.020)	0.28	(0.020)	0.32	(0.020)	0.40	(0.020)
SW6010 - Metals (mg/L)								
Antimony	ND	(0.20)	0.15 @	(0.10)	ND	(0.10)	ND	(0.10)
Cadmium	ND	(0.010)	ND	(0.0050)	ND	(0.0050)	0.0066 @	(0.0050)
Nickel	ND	(0.040)	ND	(0.020)	ND	(0.020)	0.032 @	(0.020)
SW7740 - Selenium (mg/L)	0.033 @	(0.020)	0.023 @	(0.020)	0.032 @	(0.020)	0.071 @	(0.020)

NOTE: Table presents only constituents detected in groundwater at this site.
ND = Not Detected, at the reported detection limit.
@ = Measured result is less than five times the detection limit.

Table 4-21

Concentrations of Organic Analytes in Site 4 Groundwater Samples

Location: Sample ID:	MW-04-01 04-01-01		MW-04-02 04-02-01		MW-04-03 04-03-01		MW-04-04 04-04-01	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (µg/L)	1540	(200)	1900	(200)	527	(200)	3180	(200)
SW8240 - Volatile Organics (µg/L)								
Methylene chloride	8.2 @	(5.0)	5.5 @	(5.0)	39	(5.0)	36	(5.0)

NOTE: Table presents only constituents detected in groundwater at this site.
@ = Measured result is less than five times the detection limit.

Appendix B-2-2

Portions of: *Phase II RCRA Facility Investigation Report Table 1 Solid Waste Management Units Holloman Air Force Base, NM,* Foster Wheeler Environmental Corporation and Radian Corporation, June 1995

DCN 95-670-008-09

Draft Final

PHASE II RCRA FACILITY INVESTIGATION REPORT

TABLE 1 SOLID WASTE MANAGEMENT UNITS
HOLLOMAN AIR FORCE BASE, NM

VOLUME I

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/CEVR
Langley Air Force Base, VA

Prepared by:

Foster Wheeler Environmental Corporation
143 Union Blvd., Suite 1010
Lakewood, Colorado 80203
303/988-2202

Radian Corporation
8501 North Mopac Blvd.
Austin, Texas 78720
512/454-4797

Under Contract No. DACW45-94-D-0003, DO No. 02, WAD 03 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

June 1995

Analytical Results

All groundwater samples collected at SWMU 102 were analyzed for total (unfiltered) selenium using EPA Method SW7740. The analytical results are presented in Table 4.2-1. The concentrations of selenium in groundwater samples collected during the Phase II RFI were generally lower than those measured during the 29 Sites RI. As in the 29 Sites RI, the sample from downgradient monitor well MW-04-04 contained the highest concentration of selenium (0.054 mg/L). However, this was the only Phase II RFI result to exceed the detection limit of 0.05 mg/L. None of the groundwater samples contained total selenium concentrations in excess of the background UTL (0.079 mg/L).

4.2.4 Conclusions

Total selenium concentrations in groundwater samples from SWMU 102 do not exceed the Base-wide background UTL for total selenium. This indicates that the detected selenium concentrations occur naturally in the groundwater at this site and are not a result of past waste disposal practices. Selenium can be eliminated as a COPC at this site.

4.2.5 Recommendations

NFA is recommended for SWMU 102. A Class 3 permit modification request will be completed by Holloman AFB to achieve NFA status. Monitor well MW-04-02 should be abandoned.

Table 4.2-1
Analytical Results for SWMU 102 Groundwater Samples

Location ID		MW-04-01		MW-04-03		MW-04-04		MW-BG-04	
SW7740 (mg/L)	Selenium	0.0086 J	(0.01)	0.011 J	(0.025)	0.054	(0.025)	0.0065 J	(0.05)

J = Estimated concentration; analyte measured below the detection limit.
( ) = Detection limit.

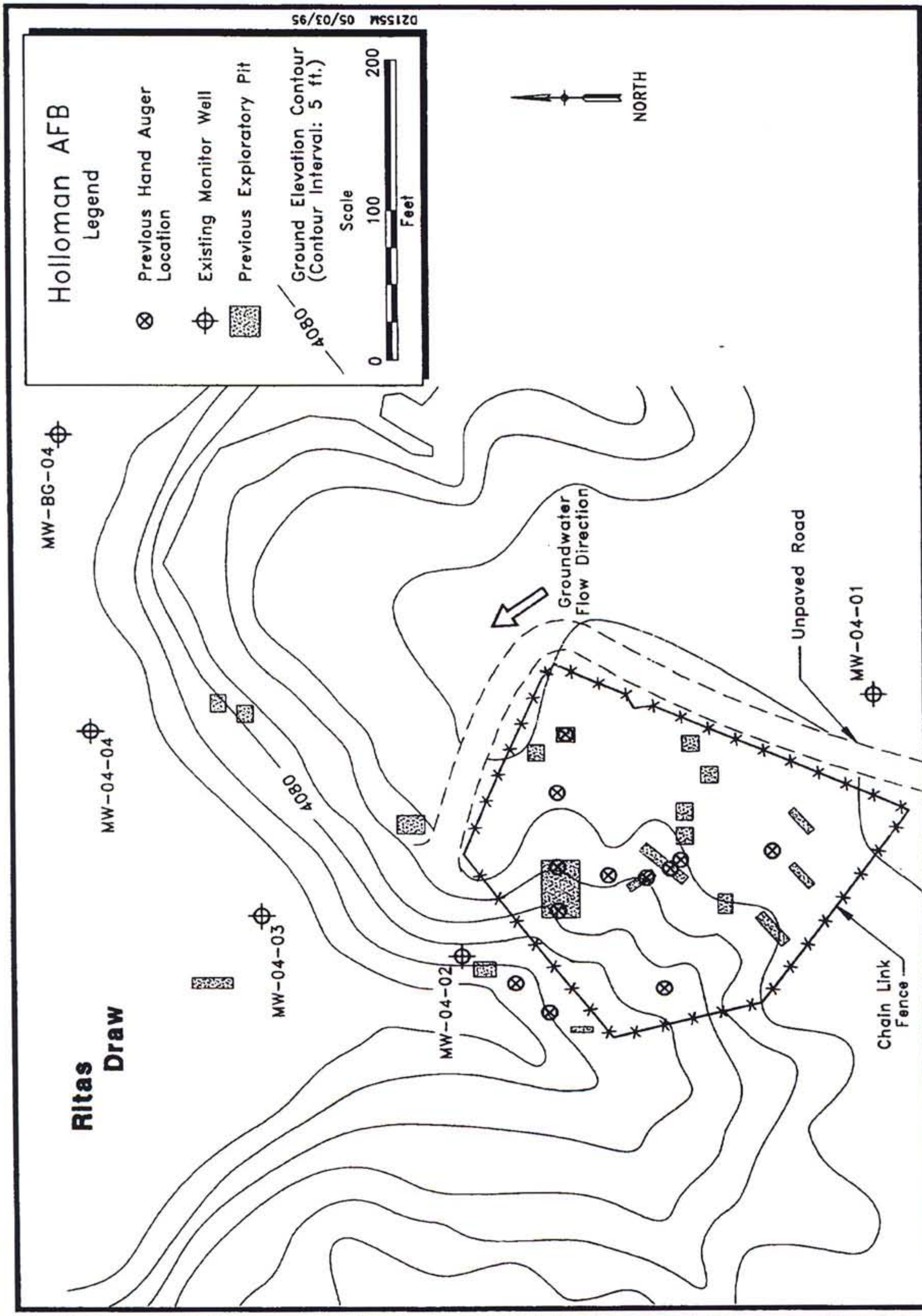


Figure 4.2-1. SWMU 102 - Groundwater Sample Locations

Appendix B-2-3

Portions of: *Decision Documents Installation Restoration Program*, Radian Corporation, September 1995

Headquarters, Air Combat Command
Langley Air Force Base,
Virginia

Decision Documents

Installation Restoration Program

September 1995

49th FIGHTER WING

49 CES/CEV
Holloman Air Force Base,
New Mexico

Declaration

Statutory Preference for Treatment as a Principal Element is not Applicable and a Five-Year Review is not Required

Site Name and Location
IRP Site OT-04 (RCRA SWMU 102)
Acid Trailer Burial Site
Holloman Air Force Base, New Mexico

Statement of Basis and Purpose
This decision document presents the selected remedial action for the referenced site chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record file for this site.

The State of New Mexico concurs on the selected remedy.

Description of the Selected Remedy: No Action
Site investigations and a voluntary remedial action conducted for the site indicate that no action is necessary to protect human health and the environment. As part of the no action remedy, debris was removed from the site and a chain-link fence was erected to prohibit unauthorized access.

Declaration Statement
The remedial investigation, the associated risk assessment, a voluntary remedial action, and the RCRA facilities investigation conducted for the site indicate that conditions at the site do not require further action to ensure the protection of human health and the environment. Because no hazardous substances will remain on site above health-based levels, a five-year review is not necessary.

If new evidence suggesting the need for further action becomes available, the site closeout decision may be changed. Likewise, future changes in land use, environmental regulations, or environmental laws may reverse the closeout decision.

Mark Weidler, Cabinet Secretary
New Mexico Environment Department

Date: 9/29/95

Bruce Carlson
Brigadier General, USAF Commander

Date: 3 Nov 95

B-3

DP-62 (AOC-RD)

Appendix B-3-1

Portions of: *Preliminary Assessment/Site Inspection Report for AOC-Ritas Draw, Holloman Air Force Base, New Mexico, Delivery Order 18, Work Authorization Directive 05,* Groundwater Technology Government Services, Inc., November 11, 1998

AR 1150

GROUNDWATER
TECHNOLOGY
GOVERNMENT SERVICES

Groundwater Technology Government Services, Inc
2501 Yale Boulevard SE, Suite 204 Albuquerque, NM 87106 USA
Tel (505) 242-3113 Fax: (505) 242-1103

November 11, 1998

Mr Michael J Bone, P E
Foster Wheeler Environmental Corporation (FWENC)
143 Union Boulevard, #1010
Lakewood, CO 80228

FINAL

RE: Preliminary Assessment/Site Inspection Report for AOC-Ritas Draw, Holloman Air Force Base, New Mexico, Delivery Order 18, Work Authorization Directive 05

Prime Contract No. DACW-45-94-D-0003
MOA NO. DENS-94-11159JM

Dear Mr Bone·

This letter presents the results of the Preliminary Assessment/Site Inspection (PA/SI), Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI), conducted at Area of Concern (AOC)-Ritas Draw, Holloman Air Force Base (AFB), New Mexico in May 1998 The work consisted of a geophysical survey and collecting direct push technology (DPT) soil and groundwater samples to determine the location and extent of an abandoned drum burial site The work was performed in accordance with the standard operating procedures (SOPs) established in the "Field Sampling Plan and Quality Assurance Project Plan for Preliminary Assessment/Site Inspection for AOC-Ritas Draw, Holloman AFB, New Mexico" (Foster Wheeler Environmental Corporation [FWENC] and Groundwater Technology, 1998)

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of the investigation was to determine the location and extent of potential chemicals that might have been released at the abandoned drum burial site A geophysical survey was conducted at the site to locate possible buried drums related to missile testing that occurred at Holloman AFB during the 1950s Based upon the geophysical survey results, close proximity to potential source areas was investigated using DPT A total of four DPT borings were installed at AOC-Ritas Draw.

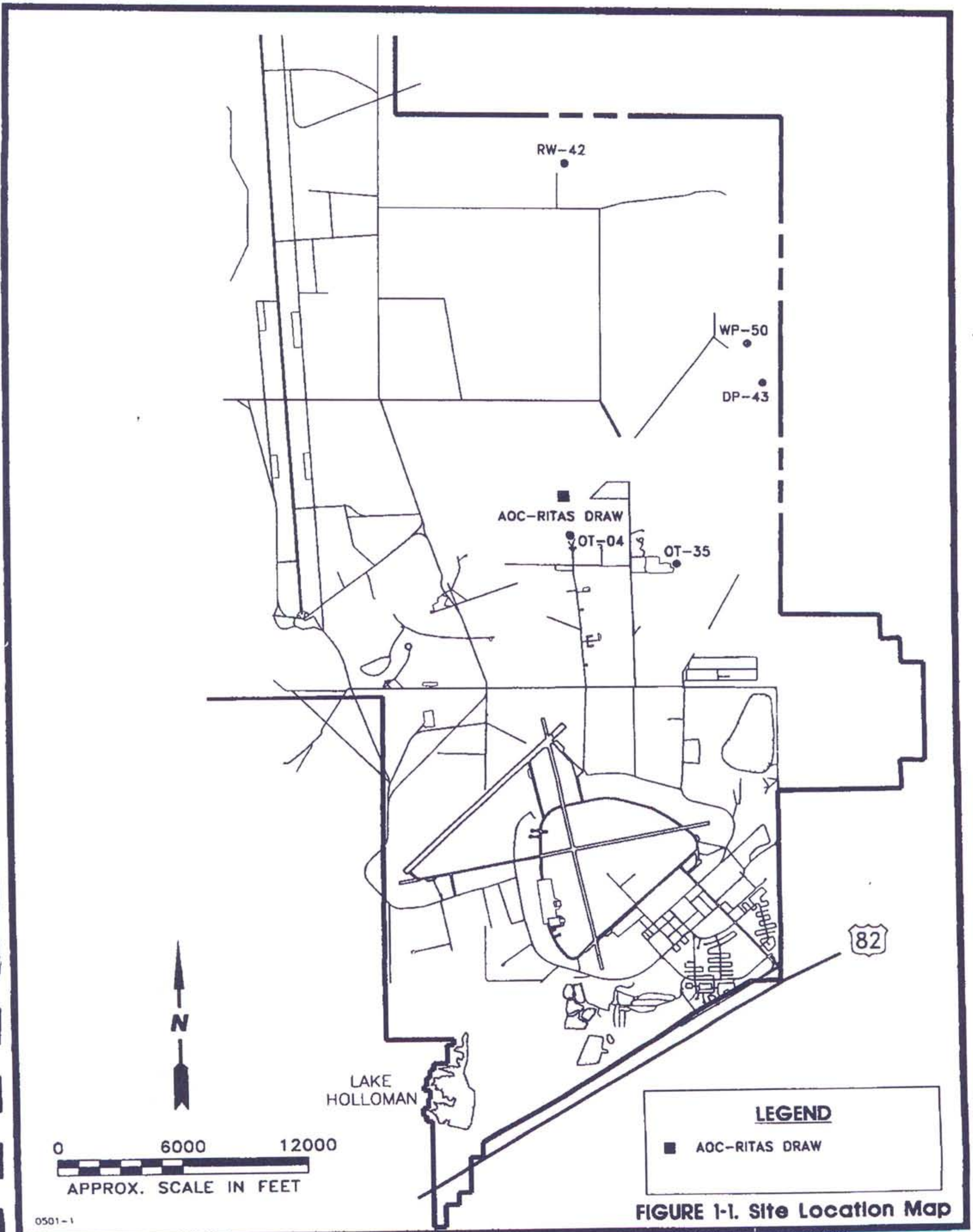


FIGURE 1-1. Site Location Map

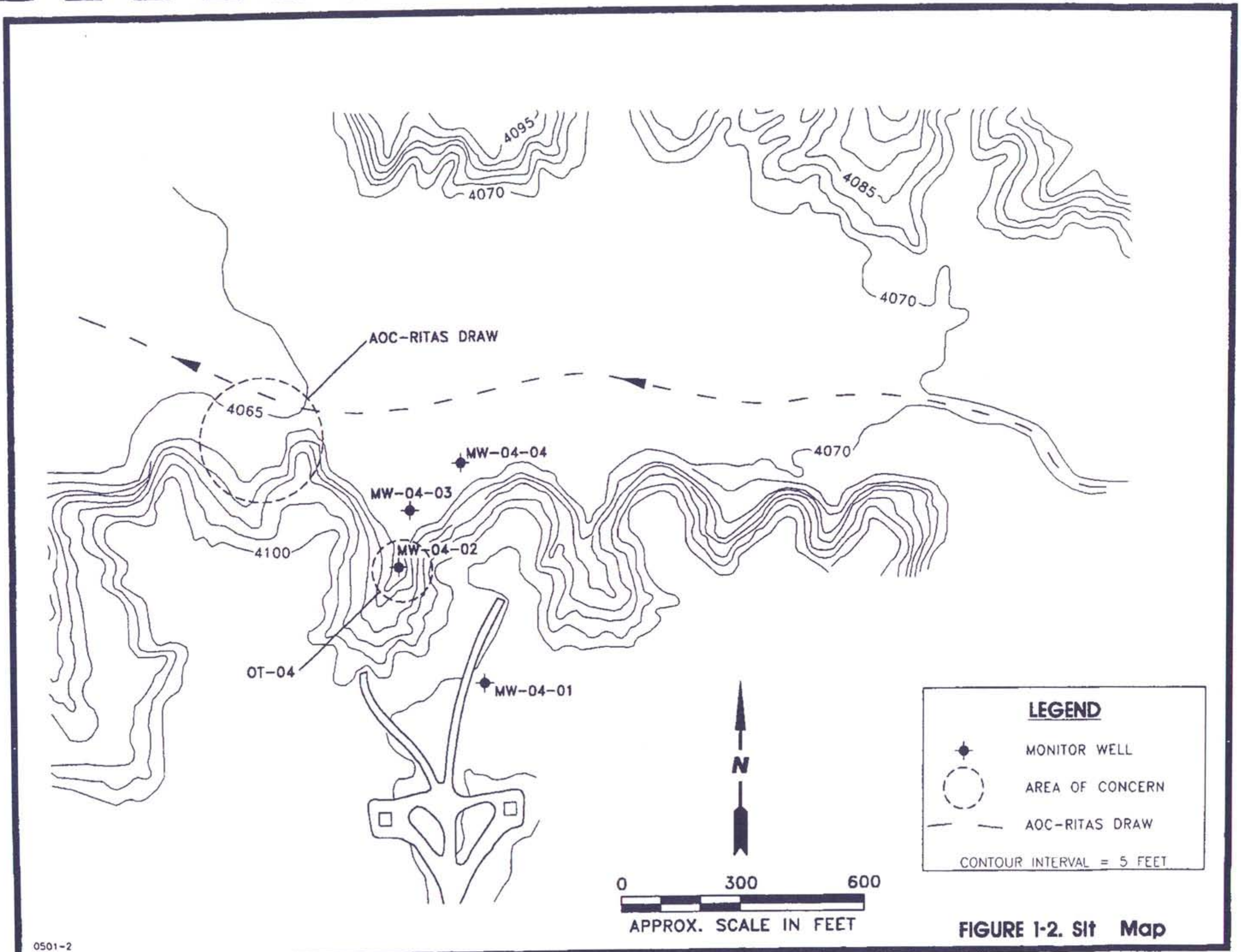


FIGURE 1-2. Sit Map

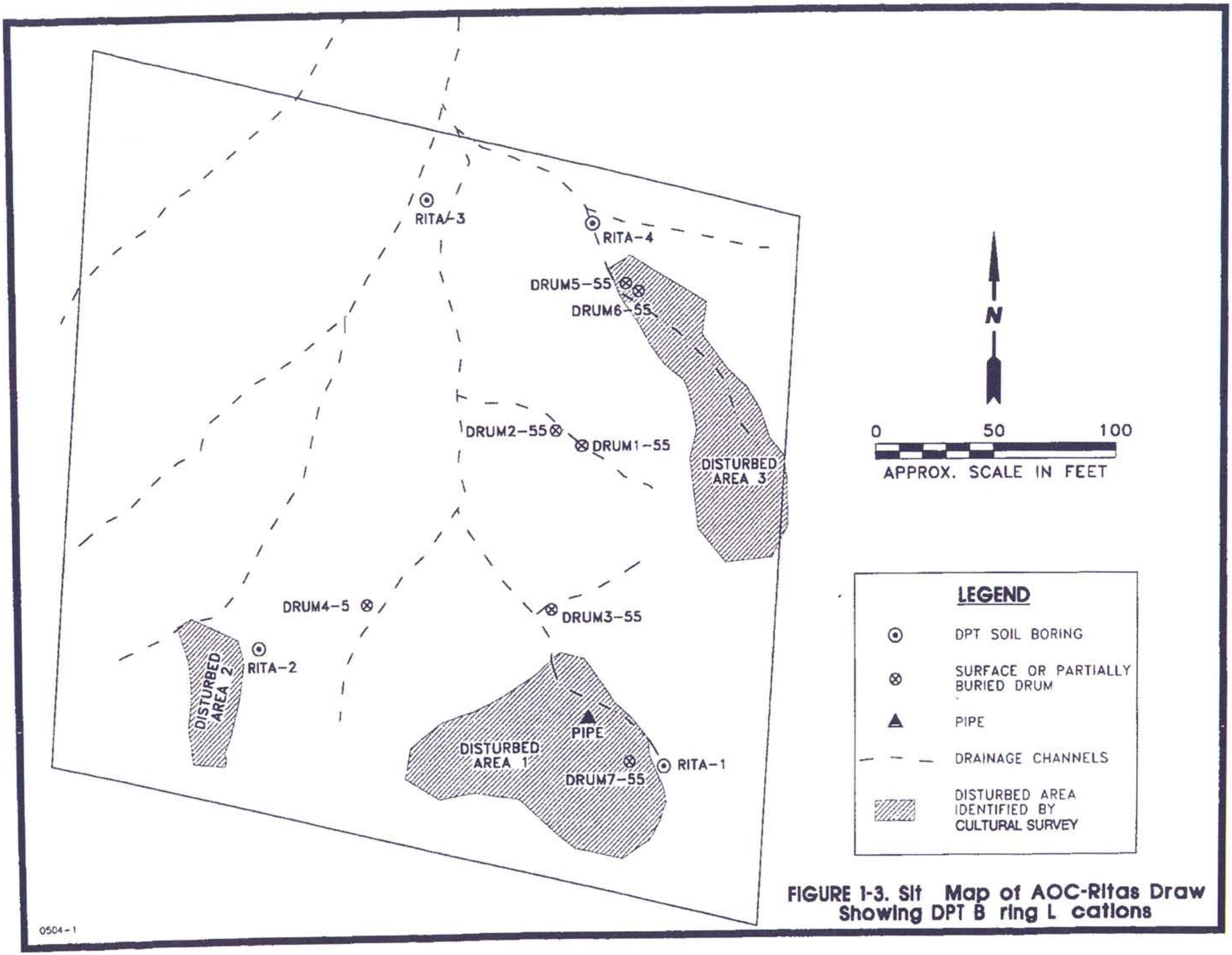


FIGURE 1-3. Sit Map of AOC-Ritas Draw Showing DPT B ring L cations

TABLE 1
SOIL ANALYTICAL RESULTS
AOC-RITAS DRAW
HOLLOMAN AFB, NEW MEXICO
MAY 21, 1998

Sample ID	RITA-1-2	RITA-1-9	RITA-1-15	RITA-1-20	RITA-2-2	RITA-2-5	RITA-2-12	RITA-2-12-DUP	RITA-2-18	RITA-3-2	RITA-4-2	RITA-4-8
Depth (ft)	**2**	**9**	**15**	**20**	**2**	**5**	**12**	**12**	**18**	**2**	**2**	**8**
VOCs-EPA SW-846 Method 8260A (μg/kg)												
Acetone	15J,BL	16J	13J	10J	17J	11J	20	23	25	12J	16J	18J
Methylene Chloride	4.7J,BL	ND<5.0	ND<5.0	ND<5.0	ND<5.0	ND<5.0	ND<5.0	ND<5.0	ND<5.0	ND<5.0	ND<5.0	ND<5.0
2-Butanone (MEK)	ND<20	ND<20	ND<20	ND<20	ND<20	ND<20	ND<20	ND<20	ND<20	ND<20	ND<20	8.4J
All others	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SVOCS-EPA SW-846 Method 8270B (μg/kg)												
All analytes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitroaromatics and Nitramines-EPA SW-846 Method 8330 (μg/g)												
All analytes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TAL Metals-EPA SW-846 Methods 6010B/7471A (mg/kg)												
Arsenic	1.8B	2.0	1.5B	1.2B	ND<5.0	ND<1.0	17.4	9.1	1.1B	0.98B	0.80B	1.4B
Cadmium	ND<1.0	0.37B	0.39B	ND<1.0	ND<2.5	0.084B	0.17B	0.16B	0.13B	ND<1.0	0.17B	0.15B
Lead	1.9	5.1	5.3	0.39B	ND<1.5	0.71	0.79	ND<0.60	0.89	0.48B	2.0	1.2
Antimony	1.8B	1.5B	1.7B	1.9B	2.6B	ND<1.0	1.7B	1.6B	1.6B	1.6B	0.90B	1.7B
Selenium	ND<1.0	1.3	ND<1.0	ND<1.0	ND<2.5	ND<0.50	0.56B	0.53B	ND<1.0	ND<1.0	0.61	ND<1.0
Thallium	ND<2.0	1.1B	ND<2.0	ND<2.0	1.9B	ND<1.0	ND<2.0	ND<2.0	ND<2.0	ND<2.0	ND<1.0	ND<2.0
Silver	ND<2.0	ND<2.0	ND<2.0	ND<2.0	ND<2.0	ND<1.0	ND<2.0	0.75B	ND<2.0	ND<2.0	ND<1.0	ND<2.0
Aluminum	2,270	11,800	12,600	1,390	478	1,680	944	979	2,350	994	3,540	2,220
Barium	26.6	79.3	29.0	27.3	10.7	15.4	9.3	9.2	22.0	10.9	10.2	4.4
Beryllium	ND<0.40	0.61	0.67	ND<0.40	ND<0.40	0.11B	ND<0.40	ND<0.40	ND<0.40	ND<0.40	0.25	ND<0.40
Calcium	164,000	154,000	179,000	146,000	199,000	15,400	168,000	164,000	136,000	146,000	67,600	136,000

TABLE 1 (Concluded)
SOIL ANALYTICAL RESULTS
AOC-RITAS DRAW
HOLLOMAN AFB, NEW MEXICO
MAY 21, 1998

Sample ID	RITA-1-2	RITA-1-9	RITA-1-15	RITA-1-20	RITA-2-2	RITA-2-5	RITA-2-12	RITA-2-12-DUP	RITA-2-18	RITA-3-2	RITA-4-2	RITA-4-8
Depth (ft)	**2**	**9**	**15**	**20**	**2**	**5**	**12**	**12**	**18**	**2**	**2**	**8**
TAL Metals-EPA SW-846 Methods 6010B/7471A (mg/kg) (continued)												
Cobalt	0 91B	3.5	4.1	ND<2.0	ND<2.0	0.46B	0 64B	1 3B	ND<2 0	ND<2 0	1 4	1 3B
Chromium	3 1	14 8	14 5	4 2	ND<2 0	3 9	1 8B	2 4	1 8B	1 5B	4 5	1 9B
Copper	1.4B	5.0	4 7	ND<4.0	ND<4 0	0 49B	0 78B	1.2B	ND<4 0	ND<4 0	1 9B	1 8B
Iron	326	2,240	6,680	1,190	888	1,160	3,940	5,200	1,480	569	3,960	2,500
Potassium	484B	3,150	3,280	325B	ND<1,000	388B	259B	355B	479B	208B	955	540B
Magnesium	2,830	7,290	5,600	735	611	764	468	471	1,090	718	2,530	2,600
Manganese	47 7	99 3	232	12 9	5.3	17 1	9 6	11 1	16.7	15 7	80 8	23 8
Sodium	ND<1,000	798B	1,560	ND<1,000	ND<1,000	ND<500	ND<1,000	ND<1,000	ND<1,000	480B	920	1,310
Nickel	2 4B	11.0	11.5	2.9B	ND<8 0	1 8B	ND<8 0	1.6B	1 5B	1.2B	3 9B	2 5B
Vanadium	8.5	21 0	17.5	2 4	1 1B	3.0	22 8	16.9	3.6	2.1	7 0	5 2
Zinc	6 2	25 8	28.4	3.8B	1 3B	3.1	2 6B	3 3B	4 9	3.3B	9 0	7 5
Mercury	ND<0 033	ND<0 033	ND<0.033	ND<0 033	ND<0 033	ND<0.033	ND<0 033	ND<0 033	ND<0 033	ND<0 033	ND<0 033	ND<0 033

<	Indicates compound not detected at or above the RL
B	Estimated result, result is less than RL
BL	Method blank contamination The associated method blank contains the target analyte at a reportable level
ft	Feet
J	Estimated result, result is less than RL
mg/kg	Milligrams per kilogram
ND	Not detected
RL	Reporting limit
SVOCs	Semivolatile organic compounds
TAL	Target Analyte List
µg/kg	Micrograms per kilogram
VOCs	Volatile organic compounds

TABLE 2
GROUNDWATER ANALYTICAL RESULTS
AOC-RITAS DRAW
HOLLOMAN AFB, NEW MEXICO
MAY 21, 1998

Sample ID	RITA-3-GW-7	RITA-3-GWDP-7	RITA-4-GW-8
VOCs-EPA SW-846 Method 8260A (μg/L)			
Benzene	ND<1 0	ND<1 0	0 27J
Ethylbenzene	ND<1 0	ND<1 0	0 22J
2-Butanone (MEK)	ND<5 0	ND<5 0	1.2J
4-Methyl-2-pentanone	ND<5.0	ND<5 0	0 72J
Toluene	ND<1.0	ND<1 0	0 29J
Xylenes (total)	ND<1.0	ND<1.0	0.88J
All others	ND	ND	ND
SVOCS-EPA SW-846 Method 8270B (g/L)			
All analytes	ND	ND	ND
Nitroaromatics and Nitramines-EPA SW-846 Method 8330 (μg/L)			
All analytes	ND	ND	ND
TAL Metals-EPA SW-846 Methods 6010B/7470A (mg/L)			
Arsenic	0 032	0.029	0 017B
Cadmium	ND<0 010	0 0012B	ND<0 010
Lead	ND<0 014G	ND<0 015G	ND<0 014G
Antimony	0.034	0 036	0.032
Selenium	ND<0.026G	ND<0 023G	ND<0.017G
Thallium	ND<0 020	ND<0 020	ND<0 020
Silver	ND<0 10	ND<0.10	ND<0.050
Aluminum	ND<1 0	ND<1 0	ND<0 50
Barium	ND<0 10	ND<0 10	ND<0.050
Beryllium	ND<0 020	ND<0 020	ND<0 010
Calcium	828	823	799
Cobalt	ND<0 10	ND<0 10	ND<0 050
Chromium	ND<0 10	ND<0 10	ND<0.050
Copper	ND<0.20	ND<0.20	0.014B
Iron	ND<1 0	ND<1.0	0 63
Potassium	63 2	63 8	54.6
Magnesium	1,840	1,830	1,660
Manganese	0 13	0 11	0 36
Sodium	11,600	11,600	9,490

TABLE 2 (Concluded)
GROUNDWATER ANALYTICAL RESULTS
AOC-RITAS DRAW
HOLLOMAN AFB, NEW MEXICO
MAY 21, 1998

Sample ID	RITA-3-GW-7	RITA-3-GWDP-7	RITA-4-GW-8
TAL Metals-EPA SW-846 Methods 6010B/7470A (mg/L) (continued)			
Nickel	ND<0 40	ND<0 40	ND<0 20
Vanadium	ND<0 10	0 042B	ND<0 050
Zinc	ND<0.20	ND<0.20	ND<0.10
Mercury	ND<0 00020	ND<0 00020	ND<0.00020

<	Indicates compound not detected at or above the RL.
B	Estimated result; result is less than RL
G	Elevated reporting limit The reporting limit is elevated due to matrix interference.
J	Estimated result, result is less than RL
mg/L	Milligrams per liter
ND	Not detected
RL	Reporting limit
SVOCs	Semivolatile organic compounds
TAL	Target Analyte List
µg/L	Micrograms per liter
VOCs	Volatile organic compounds

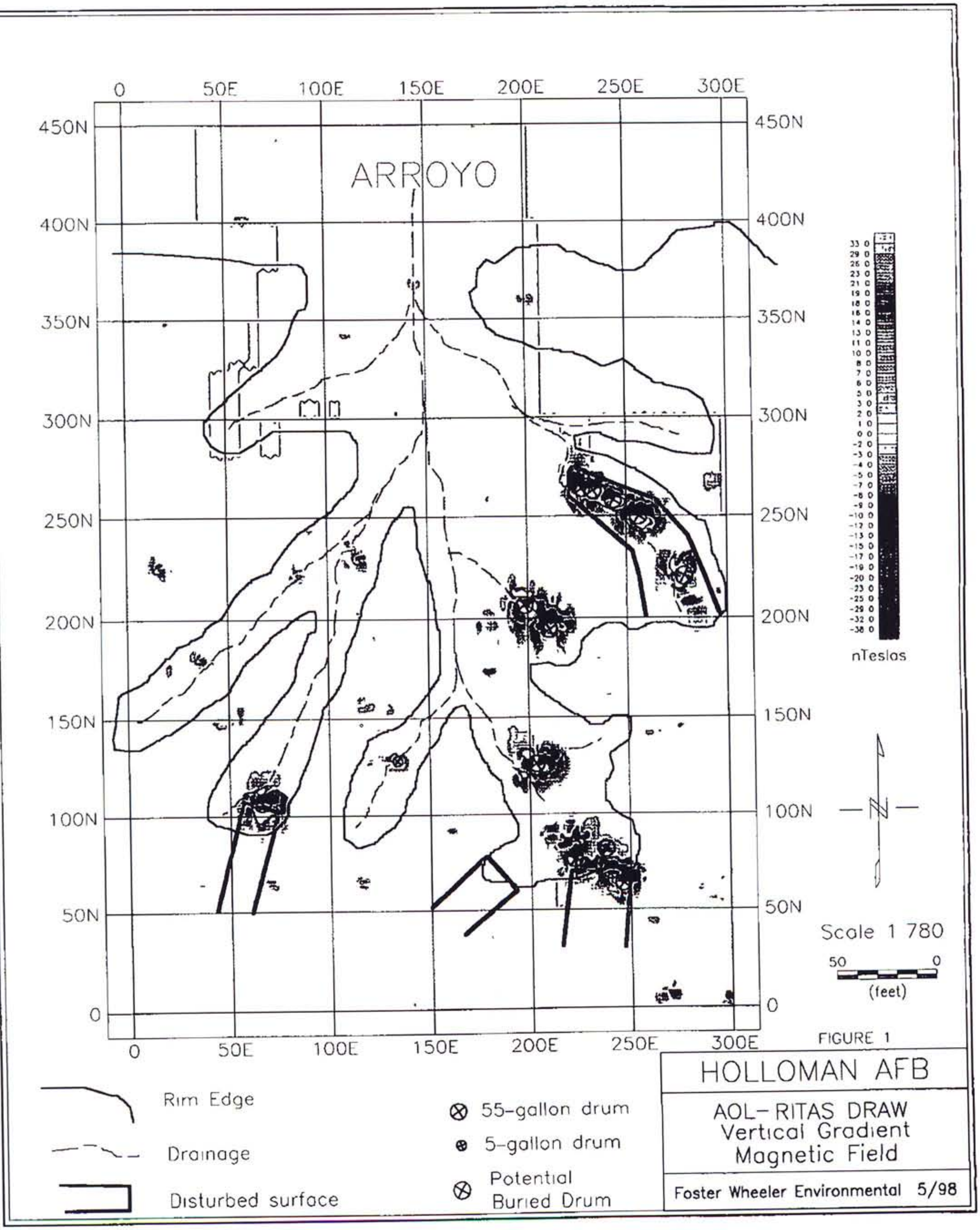


FIGURE 1

HOLLOMAN AFB

AOL-RITAS DRAW
Vertical Gradient
Magnetic Field

Foster Wheeler Environmental 5/98

Appendix B-3-2

Portions of: *RCRA Facility Investigation Report ERP Site No. DP-62, Ritas Draw Holloman Air Force Base, New Mexico,* Bhate Environmental Associates, Inc., August 2004

RCRA FACILITY INVESTIGATION REPORT

ERP SITE NO. DP-62, RITAS DRAW
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49CES/CEV
Holloman Air Force Base
New Mexico

Under Contract To:

U.S. Army Corps of Engineers
Omaha, Nebraska
Under Contract No. DACA45-03-D-0012
Delivery Order No. 05, WAD 03

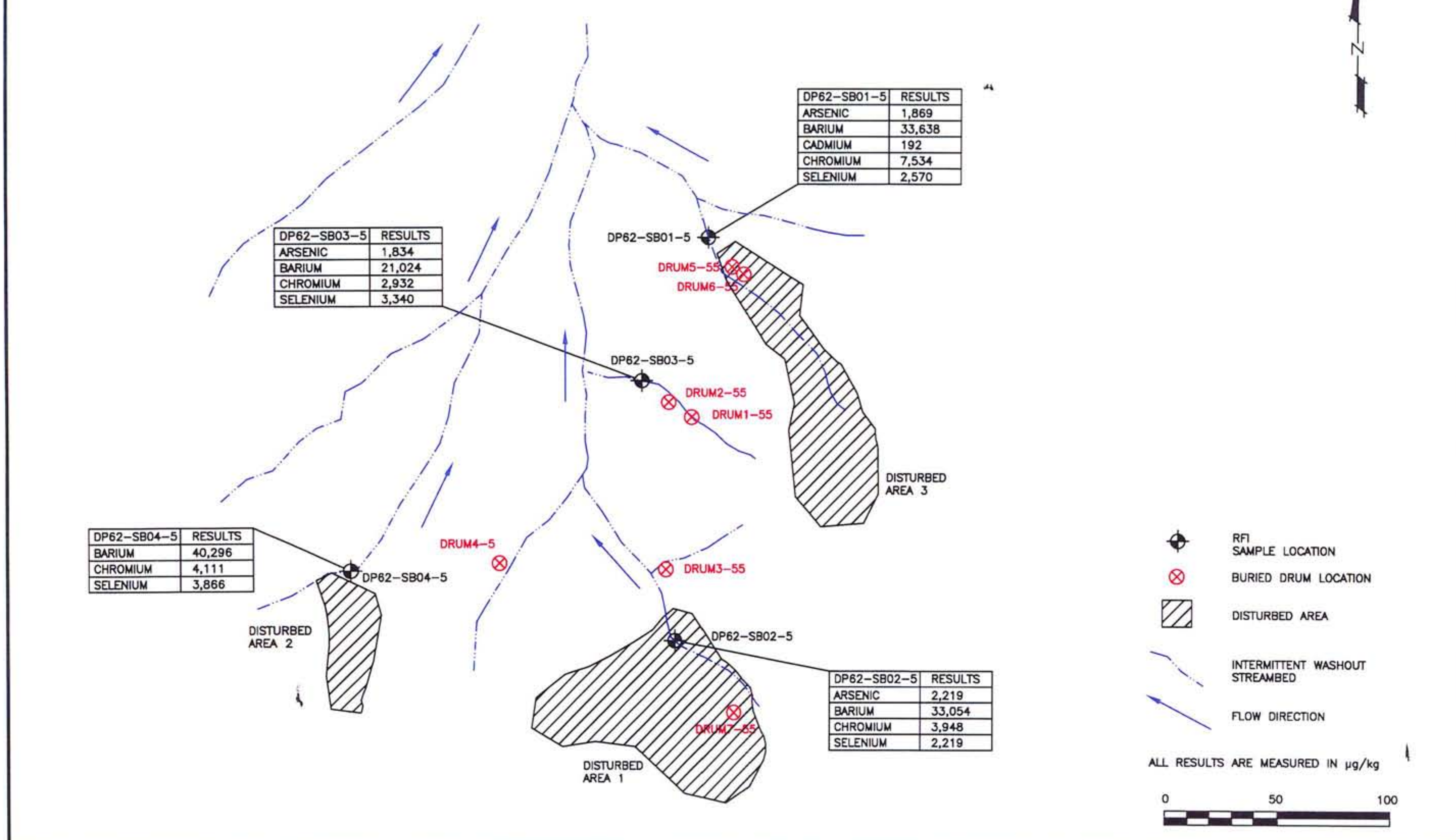
Prepared by:

Bhate Environmental Associates, Inc.
1608 13th Avenue South, Suite 300
Birmingham, Alabama 35205

Bhate Project No. 9030024.03

August 2004

RITAS DRAW



BHATE
Environmental Engineers and Scientists

ANALYTICAL RESULTS FOR METALS IN SOIL SAMPLES
DP-62 RITAS DRAW

PROJECT NO.	SCALE	DATE	DRAWN BY:	CHECKED BY:
9030024	AS SHOWN	05/26/04	SRH/MRM	–
			DRAWING NO: HAFBDP62Fig5(NEW)	

Figure 5

Holloman Air Force Base
New Mexico

TABLE 4
VOC and SVOC CONCENTRATIONS IN SOIL SAMPLES
DP-62 RITAS DRAW
HOLLOMAN AFB, NEW MEXICO

Constituent of Concern	Sample ID				
	DP62-SB01-5	DP62-SB01-5A	DP62-SB02-5	DP62-SB03-5	DP62-SB04-5
Date Sampled	**3/31/2004**	**3/31/2004**	**3/31/2004**	**3/31/2004**	**3/31/2004**
Volatile Organic Compounds (VOCs)	ND	ND	ND	ND	ND
Semi-Volatile Organic Compounds (SVOCs)	ND	ND	ND	ND	ND

Notes:

1. All results measured in mg/kg
2. ND - Not detected below detection limit
3. VOCs were analyzed by EPA Method 8260B
4. SVOCs were analyzed by EPA Method 8270C
5. DP62-SB01-5A is the field duplicate sample

TABLE 5

RCRA METALS and TOTAL PETROLEUM HYDROCARBON CONCENTRATIONS IN SOIL SAMPLES

DP-62 RITAS DRAW

HOLLOMAN AFB, NEW MEXICO

Constituent of Concern	Sample ID					SSL (µg/kg)
	DP62-SB01-5	DP62-SB01-5A	DP62-SB02-5	DP62-SB03-5	DP62-SB04-5	Residential
Date Sampled	3/31/2004	3/31/2004	3/31/2004	3/31/2004	3/31/2004	
Metals (µg/kg)						
Arsenic	1,869	1,530	2,219	1,834	<1,000	3.90E+03
Barium	33,638	48,356	33,054	21,024	40,296	5.45E+06
Cadmium	192	<500	<500	<500	<500	7.41E+04
Chromium*	7,534	8,503	3,948	2,932	4,111	2.34E+05
Lead	<500	<500	<500	<500	<500	4.00E+05
Mercury	<140	<140	<140	<140	<140	1.00E+08
Selenium	2,570	1,764	2,219	3,340	3,866	3.91E+05
Silver	<500	<500	<500	<500	<500	3.91E+05
Carbon Chains (µg/kg) (Total Petroleum Hydrocarbons)						
C06 - C10	<3,000	<3,000	<3,000	<3,000	<3,000	NA
C10 - C22	<3,000	<3,000	<3,000	<3,000	<3,000	NA
C22 - C36	<5,000	<5,000	<5,000	<5,000	<5,000	NA
Total (C6 - C36)	<4,000	<4,000	<4,000	<4,000	<4,000	893,333

Notes:

1. µg/kg - Micrograms per kilogram
2. Concentrations are on dry-weight basis
3. Soil screening levels (SSL) for C10 - C36 are averaged TPH values of Diesel#2/crankcase oil, #3 and #6 fuel oil, and Kerosene and jet fuel in the NMED TPH Screening Guidelines.
4. SSLs are based on ingestion, outdoor inhalation, and dermal contact.
5. * SSLs for chromium were calculated conservatively based on chromium (VI) toxicity values.
6. The lab concentrations were reported on a wet-weight basis. The detected concentrations were converted to dry-weight basis using the following relationship.

$$\boxed{C_d = C_w\left(1 + \frac{\theta_w}{\rho_b}\right)}$$

where,

C_d = concentration on dry-weight basis

C_w = concentration on wet-weight basis

θ_w = water content (0.26 g/cm^3-soil)

ρ_b = bulk density of soil (1.55 g/cm^3)

7. DP62-SB01-5A is the field duplicate sample
8. Metals were analyzed by EPA Method 6010B/7410A
9. TPH was analyzed by EPA Method 8015

Appendix B-3-3

Portions of: *Final Permit Decision: Class III Permit Modification for No Further Action Status for 7 Solid Waste Management Units/Areas of Concern, Holloman Air Force Base,* New Mexico Environment Department, November 29, 2005

State of New Mexico
ENVIRONMENT DEPARTMENT
Water and Waste Management Division
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502-6110
Telephone (505) 827-1758
Fax (505) 827-0310
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 29, 2005

Ms. Debbie Hartell
Chief, Environmental Flight
49 CES/CEV
550 Tabosa Avenue
Holloman AFB, NM 88330-8458

RE: FINAL PERMIT DECISION: CLASS III PERMIT MODIFICATION FOR NO FURTHER ACTION STATUS FOR 7 SOLID WASTE MANAGEMENT UNITS/AREAS OF CONCERN
HOLLOMAN AIR FORCE BASE EPA ID# NM65721224422
HWB-HAFB-04-021

Dear Ms. Hartell:

This letter notifies you of a final permit decision by the New Mexico Environment Department (NMED) to modify Module IV of the Resource Conservation and Recovery Act (RCRA) Permit NM65721224422 issued to the U.S. Department of Defense/Holloman Air Force Base (DoD/HAFB). DoD/HAFB requested this modification on November 30, 2004. The modification consists of the approval of No Further Action (NFA) status for seven (7) Solid Waste Management Units (SWMUs) located at HAFB near Alomogordo, New Mexico. The modification is effective thirty (30) days after the date of this letter.

Enclosed is the modification in the form of changes to Tables A and B, Module IV, Appendix IV-A. Table A lists SWMUs and Areas of Concern (AOCs) subject to Corrective Action, which no longer contains the subject 7 sites approved for NFA status herein. Table B lists SWMUs and AOCs not requiring corrective action. Also enclosed is a list (Table 1) of the 7 sites approved for NFA status by this action.

In accordance with 20.4.1 NMAC, NMED provided public notice and conducted a 45-day public comment period from September 30 through November 15, 2005, regarding this modification request. No comments were received from the public during the comment period.

If you have any questions regarding this decision, please contact Mr. Cornelius Amindyas of my staff at (505) 284-5086.

Sincerely,

Cindy Padilla

Cindy Padilla
Director
Permits Management Program

CP:ca (HWB)

Enclosures

cc: J. Bearzi, NMED HWB
W. Moats, NMED HWB
C. Amindyas, NMED HWB
L. King, EPA, 6PD-N
File: Reading and HAFB 05

Table 1. List of SWMUs approved for NFA.

SERIAL NO.	SWMU	ERP SITE ID	UNIT NAME
10	**106**	**LF-01**	**Main Base Landfill**
26	**136**	**N/A**	**Building 1119 Washrack Drainage Area**
28	**139**	**N/A**	**Lake Holloman**
29	**140**	**N/A**	**Lake Stinky**
32	**166**	**SD-25**	**MOBSS Drainage Lagoon**
45	**AOC-FST837**	**N/A**	**Building 837 Fuel Septic Tank**
62	**AOC-RD**	**DP-62**	**Rita's Draw Disposal Pit**

B-4

OT-37 (AOC-L)

Appendix B-4-1

Portions of: *Draft Final Remedial Investigation (RI) Report Investigation, Study and Recommendation for 29 Waste Sites Holloman Air Force Base, NM,* Radian Corporation, June 1992

RADIAN
CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

(Mailing Address)
P.O. Box 201088
Austin, TX 78720-1088
(Shipping Address)
8501 North Mopac Blvd.
Austin, TX 78759
(512) 454-4797

REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 North MoPac Blvd.
P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

June 1992

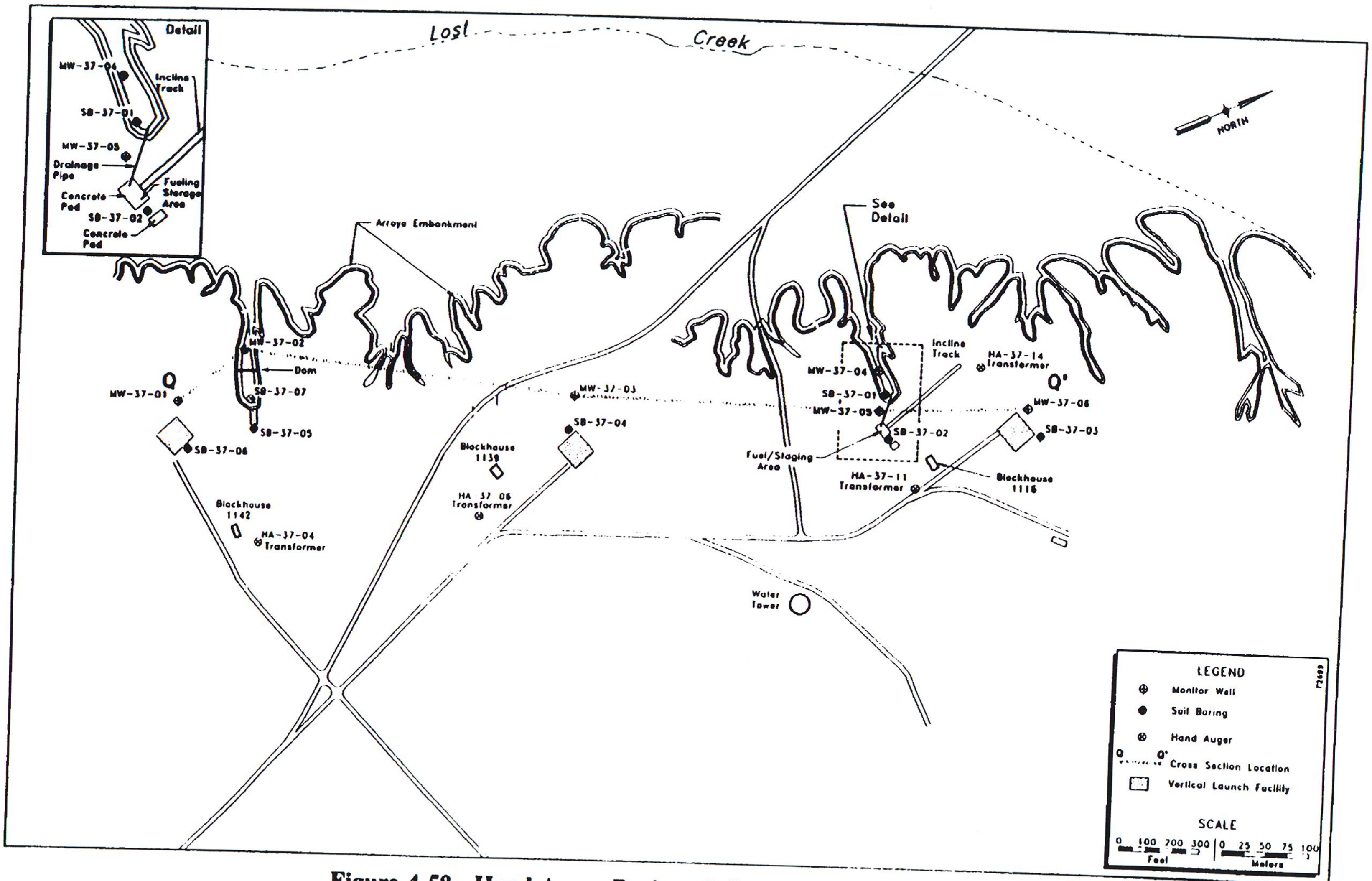


Figure 4-58. Hand Auger Boring, Soil Boring, Monitor Well, and Cross Section Locations for Site 37

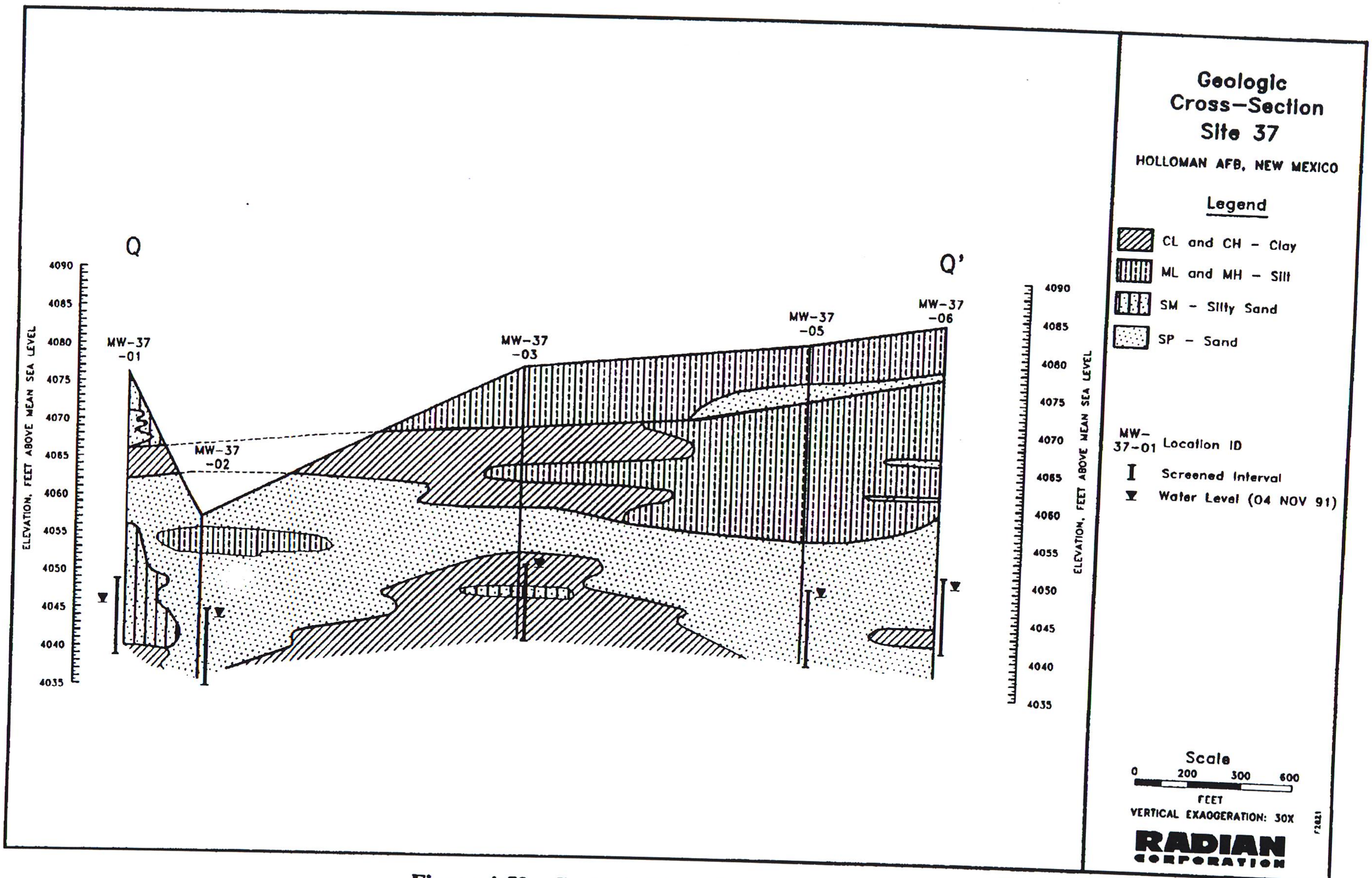


Figure 4-59. Geologic Cross Section for Site 37

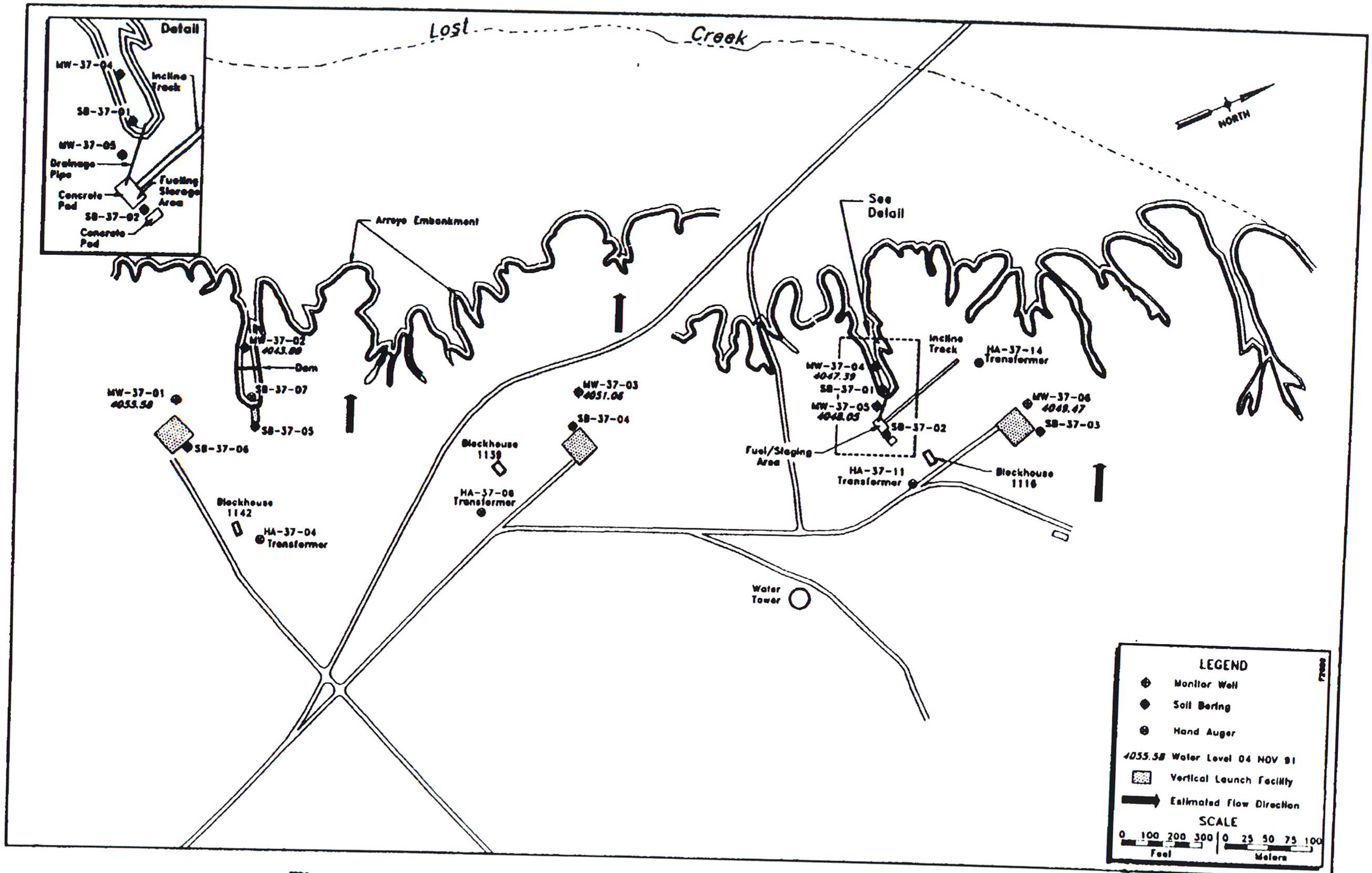


Figure 4-60. Monitor Well Locations and Groundwater Elevations for Site 37

Table 4-77

Concentrations of PCBs and Total Recoverable Petroleum Hydrocarbons in Site 37 Step-Down Transformer Station Samples

					SW8080 - PCBs (µg/kg)			
			EPA 418.1 - TRPH (mg/kg)		PCB-1254		PCB-1260	
Location	Sample ID	Depth	Result	(DL)	Result	(DL)	Result	(DL)
HA-37-04	91JULH037-018	0 - 2 ft	30600	(10.3)	ND	(12)	ND	(12)
HA-37-06	91JULH037-020	0 - 2 ft	141	(10.5)	9.2 J	(12)	ND	(12)
HA-37-11	91JULH037-025	0 - 2 ft	79.70	(10.1)	ND	(12)	80 C	(12)
HA-37-14	91JULH037-028	0 - 2 ft	21.60 @	(10.2)	ND	(310)	3200 C	(310)

NOTE: Table presents only constituents detected in soil at this site.
ND = Not Detected, at the reported detection limit.
J = Detected below the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.

Table 4-78

Concentrations of Inorganic Analytes in Site 37 Soil Samples

Location	SB-37-01				SB-37-02			
[illegible] Depth	[illegible] 2.5 - 4.5 ft		91JUL1H037-002 10 - 12 ft		91JUL1H037-003 2.5 - 4.5 ft		[illegible] 10 - 12 ft	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)								
Beryllium	0.78 @	(0.41)	ND	(0.91)	ND	(0.80)	ND	(0.39)
Cadmium	ND	(1.0)	ND	(2.3)	ND	(2.0)	ND	(0.97)
Chromium	13	(2.0)	9.6 @	(4.5)	4.4 @	(4.0)	8.0 @	(1.9)
Copper	ND	(4.1)	ND	(9.1)	ND	(8.0)	ND	(3.9)
Nickel	10 @	(4.1)	ND	(9.1)	ND	(8.0)	ND	(3.9)
Zinc	32	(4.1)	19 @	(9.1)	23 @	(8.0)	16 @	(3.9)
SW7060 - Arsenic (mg/kg)	3.0	(0.45)	1.5 @	(0.48)	1.4 @	(0.42)	0.88 @	(0.44)
SW7421 - Lead (mg/kg)	6.5	(1.3)	2.4	(0.36)	1.6	(0.32)	5.9 @	(1.3)

Table 4-78

(Continued)

Location:	SB-37-03				SB-37-04			
Sample ID: Depth:	91JULH037-005 0 - 2 ft		91JULH037-006 7.5 - 9.5 ft		91JULH037-007 5 - 7 ft		91JULH037-008 15 - 17 ft	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)								
Beryllium	ND	(0.77)	ND	(0.35)	ND	(0.40)	ND	(0.75)
Cadmium	ND	(1.9)	ND	(0.87)	ND	(0.99)	ND	(1.9)
Chromium	5.5 @	(3.8)	2.6 @	(1.7)	4.7 @	(2.0)	14 @	(3.8)
Copper	14 @	(7.7)	ND	(3.5)	ND	(4.0)	ND	(7.5)
Nickel	ND	(7.7)	ND	(3.5)	4.0 @	(4.0)	14 @	(7.5)
Zinc	26 @	(7.7)	5.8 @	(3.5)	12 @	(4.0)	30 @	(7.5)
SW7060 - Arsenic (mg/kg)	1.6 @	(0.47)	1.2 @	(0.43)	1.8 @	(0.41)	2.6	(0.41)
SW7421 - Lead (mg/kg)	14	(0.35)	1.1 @	(0.32)	1.6	(0.30)	3.7	(0.30)

Table 4-78

(Continued)

Location	SB-37-05				SB-37-06			
Sample ID / Depth	91JULJ4037-009 0 - 2 ft		91JULJ4037-010 10 - 12 ft		91JULJ4037-011 2.5 - 4.5 ft		91JULJ4037-013 25 - 27 ft	
Analytes	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)								
Beryllium	ND	(0.82)	ND	(0.45)	ND	(0.80)	ND	(0.51)
Cadmium	4.7 @	(2.1)	ND	(1.1)	ND	(2.0)	ND	(1.3)
Chromium	6.5 @	(4.1)	2.9 @	(2.2)	ND	(4.0)	5.8 @	(2.5)
Copper	ND	(8.2)	ND	(4.5)	ND	(8.0)	ND	(5.1)
Nickel	ND	(8.2)	ND	(4.5)	ND	(8.0)	5.7 @	(5.1)
Zinc	16 @	(8.2)	4.7 @	(4.5)	ND	(8.0)	15 @	(5.1)
SW7060 - Arsenic (mg/kg)	2.3	(0.45)	1.4 @	(0.44)	1.2 @	(0.48)	1.8 @	(0.39)
SW7421 - Lead (mg/kg)	3.8	(0.34)	0.70 @	(0.33)	1.9	(0.28)	0.51 @	(0.21)

Table 4-78

(Continued)

Location:	SB-37-07			
Sample ID: Depth:	91JUL1H037-013 2 - 4 ft		91JUL1H037-014 3 - 5 ft	
Analyses	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)				
Beryllium	0.57 @	(0.40)	ND	(0.37)
Cadmium	ND	(1.0)	ND	(0.92)
Chromium	10	(2.0)	4.0 @	(1.8)
Copper	6.1 @	(4.0)	4.1 @	(3.7)
Nickel	8.0 @	(4.0)	ND	(3.7)
Zinc	26	(4.0)	9.6 @	(3.7)
SW7060 - Arsenic (mg/kg)	3.5	(0.45)	1.2 @	(0.38)
SW7421 - Lead (mg/kg)	14	(1.2)	1.7	(0.26)

NOTE: Table presents only constituents detected in soil at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.

Table 4-79

Concentrations of Organic Analytes in Site 37 Soil Samples

Location:	SB-37-01				SB-37-02			
Sample ID: Depth:	91JULH037-001 2.5 - 4.5 ft		91JULH037-002 10 - 12 ft		91JULH037-003 2.5 - 4.5 ft		91JULH037-004 10 - 12 ft	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	ND	(11.0)	ND	(12.3)	ND	(12.0)	10.8 @	(10.7)
SW8240 - Volatile Organics (µg/kg)								
1,1-Dichloroethene	ND	(120)	25 J	(120)	ND	(120)	ND	(130)
Ethyl benzene	ND	(120)	ND	(120)	ND	(120)	3.0 J	(130)
Methylene chloride	370 B@	(120)	450 B@	(120)	1400 B	(120)	110 JB	(130)
Tetrachloroethene	ND	(120)	ND	(120)	ND	(120)	33 J	(130)
Toluene	7.9 J	(120)	7.8 JB	(120)	10 JB	(120)	8.9 J	(130)
Xylenes	ND	(120)	ND	(120)	ND	(120)	8.9 J	(130)
Location:	SB-37-03				SB-37-04			
Sample ID: Depth:	91JULH037-005 0 - 2 ft		91JULH037-006 7.5 - 9.5 ft		91JULH037-007 5 - 7 ft		91JULH037-008 15 - 17 ft	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	3860	(122)	ND	(11.2)	ND	(12.2)	ND	(13.0)
SW8240 - Volatile Organics (µg/kg)								
1,1-Dichloroethene	ND	(120)	ND	(110)	.79 J	(120)	ND	(130)
Ethyl benzene	ND	(120)	ND	(110)	ND	(120)	ND	(130)
Methylene chloride	130 B@	(120)	260 B@	(110)	3.731 JB	(120)	190 B@	(130)
Tetrachloroethene	ND	(120)	ND	(110)	ND	(120)	ND	(130)
Toluene	8.5 J	(120)	9.4 J	(110)	.256 J	(120)	7.6 J	(130)
Xylenes	ND	(120)	ND	(110)	ND	(120)	ND	(130)

Table 4-79

(Continued)

Location:	SB-37-05				SB-37-06			
Sample ID: Depth:	91JULH037-009 0 - 2 ft		91JULH037-010 10 - 12 ft		91JULH037-011 2.5 - 4.5 ft		91JULH037-012 25 - 27 ft	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	16.0 @	(12.0)	ND	(12.3)	ND	(12.9)	ND	(14.1)
SW8240 - Volatile Organics (µg/kg)								
1,1-Dichloroethene	ND	(120)	ND	(130)	ND	(130)	ND	(140)
Ethyl benzene	ND	(120)	ND	(130)	ND	(130)	ND	(140)
Methylene chloride	530 B@	(120)	110 JB	(130)	96 JB	(130)	54 JB	(140)
Tetrachloroethene	ND	(120)	ND	(130)	ND	(130)	ND	(140)
Toluene	9.2 J	(120)	7.8 J	(130)	7 JB	(130)	6.9 JB	(140)
Xylenes	ND	(120)	ND	(130)	ND	(130)	ND	(140)

Table 4-79

(Continued)

Location:	SB-37-07			
Sample ID: Depth:	[illegible]		[illegible]	
Analyte	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	48.2 @	(11.6)	22.3 @	(15.2)
SW8240 - Volatile Organics (µg/kg)				
1,1-Dichloroethene	ND	(120)	ND	(110)
Ethyl benzene	ND	(120)	ND	(110)
Methylene chloride	780	(120)	56 JB	(110)
Tetrachloroethene	ND	(120)	ND	(110)
Toluene	10 JB	(120)	ND	(110)
Xylenes	ND	(120)	ND	(110)

NOTE: Table presents only constituents detected in soil at this site.
ND = Not Detected, at the reported detection limit.
J = Detected below the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.
@ = Measured result is less than five times the detection limit.

Table 4-80

Concentrations of Inorganic Analytes in Site 37 Groundwater Samples

Location: Sample ID:	MW-37-01 37-01-01		MW-37-02 37-02-01		MW-37-03 37-03-01	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)
EPA 160.1 - Total Dissolved Solids (mg/L)	11000	(10)	14000	(10)	10000	(10)
EPA 300.0 - Chloride (mg/L)	3000	(26)	5300	(26)	2500	(26)
EPA 300.0 - Sulfate (mg/L)	4200	(5.0)	3400	(5.0)	4700	(5.0)
EPA 340.2 - Fluoride (mg/L)	1.5	(0.10)	1.3	(0.10)	1.6	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	48	(1.1)	66	(1.1)	48	(1.1)
EPA 365.2 - Total Phosphorus (mg/L)	0.10	(0.020)	0.14	(0.020)	0.19	(0.020)
SW6010 - Metals (mg/L)						
Antimony	0.11 @	(0.10)	0.12 @	(0.10)	0.11 @	(0.10)
Cadmium	ND	(0.0050)	ND	(0.0050)	0.0055 @	(0.0050)
Chromium	ND	(0.010)	ND	(0.010)	0.011 @	(0.010)
Copper	0.032 Z@	(0.020)	ND Z	(0.020)	0.024 Z@	(0.020)
Nickel	ND	(0.020)	ND	(0.020)	0.029 @	(0.020)
Zinc	ND	(0.020)	ND	(0.020)	0.048 @	(0.020)
SW7060 - Arsenic (mg/L)	ND	(0.016)	ND	(0.016)	ND	(0.016)
SW7421 - Lead (mg/L)	ND	(0.0030)	ND	(0.0030)	ND	(0.0030)
SW7740 - Selenium (mg/L)	ND	(0.020)	ND	(0.020)	ND	(0.020)

Table 4-80

(Continued)

Location: Sample ID:	MW-37-04 37-04-01		MW-37-05 37-05-01		MW-37-06 37-06-01	
Analytes	Result	(DL)	Result	(DL)	Result	(DL)
EPA 160.1 - Total Dissolved Solids (mg/L)	13000	(10)	12000	(10)	17000	(10)
EPA 300.0 - Chloride (mg/L)	4900	(26)	3900	(26)	6800	(26)
EPA 300.0 - Sulfate (mg/L)	3100	(5.0)	4000	(5.0)	3700	(5.0)
EPA 340.2 - Fluoride (mg/L)	1.7	(0.10)	2.0	(0.10)	1.5	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	75	(1.1)	75	(1.1)	74	(1.1)
EPA 365.2 - Total Phosphorus (mg/L)	0.19	(0.020)	0.32	(0.020)	0.26	(0.020)
SW6010 - Metals (mg/L)						
Antimony	0.12 @	(0.10)	ND	(0.40)	ND	(0.10)
Cadmium	ND	(0.0050)	ND	(0.020)	ND	(0.0050)
Chromium	ND	(0.010)	0.048 @	(0.040)	0.012 @	(0.010)
Copper	ND Z	(0.020)	0.28 @	(0.080)	ND	(0.020)
Nickel	ND	(0.020)	ND	(0.080)	0.028 @	(0.020)
Zinc	ND	(0.020)	0.12 @	(0.080)	0.030 @	(0.020)
SW7060 - Arsenic (mg/L)	ND	(0.016)	0.016 @	(0.016)	ND	(0.016)
SW7421 - Lead (mg/L)	ND	(0.0030)	0.011 @	(0.0030)	0.0044 @	(0.0030)
SW7740 - Selenium (mg/L)	0.016 @	(0.010)	ND	(0.010)	ND	(0.010)

NOTE: Table presents only constituents detected in groundwater at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.
Z = SW6010, SW7421--Analyte detected in method blank.

Table 4-81

Concentrations of Organic Analytes in Site 37 Groundwater Samples

Location: Sample ID:	MW-37-01 37-01-01		MW-37-02 37-02-01		MW-37-03 37-03-01	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)
SW8240 - Volatile Organics ($\mu g/L$)						
1,1,2,2-Tetrachloroethane	ND	(5.0)	ND	(5.0)	ND	(5.0)
Acetone	ND	(100)	ND	(100)	ND	(100)
Bromodichloromethane	2.3 J	(5.0)	ND	(5.0)	ND	(5.0)
Chloroform	7.4 @	(5.0)	1.9 J	(5.0)	6.3 @	(5.0)
Methylene chloride	18 B@	(5.0)	17 B@	(5.0)	1.6 JB	(5.0)
Location: Sample ID:	**MW-37-04 37-04-01**		**MW-37-05 37-05-01**		**MW-37-06 37-06-01**	
Analyte	**Result**	**(DL)**	**Result**	**(DL)**	**Result**	**(DL)**
SW8240 - Volatile Organics ($\mu g/L$)						
1,1,2,2-Tetrachloroethane	ND	(5.0)	ND	(5.0)	0.59 J	(5.0)
Acetone	ND	(100)	ND	(100)	6.0 J	(100)
Bromodichloromethane	1.2 J	(5.0)	ND	(5.0)	ND	(5.0)
Chloroform	3.4 J	(5.0)	5.0 @	(5.0)	1.3 J	(5.0)
Methylene chloride	9.1 B@	(5.0)	ND	(5.0)	11 B@	(5.0)

NOTE: Table presents only constituents detected in groundwater at this site.
ND = Not Detected, at the reported detection limit.
J = Detected below the detection limit.
@ = Measured result is less than five times the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Table 4-82

Soil and Groundwater Analytes Detected Above Risk-Based Action Levels at Site 37

Analyte	Location ID	Result		Action Level
Soil Results (mg/kg)				
Beryllium	SB-37-01	0.78	@	0.2
Beryllium	SB-37-07	0.57	@	0.2
PCB-1260	HA-37-14	3.2	C	0.09
Groundwater Results (mg/L)				
Antimony	MW-37-01	0.11	@	0.01
Antimony	MW-37-02	0.12	@	0.01
Antimony	MW-37-03	0.11	@	0.01
Antimony	MW-37-04	0.12	@	0.01
Arsenic	MW-37-05	0.016	@	0.01
Cadmium	MW-37-03	0.0055	@	0.005
Chloroform	MW-37-01	0.0074	@	0.006
Chloroform	MW-37-03	0.0063	@	0.006
Fluoride	MW-37-05	2		2
Methylene chloride[a]	MW-37-01	0.018	B@	0.005
Methylene chloride[a]	MW-37-02	0.017	B@	0.005
Methylene chloride[a]	MW-37-04	0.0091	B@	0.005
Methylene chloride[a]	MW-37-06	0.011	B@	0.005

Note: Result units were changed to match action level units for this table.

@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
[a] Methylene chloride was determined to be a laboratory contaminant in a QA/QC review and is, therefore, not considered to be above the action level in samples from the site.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

DRILLING LOG

1. COMPANY NAME RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR SOUTHWEST ENG INC	HOLE NO. SB-37-01	SHEET 1 OF 2 SHEETS
3. PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION 37		
5. NAME OF DRILLER ART VALTIERRA	6. MANUFACTURER'S DESIGNATION OF DRILL HOLLOW-STEM AUGER		
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"	8. HOLE LOCATION 688488.57(Y), 538891.40(X)		
	9. SURFACE ELEVATION 4070.22		
	10. DATE STARTED 26 SEP 91	11. DATE COMPLETED 26 SEP 91	
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED		
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED		
14. TOTAL DEPTH OF HOLE 20 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)		

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
21. TOTAL CORE RECOVERY %					
22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY) GROUT	23. SIGNATURE OF INSPECTOR ACD	

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SILTY SAND: light brown (5YR 6/4), dry, poorly graded, crumbly, soft. (SM)	HS=0.0ppm			1,1,3,2	1.7/2.0 ft
	2	tan (10YR 8/2), caliche at 2).0 ft.	HS=0.0ppm		91JULH037-001	4,13,31,48	2.0/2.0 ft
	4	CLAYEY SILT: brown (5YR 5/6), firm/hard sample, gypsum crystals/spots, white spots, moist. (MH)	HS=0.0ppm			7,17,21,30	2.0/2.0 ft
	7		HS=0.0ppm			7,17,18,21	2.0/2.0 ft
	8	SILTY SAND: tan (10YR 8/2) to light brown orange (5YR 8/4), some caliche, dry, crumbly, poorly graded. (SM)					

DRILLING LOG

HOLE NO. SB-37-01

PROJECT: HOLLOMAN AFB RI/FS

INSPECTOR: ACD

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	10–10.5		HS=0.0ppm		91JULH037 -002	9,50+	1.0/2.0 ft
	10.5–15	SAND: clean, brown and olive, mottled, hard (not really caliche), crumbly, dry to slightly moist. (SP)					
	15–16.5	CLAYEY SILT: brown (5YR 5/6), high plasticity, white spots/streaks, olive zone above sand. (MH)	HS=0.0ppm			4,5,17,27	
	16.5–20	SAND: clean, fine to very fine, almost white, moist. (SP)					
	20	SAND, as above: tan (5YR 8/4).				6,27,39, 50+	TD= 20.0 ft

Depth scale: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

F2402

DRILLING LOG

HOLE NO. SB-37-02

F2409

1. COMPANY NAME RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION 37
5. NAME OF DRILLER ART VARTIERRA	6. MANUFACTURER'S DESIGNATION OF DRILL HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"	8. HOLE LOCATION 688436.70(Y), 539049.78(X)
	9. SURFACE ELEVATION 4082.57
	10. DATE STARTED 26 SEP 91 / 11. DATE COMPLETED 26 SEP 91
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE 25 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY) GROUT	23. SIGNATURE OF INSPECTOR HTH		

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0					1,5,2,9	no sample, no recovery
	2.5	SILT: very pale orange (10YR 8/2), low plasticity, dry, white specks. (ML)	HS=0.0ppm		91JULH037-003	10,22,22,32	8.0/2.0 ft
	5	SILT, as above. (ML)	HS=0.0ppm			30,33,29,24	1.7/2.0 ft
	7.5	SILT, as above: pale yellowish-brown (10YR 6/2). (ML)	HS=0.0ppm			28,25,26,17	1.8/2.0 ft

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. SB-37-02

DRILLING LOG

HOLE NO.	SB-37-02
PROJECT	HOLLOMAN AFB RI/FS
INSPECTOR	HTH
SHEET 2 OF 2 SHEETS	

DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
10	SILT, as above. (ML)	HS=0.0ppm		91JULH037 -004	17,9,16,11	1.7/2.0 ft
11	SAND: light brown (5YR 6/4), fine to very fine grained, poorly graded, dry. (SP)					
15	SAND: greyish-orange (10YR 7/4), coarse to fine grained, some small gravel, well graded, dry. (SP)	HS=0.0ppm			17,18,11, 20	1.6/2.0 ft
16	CLAY: moderate brown (5YR 4/4), medium to low plasticity, hard, gypsum crystals. (CL)					
20	CLAY, as above.					
25	CLAY: dark reddish-brown (10R 3/4), high plasticity, hard, moist. (CH)	HS=0.0ppm			19,20,31, 50	1.5/2.0 ft
27	no groundwater encountered, CME-55 can't drill through hard clay					TD= 27.0 ft

Depth scale: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES — HOLE NO. SB-37-02

12409

DRILLING LOG

HOLE NO.	SB-37-03
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET	1 OF 2 SHEETS
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688957.31(Y), 539260.17(X)
9. SURFACE ELEVATION	4085.89
10. DATE STARTED	26 SEP 91
11. DATE COMPLETED	26 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH DRILLED INTO ROCK	
14. TOTAL DEPTH OF HOLE	17 ft.
15. DEPTH GROUNDWATER ENCOUNTERED	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: ; OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SAND: greyish-orange (10YR 7/4), very fine, moist, loose, crumbly, clean, poorly graded. (SP)	HS=2.5ppm		91JULH037-005	10,12,10,9	2.0/2.0 ft
	2	brown/tan (10YR 6/6).					
	2.5		HS=0.0ppm			10,17,9,14	2.0/2.0 ft
	3	changes to a fine to very fine, tan (10YR 8/2) sand, hard (not quite caliche) sand.					
	5	changes to an orange-pink (5YR 8/4) color.	HS=0.0ppm			2,7,9,12	2.0/2.0 ft
	7.5		HS=0.0ppm		91JULH037-006	8,20,22,23	2.0/2.0 ft

DRILLING LOG

HOLE NO.	SB-37-03
SHEET	2 OF 2 SHEETS

PROJECT: HOLLOMAN AFB RI/FS

INSPECTOR: ACD

F2392

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
			HS=0.0ppm			3,13,11,13	2.0/2.0 ft
	11	CLAYEY SILT: brown (5YR 5/6), firm to stiff, high plasticity, white spots or mottles, sandy gypsum crystals. (MH)					
	12						
	13						
	14						
	15		HS=0.0ppm			18,25,15, 16	2.0/2.0 ft
	16	SILT: tan (10YR 8/2), caliche, crumbly, hard. (ML)					
	17						TD= 17 ft
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

PROJECT: HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-03

DRILLING LOG

HOLE NO. SB-37-04

F2410

1. COMPANY NAME RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR SOUTHWEST ENG INC		SHEET 1 OF 2 SHEETS
3. PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION 37		
5. NAME OF DRILLER ART VALTIERRA	6. MANUFACTURER'S DESIGNATION OF DRILL HOLLOW-STEM AUGER		
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"	8. HOLE LOCATION 687361.22(Y), 538546.76(X)		
	9. SURFACE ELEVATION 4078.51		
	10. DATE STARTED 26 SEP 91	11. DATE COMPLETED 26 SEP 91	
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED 21 ft blg		
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED		
14. TOTAL DEPTH OF HOLE 22 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)		

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY): GROUT	23. SIGNATURE OF INSPECTOR: HTH		

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SILT: very pale orange (10YR 8/2), low plasticity, dry, organic debris near top. (ML)	HS=0.0ppm			39,16,25	1.7/2.0 ft
	2.5	SILT: greyish-orange (10YR 7/4), low plasticity, dry, some fine sand, caliche layers. (ML)	HS=0.0ppm			11,12,22, 32	1.9/2.0 ft
	5	SILT, as above.	HS-0.0ppm		91JULH037 -007	20,37,29, 21	2.0/2.0 ft
	7.5	SAND: greyish-orange (10YR 7/4), silt and very fine grained ssilt and, poorly graded, dry, white specks, non-plastic. (SP)	HS=0.0ppm			17,37,31, 34	1.5/2.0 ft

DRILLING LOG

HOLE NO. SB-37-04

F2410

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	10	SAND: white (N9), very fine grained, poorly graded, dry. (SP)				37,50	0.3/2.0 ft no sample, no recovery
	11						
	12						
	13						
	14						
	15	SAND, as above. (SP)				50	no sample, no recovery
	16						
	17						
	18						
	19						
	20	CLAY: very dark red (5R 2/6), high plasticity, moist, some gypsum. (CH)			91JULH037 -008	8,12,13,25	sample 20-21 ft for analysis
	21	SAND: white (N9), very fine grained, poorly graded, wet, some silt and clay. (SP)					water at 21 ft bgl
	22						TD= 22.0 ft
	23						
	24						
	25						
	26						
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-04

DRILLING LOG

HOLE NO.	SB-37-05
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	02
5. NAME OF DRILLER	ALEX SANCHEZ
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686248.02(Y), 538052.73(X)
9. SURFACE ELEVATION	4076.36
10. DATE STARTED	26 SEP 91
11. DATE COMPLETED	26 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH DRILLED INTO ROCK	
14. TOTAL DEPTH OF HOLE	17.0 ft.
15. DEPTH GROUNDWATER ENCOUNTERED	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: ; OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SAND: tan/orange, clean, very fine, dry, crumbly, poorly graded, roots. (SP)	HS=0.0ppm		91JULH037-009	2,5,7,10	1.0/2.0 ft
	2.5	SILTY SAND: brown (5YR 6/4), tan mottles, crumbly, moist, slightly hard. (SM)	HS=0.0ppm			3,13,22,30	2.0/2.0 ft
	5		HS=0.0ppm				2.0/2.0 ft
	7.5	SAND: tan and brown (5YR 6/4) zones, clean, fine to very fine, poorly graded, moist, crumbly. (SP)	HS=0.0ppm			5,19,21,26	2.0/2.0 ft

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES | HOLE NO. SB-37-05

DRILLING LOG

HOLE NO.	SB-37-05
SHEET 2 OF 2 SHEETS	

F2394

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
					91JULH037 -010		
	11	SAND: tan (10YR 8/2), very fine, hard (almost caliche), poorly graded, crumbly. (SP)	HS=0.0ppm			1,10,26,27	2.0/2.0 ft
	12						
	13						
	14						
	15	SAND: brown (5YR 6/4), clean, fine to very fine, poorly graded. (SP)	HS=0.0ppm			20,38,50, 16	2.0/2.0 ft not able to obtain sample
	16						
	17						TD= 17.0 ft
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

F2411

DRILLING LOG

HOLE NO. SB-37-06

1. COMPANY NAME: RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR: SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT: HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION: 37
5. NAME OF DRILLER: ART VALTIERRA	6. MANUFACTURER'S DESIGNATION OF DRILL: HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"	8. HOLE LOCATION: 685990.06(Y), 538018.92(X)
	9. SURFACE ELEVATION: 4075.62
	10. DATE STARTED: 27 SEP 91 — 11. DATE COMPLETED: 27 SEP 91
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED: 34 ft bgl
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 35 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
18. GEOTECHNICAL SAMPLES — DISTURBED: — UNDISTURBED:	19. TOTAL NUMBER OF CORE BOXES
20. SAMPLES FOR CHEMICAL ANALYSIS — VOC: — METALS: — OTHER (SPECIFY): — OTHER (SPECIFY): — OTHER (SPECIFY):	21. TOTAL CORE RECOVERY %
22. DEPOSITION OF HOLE — BACKFILLED: — MONITORING WELL: — OTHER (SPECIFY): GROUT	23. SIGNATURE OF INSPECTOR: HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SILT: very pale orange (10YR 8/2), low plasticity, dry, very soft. (ML)	HS=0.0ppm			3,8,12,14	1.5/2.0 ft
	2.5	SILT: as above.	HS=0.0ppm		91JULH037-011	5,15,12,13	1.8/2.0 ft
	5	CLAYEY SILT: light brown (5YR 6/4), mottled with white gypsum sand, medium plasticity, dry, soft. (ML)	HS=0.0ppm				2.0/2.0 ft
	7.5	SAND: very pale orange (10YR 8/2), very fine grained, poorly graded, rust stains. (SP)				19,30,50	1.0/2.0 ft

DRILLING LOG

HOLE NO. SB-37-06

f2411

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	10	SAND: as above.	HS=0.0ppm			17,9,4,9	1.5/2.0 ft
	11.5	SILTY SAND: as above.					
	15	SILT: light brown (5YR 6/4) and very pale orange (10YR 8/2), low plasticity, dry, soft soft. (ML)	HS=0.0ppm			13,17,21, 23	
	20	SANDYR SILT, with clay: light brown (5YR 5/6), medium plasticity, moist, firm, sand increases with depth. (ML)	HS=0.0ppm			12,18,36, 50	
	25	SILTY SAND: light brown (5YR 5/6), very fine grained, poorly graded, non-plastic, moist, soft. (SM)	HS=0.0ppm		91JULH037 -012	13,15,25, 30	

Depth scale: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-06

DRILLING LOG

HOLE NO.	SB-37-06
SHEET 3 OF 3 SHEETS	

F2411

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30	SILTY SAND, as above.	HS=0.0ppm			24,50	
	31						
	32						
	33						
	34						water at 34.0 ft bgl
	35	SILTY SAND: as above, wet.	HS=0.0ppm				
	36						
	37						TD= 37.0 ft
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

DRILLING LOG

F2387

HOLE NO.	MW-37-01
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	-37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686025.10(Y), 537843.13(X)
9. SURFACE ELEVATION	4076.08
10. DATE STARTED	27 SEP 91
11. DATE COMPLETED	27 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH DRILLED INTO ROCK	
14. TOTAL DEPTH OF HOLE	36 ft.
15. DEPTH GROUNDWATER ENCOUNTERED	28.5 ft bgl
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 31.64 ft bgl
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED: X
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: X ; OTHER (SPECIFY):
23. SIGNATURE OF INSPECTOR	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SILTY SAND: light brown, very fine, crumbly, moist, poorly graded. (SM)					4.0/5.0 ft
	1						
	2						
	3	SANDY SILT: tan (10YR 8/2), some caliche, dry, crumbly, low plasticity. (ML)					
	4						
	5	SAND: orange-pink (5YR 8/4), clean, fine to very fine, loose, crumbly, poorly graded, homogeneous. (SP)					3.5/5.0 ft
	6						
	7						
	8						
	9						

DRILLING LOG

HOLE NO. MW-37-01

F2387

PROJECT: HOLLOMAN AFB RI/FS | INSPECTOR: ACD | SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		CLAYEY SILT: brown (5YR 5/6), meduim to high plasticity, white spots/mottles (gypsum crystals??), firm, moist, medium toughness. (MH)					-4.5/5.0 ft
	11						
	12						
	13						
	14	SAND: brown (5YR 5/6), fine to very fine, clean. (SP)					
		SAND: tan (10YR 8/2), clean, moist, crumbly, fine to very fine, poorly graded, homogeneous, minor caliche. (SP)					
	15						3.0/5.0 ft
	16						
	17	changes to brown (5YR 6/4).					
	18						
	19						
	20	SILTY SAND: brown (5YR 5/6), moist, very fine, poorly graded, homogeneous, crumbly. (SM)					3.5/5.0 ft
	21						
	22						
	23	tan laminae.					
	24						
	25						4.0/5.0 ft
	26	fine to very fine, clean sand zone.					
	27						

DRILLING LOG

PROJECT	INSPECTOR	HOLE NO.
HOLLOMAN AFB RI/FS	ACD	MW-37-01
		SHEET 3 OF 3 SHEETS

F2387

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	28.5	wet at 28.5'					
	29						
	29.64						-water at 29.64 ft 5.0/5.0 ft
	30						
	31						
	32						
	32.5–35.0			MW037-01- 32.5-35.0'			
	33						
	34						
	35	CLAY: brown (5YR 4/4), high plasticity, sticky, low toughness, large gypsum crystals. (CH)					
	36						TD=36 ft
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

PROJECT	HOLE NO.
HOLLOMAN AFB RI/FS FOR 29 SITES	MW-37-01

DRILLING LOG

HOLE NO.	MW-37-02
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686330.24(Y), 537768.93(X)
9. SURFACE ELEVATION	4057.22
10. DATE STARTED	27 SEP 91
11. DATE COMPLETED	27 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH DRILLED INTO ROCK	
14. TOTAL DEPTH OF HOLE	21.5 ft.
15. DEPTH GROUNDWATER ENCOUNTERED	~13 ft bgl
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 14.54 ft bmp
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED: X
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: X ; OTHER (SPECIFY):
23. SIGNATURE OF INSPECTOR	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0–1.5	SILTY SAND: orange-pink (5YR 8/4), loose, crumbly, dry, poorly graded, homogeneous. (SM)					3.0/5.0 ft
	1.5–5	SANDY SILT (silty sand?): brown (5YR 5/6), moist, homogeneous, loose, crumbly, low plasticity, mottled appearance. (ML)					
	5–7.5	SAND: brown (5YR 5/6), clean, very fine, loose, moist, crumbly, poorly graded, homogeneous. (SP)					3.5/4.0 ft
	7.5–10	SAND: orange-pink (5YR 8/4), very fine to fine, moist, loose, crumbly, poorly graded, clean, homogeneous. (SP)					

DRILLING LOG

PROJECT	HOLLOMAN AFB RI/FS	INSPECTOR ACD	HOLE NO. MW-37-02	SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		harder (not loose, but not caliche) at 10', moist					5.0/5.0 ft
	11						
	12						
	13	SAND: brown (5YR 5/6), fine to medium, loose, wet zone at 13 ft. (SP)					—water at 12.54 ft
	14	very fine to fine, clean, hard, caliche, homogeneous, poorly graded, wet.					
	15						5.0/5.0 ft
	16						
	17	SAND, as above: not as hard, very saturated.		MW037-02 17.5-20.0			
	18						
	19						
	20						
	21						TD=21.5 ft
	22						
	23						
	24						
	25						
	26						
	27						

F2388

DRILLING LOG

HOLE NO.	MW-37-03
SHEET 1 OF 3 SHEETS	
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	687430.86(Y), 538441.26(X)
9. SURFACE ELEVATION	4077.62
10. DATE STARTED	27 SEP 91
11. DATE COMPLETED	27 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH DRILLED INTO ROCK	
14. TOTAL DEPTH OF HOLE	36 ft.
15. DEPTH GROUNDWATER ENCOUNTERED	25.6 ft bgl
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 28.60 ft bmp
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: X ; OTHER (SPECIFY):
23. SIGNATURE OF INSPECTOR	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0–6	SILT: very pale orange (10YR 8/2), low plasticity, dry, very soft. (ML)					cuttings
	6–8	SILTY CLAY: moderate brown (5YR 4/4), medium plasticity, moist. (CL)	SC=0.0ppm				cuttings
	8–10	SANDY CLAY: moderate brown (5YR 4/4), medium plasticity, dry, very fine sand in clay. (CL)	SC=0.0ppm				cuttings

DRILLING LOG

PROJECT	INSPECTOR	HOLE NO.
HOLLOMAN AFB RI/FS	HTH	MW-37-03
		SHEET 2 OF 3 SHEETS

F2412

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11						
	12	CLAYEY SILT: moderate brown (5YR 4/4), low plasticity, firm, dry, white spots. (ML)					
	13						
	14						
	15	SANDY CLAY: moderate brown (5YR 4/4), medium plasticity, dry, hard, very fine sand, gypsum crystals. (CL)	SC=0.0ppm				cuttings; very hard to drill.
	16						
	17						
	18						
	19						easier to drill at 19 ft
	20	SAND: very pale orange (10YR 8/2), fine to very fine grained, poorly graded, dry. (SP)	SC=0.0ppm			15,30,50	
	21						
	22						
	23						
	24						
	25	CLAY: moderate brown (5YR 4/4), high plasticity, moist, firm. (CL)	SC=0.0ppm			7,9,13,11	
	26						water at 25.6 ft bgl
	27						saturation ~27.5 ft

DRILLING LOG

PROJECT	INSPECTOR	HOLE NO.
HOLLOMAN AFB RI/FS	HTH	MW-37-03
		SHEET 3 OF 3 SHEETS

F2412

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30	SILTY SAND: light brown (6YR 6/4), very fine grained, poorly graded, low plasticity, wet. (SP)	SC=0.0ppm			6,9,7,7	
	31	SILTY CLAY: light brown (6YR 6/4), high plasticity, firm, wet. (CH)					
	32						
	33						
	34						
	35						
	36						TD= 36.0 ft
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

PROJECT	HOLE NO.
HOLLOMAN AFB RI/FS FOR 29 SITES	MW-37-03

DRILLING LOG

HOLE NO.	MW-37-04
SHEET 1 OF 2 SHEETS	

F2389

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688500.66(Y), 538802.84(X)
9. SURFACE ELEVATION	4061.11
10. DATE STARTED	28 SEP 91
11. DATE COMPLETED	28 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH DRILLED INTO ROCK	
14. TOTAL DEPTH OF HOLE	20 ft.
15. DEPTH GROUNDWATER ENCOUNTERED	~8.5 ft bgl
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 16.14 ft bmp
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: X ; OTHER (SPECIFY):
23. SIGNATURE OF INSPECTOR	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0–1.4	SANDY SILT: brown (5YR 5/6) to (5YR 6/4), dry, crumbly, loose, low plasticity. (ML)					3.0/5.0 ft
	1.4–8.6	CLAYEY SILT: brown (5YR 4/4), white spots/mottles/gypsuspots/m crystals, high plasticity, firm to stiff, moist. (MH)					4.5/5.0 ft (at 5)
	8.6–	SILTY SAND: light (5YR 6/4) and moderate (5YR 4/4) brown, poorly graded, wet, loose, homogeneous, very fine grained. (SM)					

DRILLING LOG

HOLE NO. MW-37-04

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 2 SHEETS

DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
10–16	SAND: greyish-orange (10YR 7/4) to light brown, clean, fine to very fine, wet, loose, homogeneous, poorly graded. (SP)					5.0/5.0 ft; -water at 13.64 ft; 4.0/5.0 ft
16–20	SAND: tan (10YR 8/2), clean, wet, very fine to fine (some medium) grained, homogeneous, loose, poorly graded. (SP)					
20						TD=20 FT

Depth scale: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. MW-37-04

F2389

DRILLING LOG

F2390

HOLE NO.	MW-37-05
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET	1 OF 3 SHEETS
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688445.46(Y), 538940.94
9. SURFACE ELEVATION	4081.14
10. DATE STARTED	28 AUG 91
11. DATE COMPLETED	28 AUG 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	~33 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 35.04 ft bmp
14. TOTAL DEPTH OF HOLE	42 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
19. TOTAL NUMBER OF CORE BOXES	
21. TOTAL CORE RECOVERY	%
23. SIGNATURE OF INSPECTOR	ACD

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED
		X

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
		X	

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SANDY SILT: tan to grey-orange (10YR 8/6), dry, loose, crumbly, low plasticity. (ML)					3.0/5.0 ft
	2.5	caliche at ~2.5'					
	5	SAND: orange-pink (5YR 8/4), clean, fine to very fine, poorly graded, moist, loose, crumbly. (SP)					3.0/5.0 ft
	7	tan/orange (10YR 8/2). caliche layer.					
	7.5	CLAYEY SILT: brown (5YR 5/6), white spots/mottles/gypsum, high plasticity, firm to stiff, moist. (MH)					

DRILLING LOG

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

HOLE NO. MW-37-05

SHEET 2 OF 3 SHEETS

F2390

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		changes to a hard, sandy, clayey silt.					5.0/5.0 ft
	11						
	12						
	13	SANDY SILT: brown (5YR 5/6), dry, low plasticity, loose, crumbly, some interbedded MH zones. (ML)					
	14						
	15	CLAYEY SILT: high plasticity, same as 7.5-13 ft. (MH)					5.0/5.0 ft
	16						
	17						
	18						
	19						
	20	some sandy zones present.					5.0/5.0 ft
	21						
	22						
	23						
	24						
	25						
	26	SAND: tan (10YR 8/2) to light brown (5YR 6/4) zones, clean, slightly silty, poorly graded, very fine to fine grained, moist to wet, loose crumbly, homogeneous. (SP)					3.5/5.0 ft
	27						

DRILLING LOG

F2390

PROJECT	INSPECTOR	HOLE NO.
HOLLOMAN AFB RI/FS	ACD	MW-37-05
		SHEET 3 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						
	31						
	32						-water at 31.84 ft
	33			MW-037-005 32.5-35.0			
	34						
	35	interbedded sands and clayey silts: yellowish-red (5YR 5/6)					3.0/5.0 ft
	36						
	37	SAND: tan (10YR 8/2), clean, fine to very fine, homogeneous, poorly graded, wet. (SP)					
	38						
	39						
	40	hard, caliche.					very slow drilling
	41						
	42						TD=42.0 ft
	43						
	44						
	45						

DRILLING LOG

F2391

HOLE NO. MW-37-06

SHEET 1 OF 3 SHEETS

1. COMPANY NAME: RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR: SOUTHWEST ENG INC
3. PROJECT: HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION: 37
5. NAME OF DRILLER: ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL: HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"
8. HOLE LOCATION: 688953.52(Y), 539149.29(X)
9. SURFACE ELEVATION: 4084.13
10. DATE STARTED: 28 AUG 91
11. DATE COMPLETED: 28 AUG 91
12. OVERBURDEN THICKNESS:
13. DEPTH DRILLED INTO ROCK:
14. TOTAL DEPTH OF HOLE: 45 ft.
15. DEPTH GROUNDWATER ENCOUNTERED: ~40 ft bgl
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 04 NOV 91 35.82 ft bmp
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES:
20. SAMPLES FOR CHEMICAL ANALYSIS: VOC / METALS / OTHER (SPECIFY) / OTHER (SPECIFY) / OTHER (SPECIFY)
21. TOTAL CORE RECOVERY: %
22. DEPOSITION OF HOLE: BACKFILLED / MONITORING WELL: X / OTHER (SPECIFY)
23. SIGNATURE OF INSPECTOR: ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0–1.4	SILTY SAND: orange-pink (5YR 8/4), dry, loose, crumbly, poorly graded. (SM)					3.5/5.0 ft
	1.4–6	SILT: tan (10YR 8/2) and light brown/tan, hard, caliche, dry, crumbly, low plasticity. (ML)					
	6–7	SAND: tan (10YR 8/2) to yellow-tan, clean, dry, loose, fine to very fine grained, poorly graded, yellow-brown stains. (SP)					4.0/5.0 ft
	7–	SILT: red brown to brown (5YR 5/6), clayey (7-8 ft), high plasticity, white spots/mottles, sandy, low to medium plasticity (8-9 ft), firm hard, almost a silty sand (?). (MH)					

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-37-06

DRILLING LOG

PROJECT	INSPECTOR	HOLE NO.
HOLLOMAN AFB RI/FS	ACD	MW-37-06
		SHEET 2 OF 3 SHEETS

DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
11						4.5/5.0 ft
12	SILT: tan (10YR 8/2) and brown (5YR 6/4), some caliche, low plasticity, moist, soft, sandy. (ML)					
13						
14						
15	SAND: grey-orange (10YR 7/4), clean poorly graded, homogeneous, moist, loose, some hard zones, very fine. (SP)					4.5/5.0 ft
16						
17	changes to pale orange (10YR 8/2).					
18	CLAYEY, SANDY SILT: brown (5YR 5/6), gypsum crystals, medium plasticity. (MH)					
19	SANDY, CLAYEY SILT: grey-orange (10YR 7/4), firm to hard, low plasticity. (ML)					
20	CLAYEY SILT: brown (5YR 5/6), dry, loose, sticky when wet, low plasticity. (ML)					4.0/5.0 ft
21						
22	changes to grey-orange (10YR 7/4), harder.					
23	SAND: brown (5YR 5/6), loose, moist, fine to very fine, clean. (SP)					
23	CLAYEY SILT: brown (5YR 5/6), high plasticity, white spots (gypsum crystals?), firm sample, moist. (MH)					
24						
25	SILTY SAND: olive, very fine, poorly graded, loose, some thin caliche/hard zones, moist. (SM)					3.5/4.0 ft
26						
27	changes to a tan (10YR 8/2)					

F2391

DRILLING LOG

PROJECT	INSPECTOR	HOLE NO.
HOLLOMAN AFB RI/FS	ACD	MW-37-06
		SHEET 3 OF 3 SHEETS

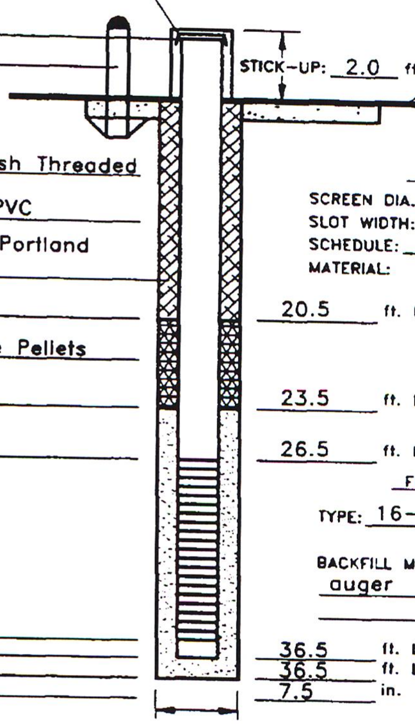
F2391

DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
29						
30						4.0/5.0 ft
31						
32	caliche zones					
	some interbedded brown laminae					
33	SAND: tan (10YR 8/2), clean, wet, fine to very fine grained, poorly graded. (SP)					-water at 33.32 ft
34						
35	SILTY SAND: olive, poorly graded. (SM)					5.0/5.0 ft
36	SILTY SAND: light brown (5YR 6/4), some caliche, moist (wet?), homogeneous, poorly graded, hard. (SM)					
37						
38						
39						
40	SILT: brown (5YR 4/4), moist to wet, loose, no caliche, firm, medium to low plasticity. (MH)					
41						
	CLAYEY SILT: high plasticity.					
42						
43	SAND: clean, light brown (5YR 6/4), clean, very fine to medium, wet, homogeneous, poorly graded. (SP)					
44						
45						TD=45.0 ft

ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 27 SEPT 91 / STARTED / COMPLETED	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4077.22	SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-37-01

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 2.0 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

LENGTH OF SOLID PIPE 28.5 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

TOP OF SEAL 20.5 ft. bgl

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK 23.5 ft. bgl

TOP OF SCREEN 26.5 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL SCREEN LENGTH 9.5 ft.

FILTER PACK

BOTTOM OF WELL 36.5 ft. bgl

BOTTOM OF BORING 36.5 ft. bgl

BORING DIAMETER 7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1437/31.64 ft. bmp

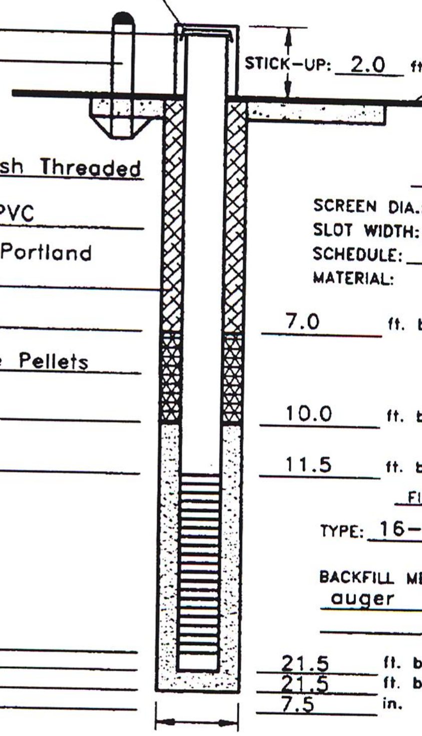
DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738D

ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 27 SEPT 91 / STARTED / COMPLETED	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4058.43	SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-37-02

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 2.0 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

TYPE OF PIPE JOINTS: Flush Threaded

LENGTH OF SOLID PIPE 13.5 ft.

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL 7.0 ft. bgl

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK 10.0 ft. bgl

TOP OF SCREEN 11.5 ft. bgl

WELL SCREEN LENGTH 9.5 ft.

FILTER PACK

BOTTOM OF WELL 21.5 ft. bgl

BOTTOM OF BORING 21.5 ft. bgl

BORING DIAMETER 7.5 in.

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: [X] PVC [ ] STAINLESS STEEL [ ] OTHER (DESCRIBE)

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1443/14.54 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738E

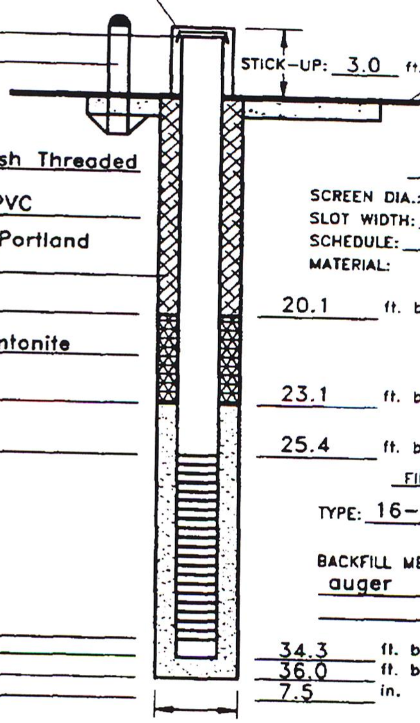
ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 27 SEPT 91 / STARTED / COMPLETED	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4079.66	SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-37-03

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox



TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 3.0 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

LENGTH OF SOLID PIPE 27.4 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: [X] PVC [ ] STAINLESS STEEL [ ] OTHER (DESCRIBE)

TOP OF SEAL 20.1 ft. bgl

TYPE OF SEAL: 1/4" Bentonite

TOP OF FILTERPACK 23.1 ft. bgl

TOP OF SCREEN 25.4 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL SCREEN LENGTH 9.5 ft.

FILTER PACK

BOTTOM OF WELL 34.3 ft. bgl

BOTTOM OF BORING 36.0 ft. bgl

BORING DIAMETER 7.5 in.

WELL DEVELOPMENT

METHOD: See well development record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 27 SEP 91/1600/26.3 ft bgl

17 OCT 91/1500/28.64 ft bmp

04 NOV 91/1505/28.60 ft bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

F2304

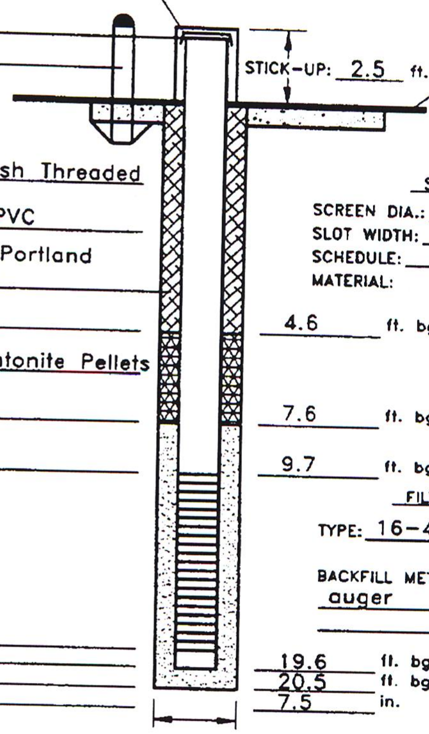
ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 28 SEPT 91 / STARTED 1400 / COMPLETED 1500	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4063.53	SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-37-04

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox



TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 2.5 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

LENGTH OF SOLID PIPE: 12.1 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC.: Type I Portland Cement

TOP OF SEAL: 4.6 ft. bgl

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK: 7.6 ft. bgl

TOP OF SCREEN: 9.7 ft. bgl

FILTER PACK

WELL SCREEN LENGTH: 9.5 ft.

BOTTOM OF WELL: 19.6 ft. bgl

BOTTOM OF BORING: 20.5 ft. bgl

BORING DIAMETER: 7.5 in.

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL DEVELOPMENT

METHOD: See well development record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL
28 SEP 91/1600/13.3 ft bgl
19 OCT 91/0840/16.09 ft bmp
04 NOV 91/1515/16.14 ft bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

F2305

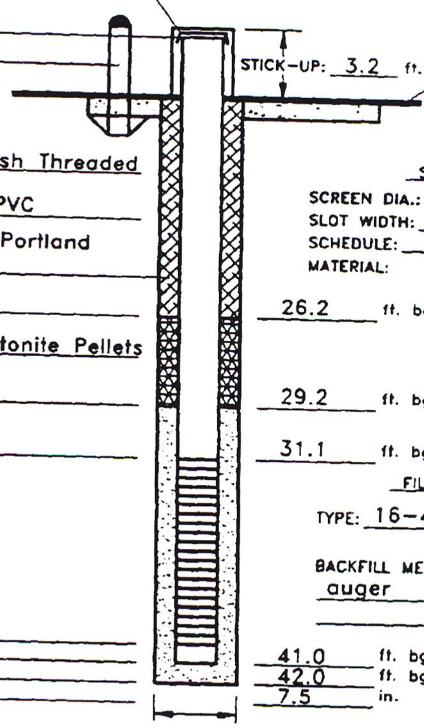
ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED: 29 SEPT 91 · STARTED: 1600 · COMPLETED: 1800	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4083.09	SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-37-05

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox



TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 3.2 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

LENGTH OF SOLID PIPE: 3.2 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

TOP OF SEAL: 26.2 ft. bgl

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK: 29.2 ft. bgl

TOP OF SCREEN: 31.1 ft. bgl

WELL SCREEN LENGTH: 9.5 ft.

FILTER PACK

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

BOTTOM OF WELL: 41.0 ft. bgl

BOTTOM OF BORING: 42.0 ft. bgl

BORING DIAMETER: 7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 19 OCT 91/0840/35.04 ft. bmp

4 NOV 91/1458/35.04 ft. bmp

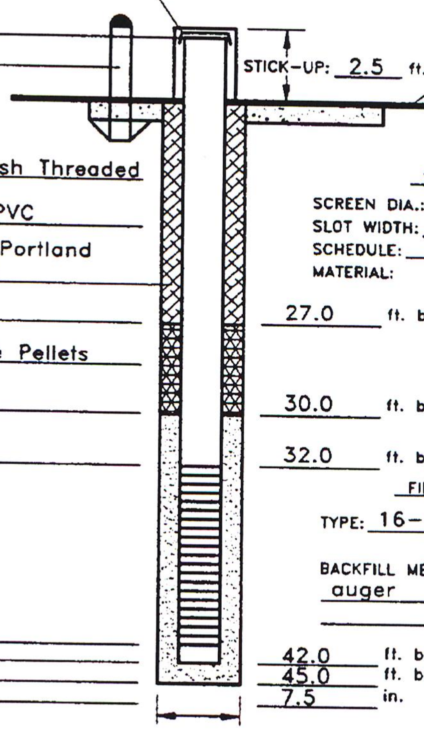
DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738M

ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED: 29 SEPT 91 / STARTED: / COMPLETED:	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING: 4085.29	SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-37-06

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 2.5 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

LENGTH OF SOLID PIPE: 34.6 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC.: Type I Portland Cement

SCREEN INFORMATION

SCREEN DIA.: 2 in.
SLOT WIDTH: 0.010 in.
SCHEDULE: 40
MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

TOP OF SEAL: 27.0 ft. bgl

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK: 30.0 ft. bgl

TOP OF SCREEN: 32.0 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL SCREEN LENGTH: 9.5 ft.

FILTER PACK

BOTTOM OF WELL: 42.0 ft. bgl
BOTTOM OF BORING: 45.0 ft. bgl
BORING DIAMETER: 7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record
TIME SPENT DEVELOPING:
VOLUME OF WATER REMOVED:
VOLUME OF WATER ADDED:
DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

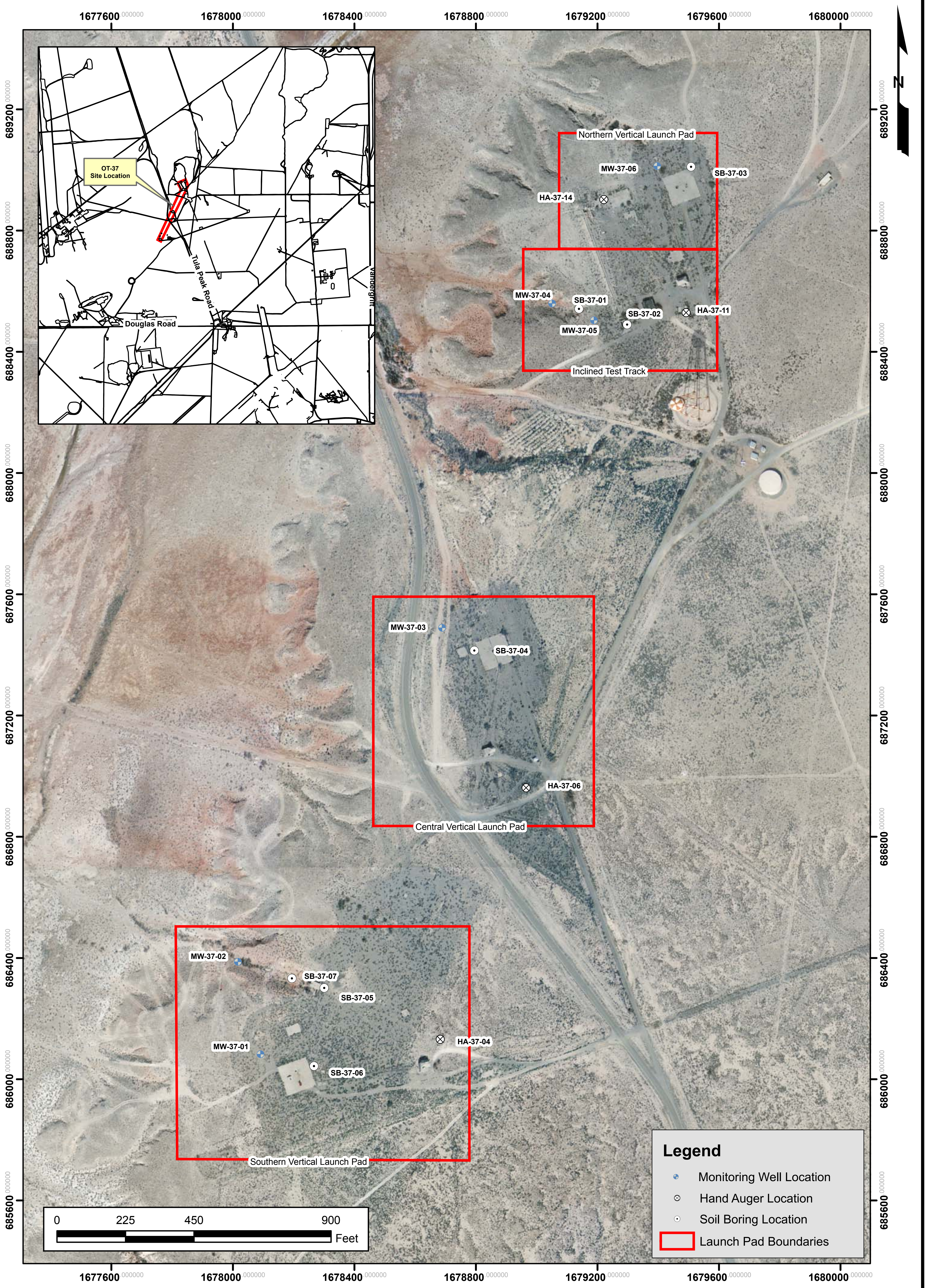
WATER LEVEL MEASUREMENTS
DATE/TIME/LEVEL 4 NOV 91/1452/35.82 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738F

Appendix B-4-2

Portions of: *Accelerated Corrective Measures Completion Report for Multiple Sites,* Bhate Environmental Associates, Inc. conducted in June 2007 (report not completed as of the date of this Work Plan)



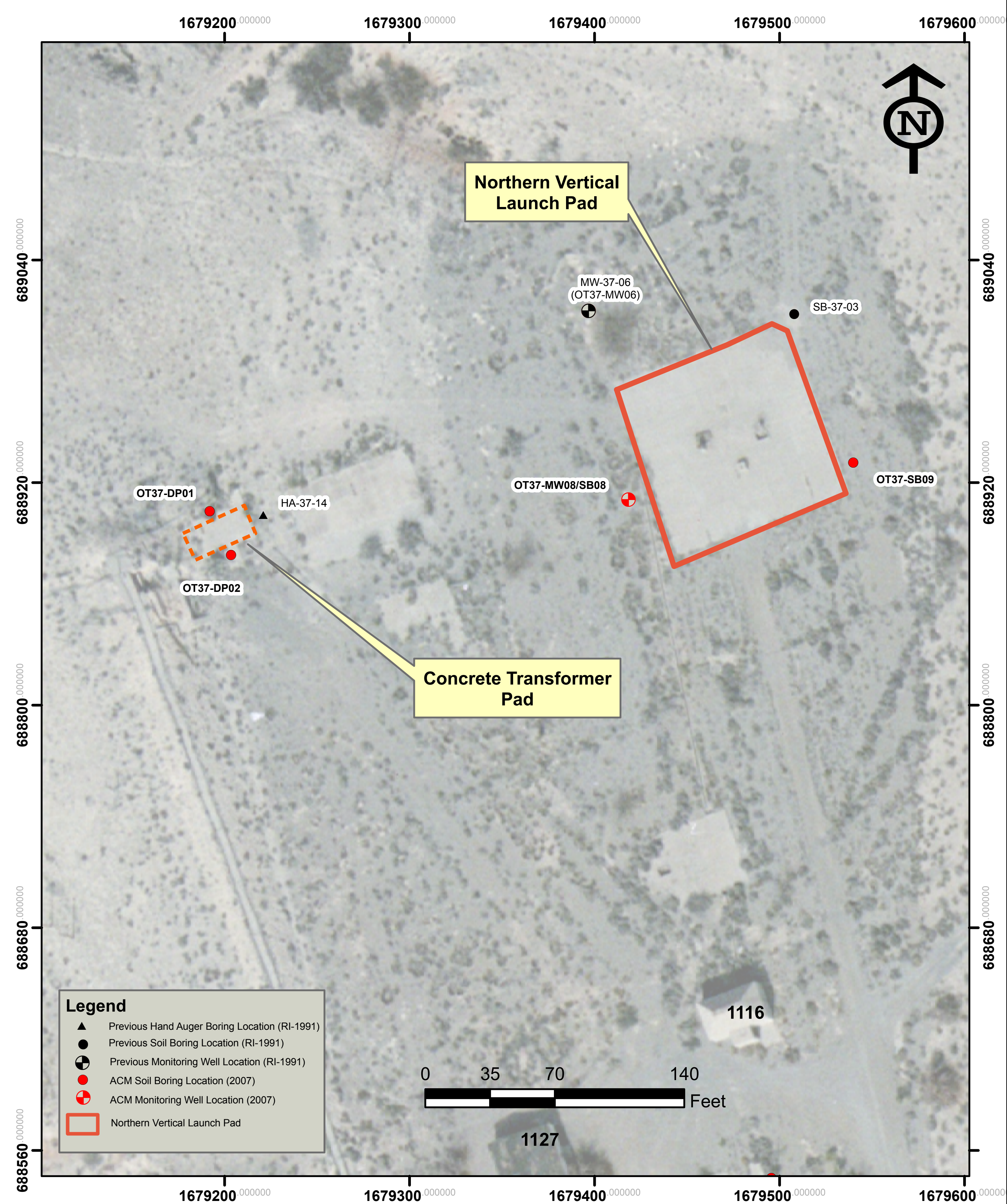
bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37 Site Map with Previous Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:
9050361	1"=300'	11/5/07	cm
			DRAWING NO: Figure 2-5

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 2-5



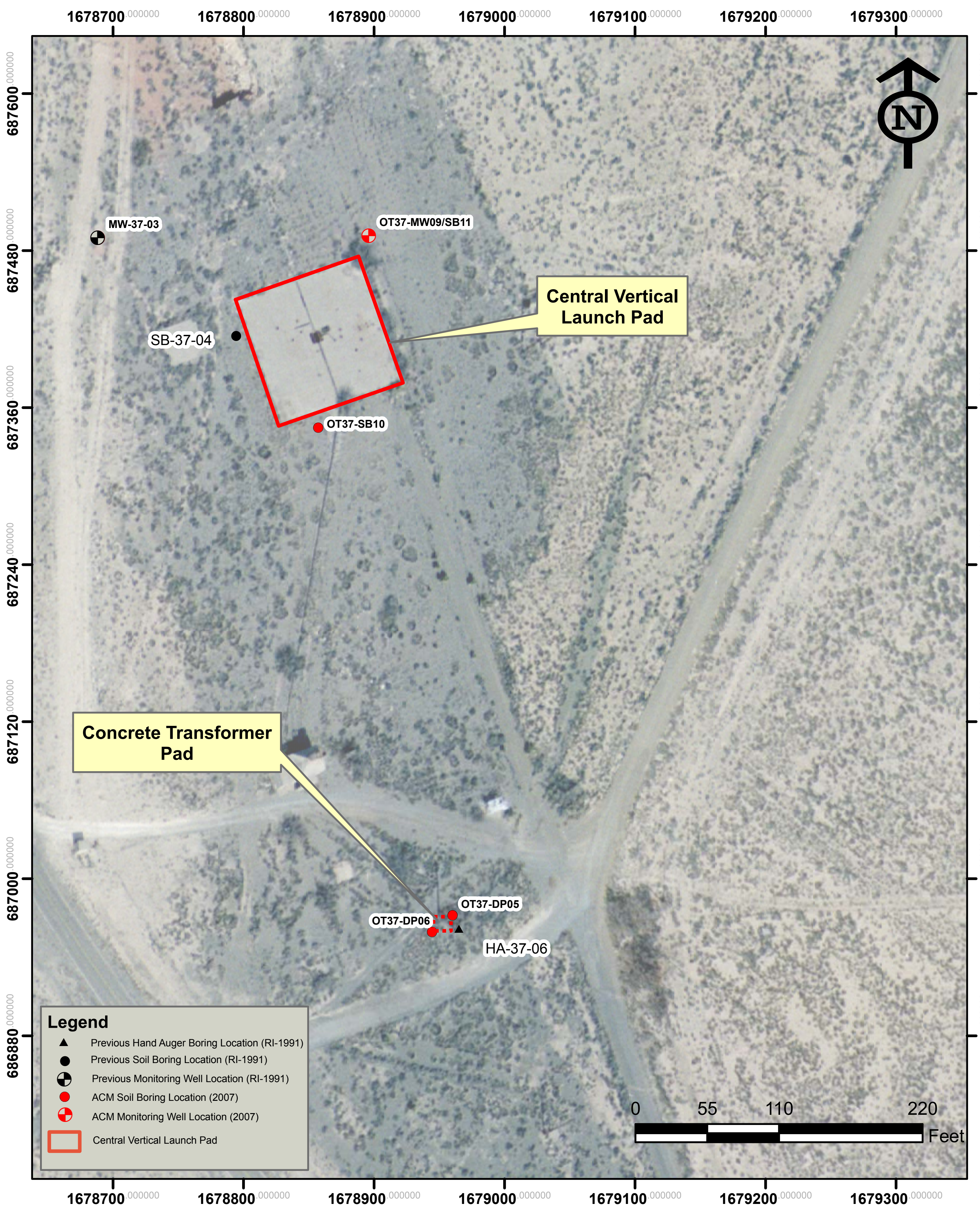
bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37 Northern Vertical Launch Pad
ACM and Previous Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=70'	11/5/07	cm	fig2-6

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 2-6



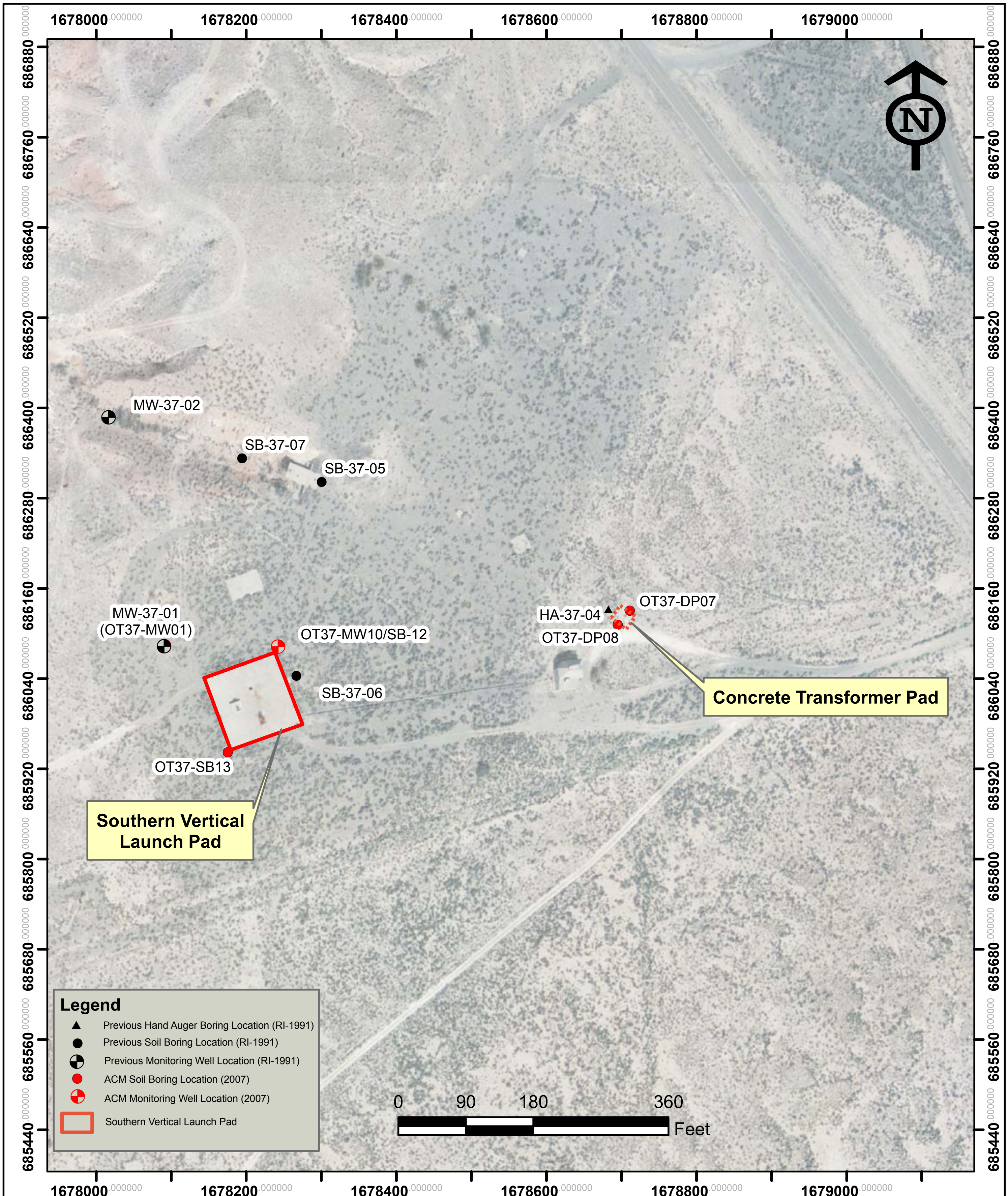
bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37 Central Vertical Launch Pad
ACM and Previous Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=100'	11/5/07	cm	fig2-7

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 2-7



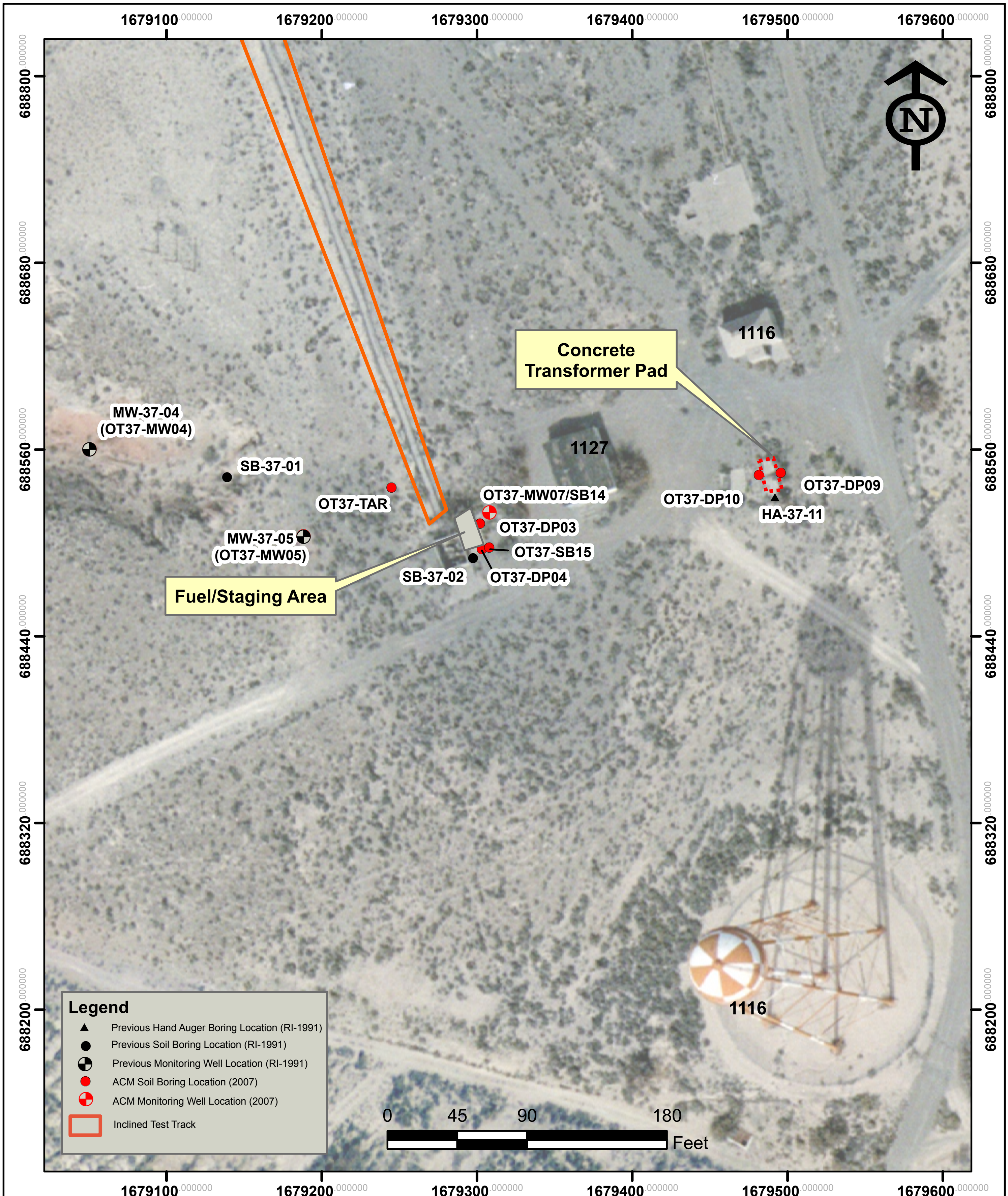
bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37 Southern Vertical Launch Pad
ACM and Previous Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=180'	11/5/07	cm	fig2-8

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 2-8



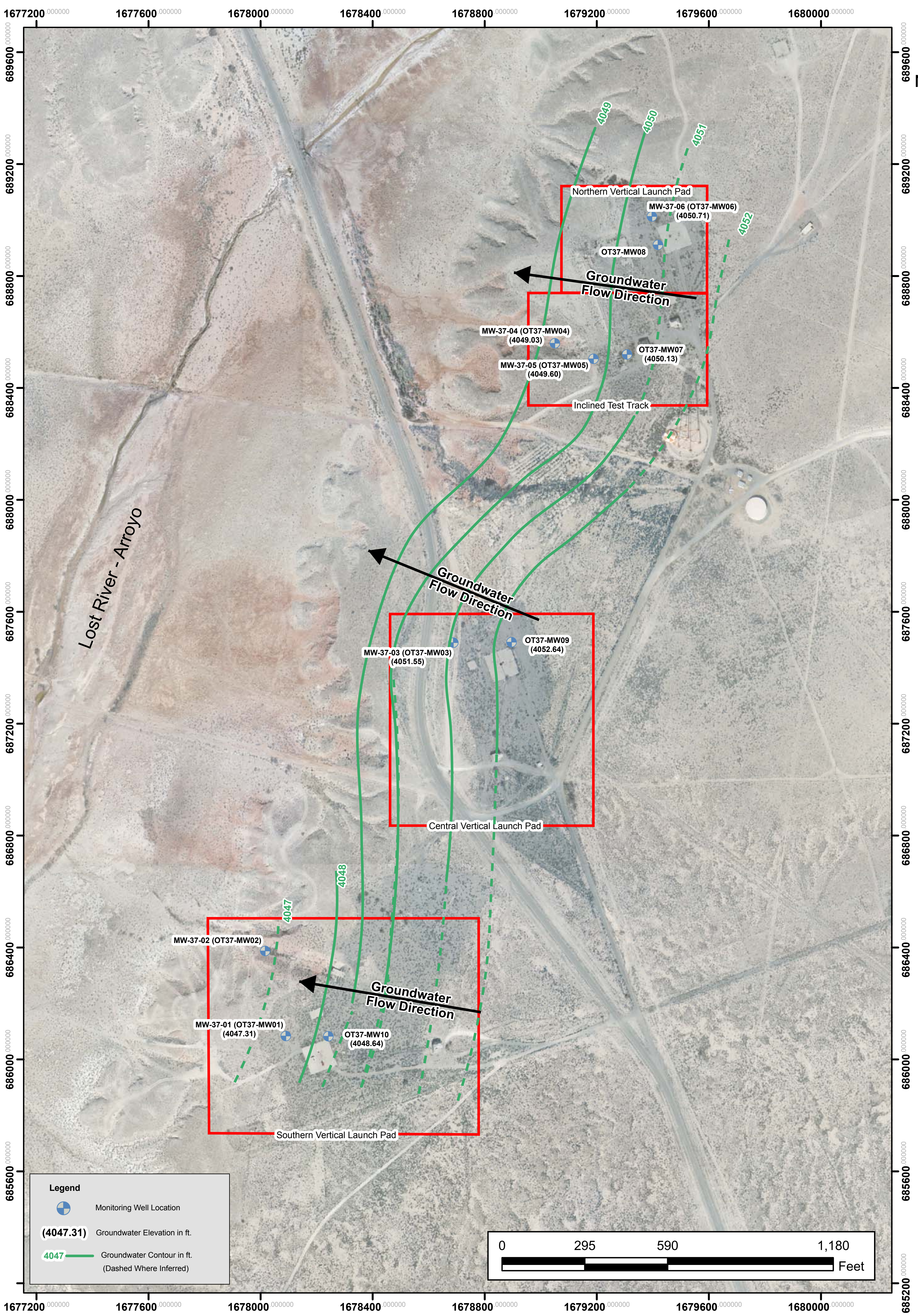
bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37 Inclined Test Track
ACM and Previous Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=90'	11/5/07	cm	fig2-9

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 2-9



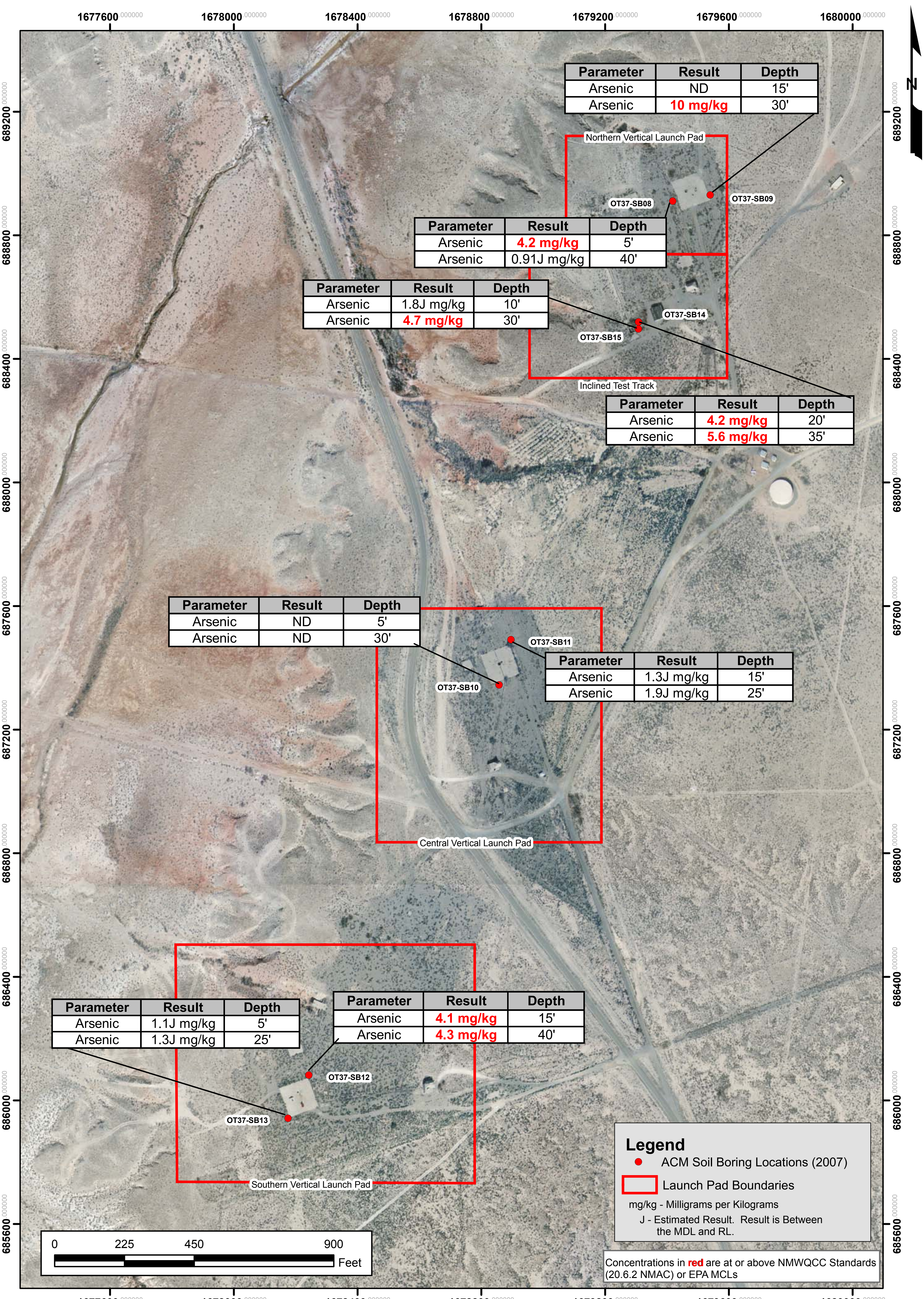
bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37 Area
Potentiometric Surface Map

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	AS SHOWN	11/6/07	CM	Figure3-9

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 3-9



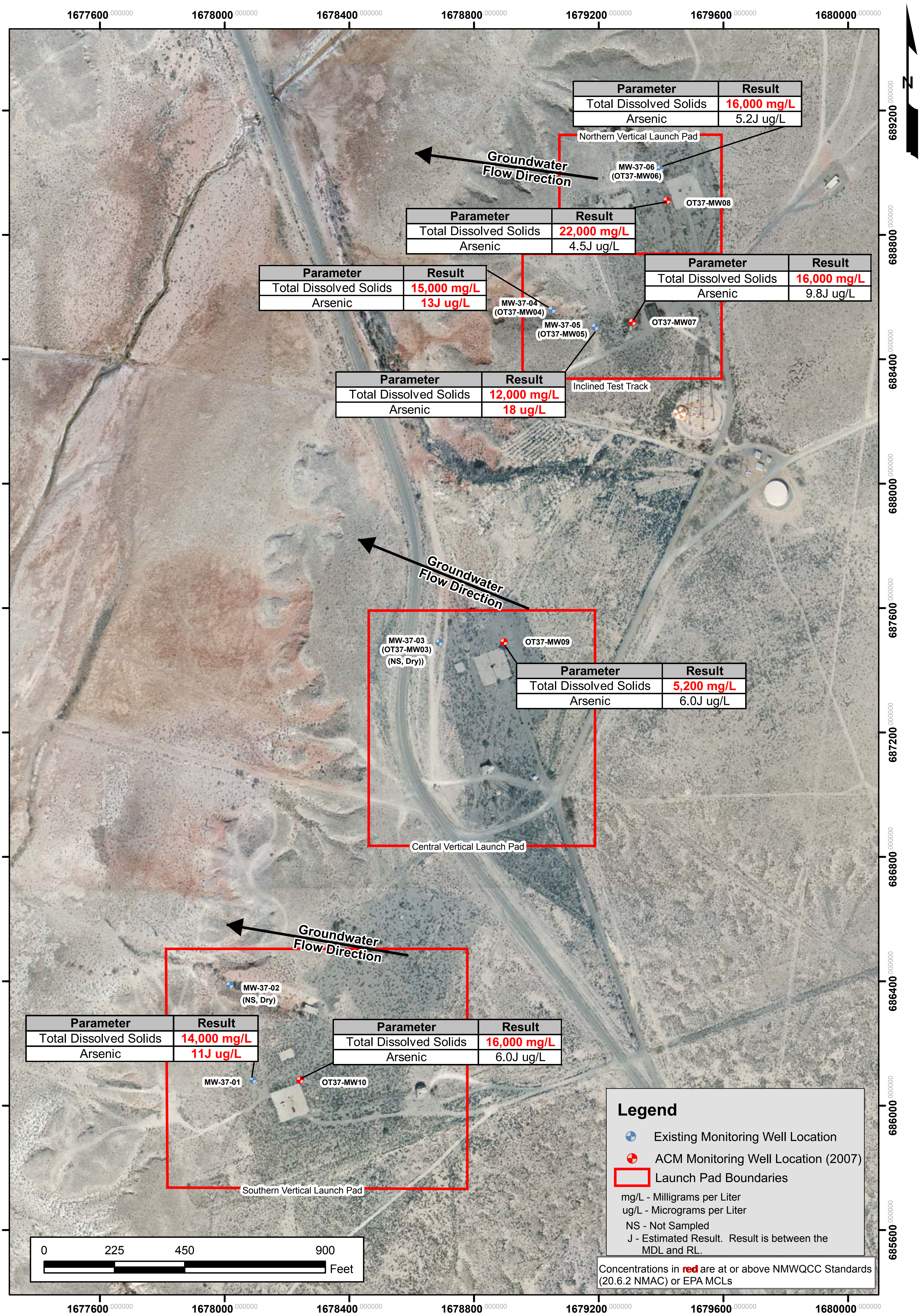
bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37
Soil Analytical Results
(July 2007)

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=300'	10/3/07	cm	Figure 4-5

Accelerated Corrective Measures
Completion Report
Holloman AFB, New Mexico

Figure 4-5



bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

OT-37
Groundwater Analytical Results
(July 2007)

PROJECT NO.	SCALE	DATE	DRAWN BY:
9050361	1"=300'	10/3/07	cm
			DRAWING NO: Figure 4-6

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 4-6

B-5

OT-38 (SWMU 137)

Appendix B-5-1

Portions of: *Draft Final Remedial Investigation (RI) Report Investigation, Study and Recommendation for 29 Waste Sites Holloman Air Force Base, NM,* Radian Corporation, June 1992

RADIAN
CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

(Mailing Address)
P.O. Box 201088
Austin, TX 78720-1088
(Shipping Address)
8501 North Mopac Blvd.
Austin, TX 78759
(512) 454-4797

REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 North MoPac Blvd.
P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

June 1992

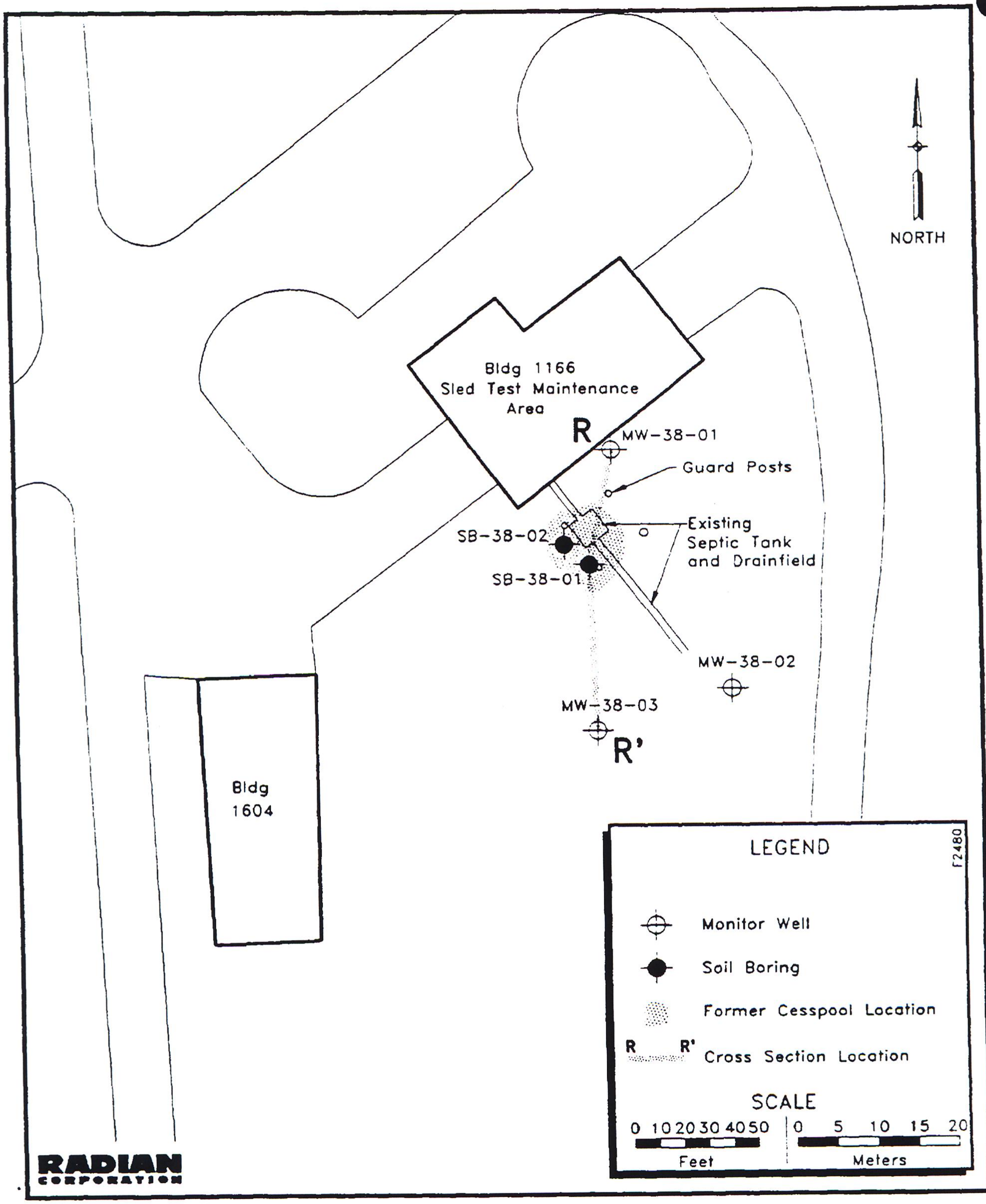


Figure 4-61. Soil Boring, Monitor Well, and Cross Section Locations for Site 38

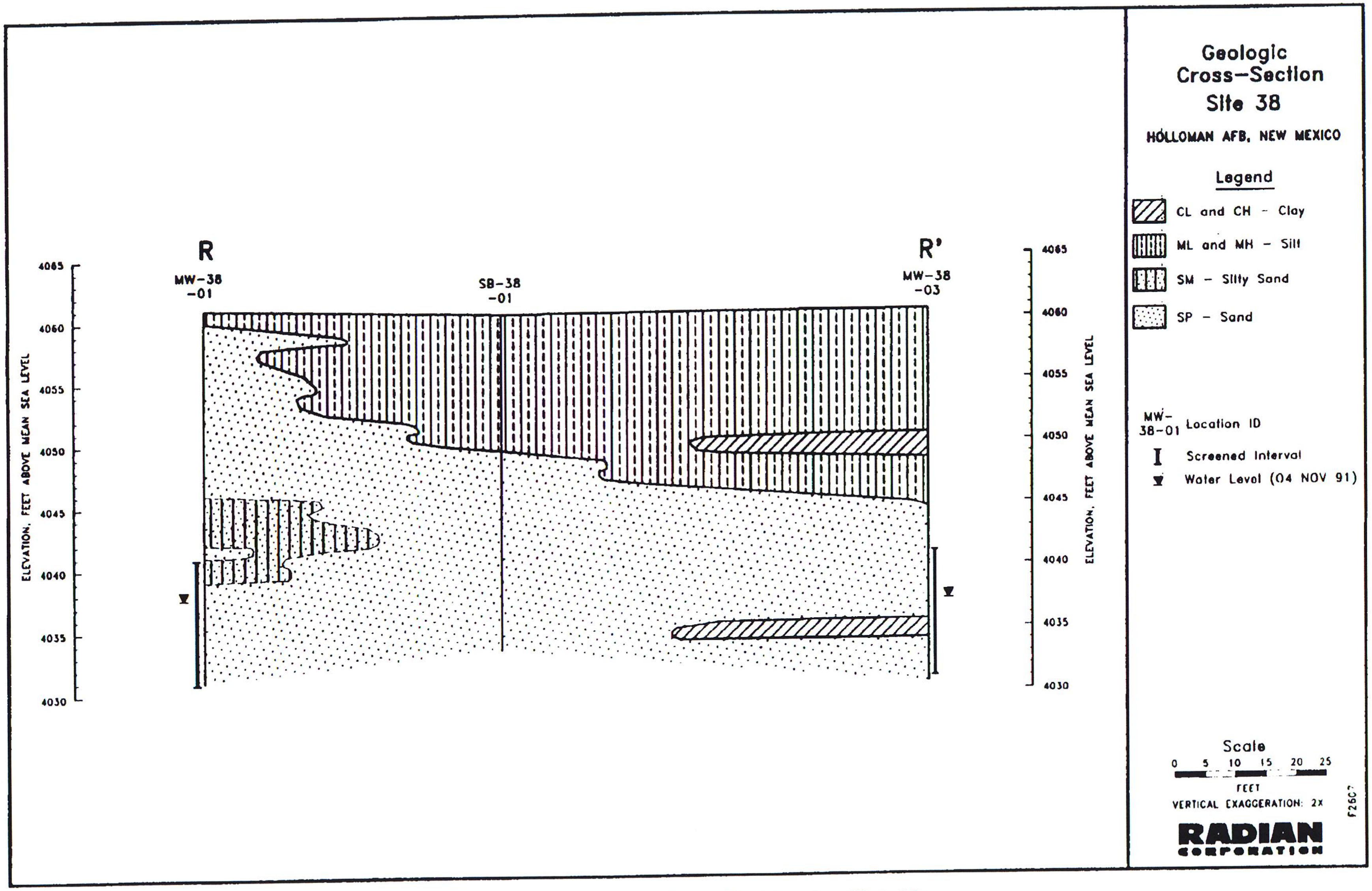


Figure 4-62. Geologic Cross Section for Site 38

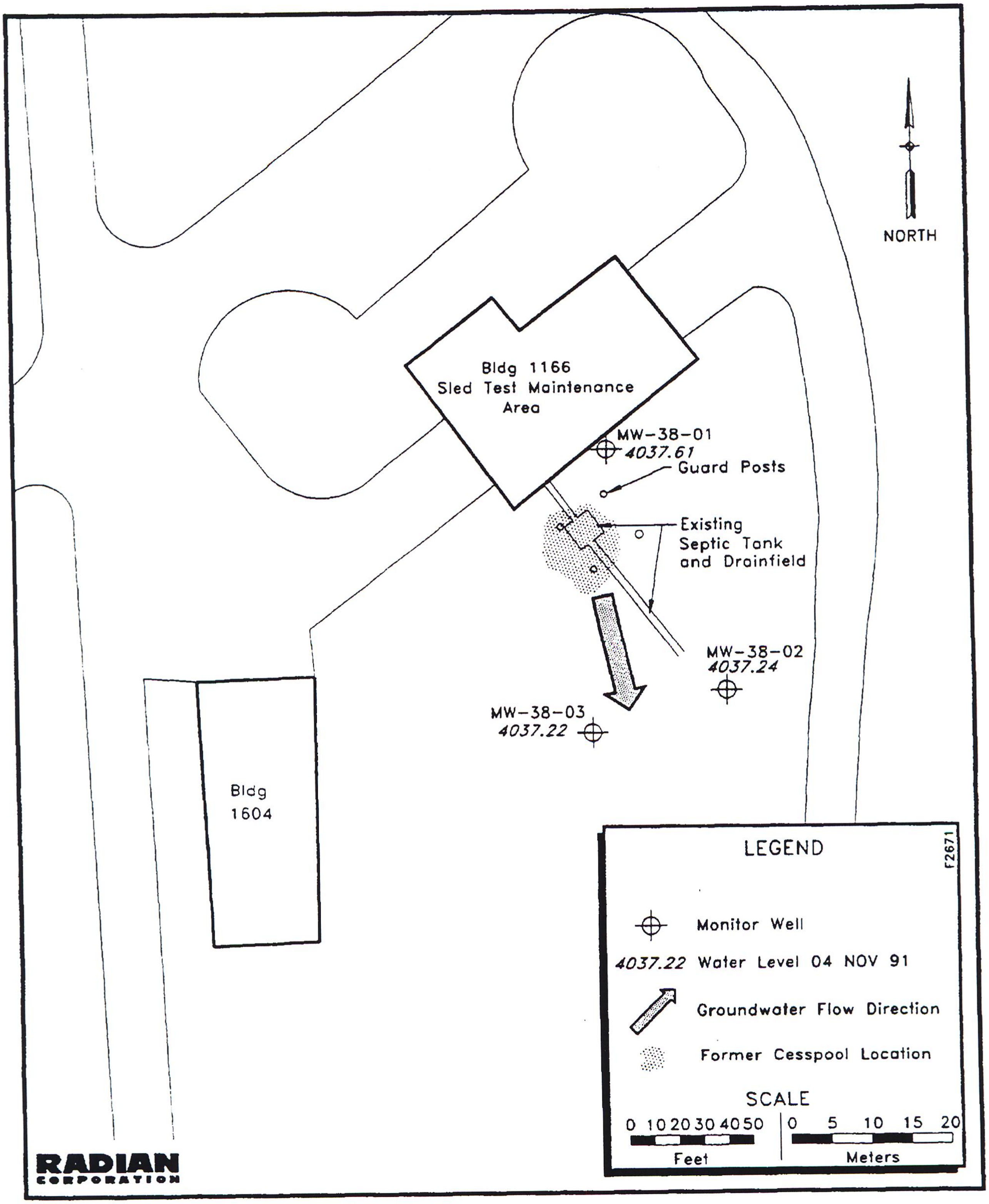


Figure 4-63. Monitor Well Locations and Groundwater Flow Direction for Site 38

Table 4-83

Concentrations of Inorganic and Organic Analytes in Site 38 Soil Samples

Location	[illegible]				[illegible]			
Sample ID [illegible]	[illegible]		[illegible]		[illegible]		[illegible]	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
Inorganic results								
SW6010 - Metals (mg/kg)								
Chromium	6.7 @	(1.9)	4.1 @	(3.4)	5.7 @	(3.4)	5.6 @	(3.7)
Nickel	5.5 @	(3.8)	ND	(6.8)	ND	(6.9)	ND	(7.5)
Zinc	19	(3.8)	7.6 @	(6.8)	14 @	(6.9)	11 @	(7.5)
SW7060 - Arsenic (mg/kg)	1.6 @	(0.37)	0.56 @	(0.36)	1.1 @	(0.37)	0.73 @	(0.36)
SW7421 - Lead (mg/kg)	2.5	(0.28)	0.70 @	(0.27)	20	(1.1)	1.1 @	(0.27)
Organic results								
EPA 418.1 - TRPH (mg/kg)	24.4 @	(12.6)	29.1 @	(12.1)	1540	(250)	18.4 @	(12.6)
SW8240 - Volatile Organics (ug/kg)								
Methylene chloride	37 JB	(130)	78 JB	(120)	52 JB	(130)	240 B@	(130)
Toluene	7.7 J	(130)	7.2 J	(120)	6.2 J	(130)	8.9 J	(130)

NOTE: Table presents only constituents detected in soil at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.
J = Detected below the detection limit.

Table 4-84

Concentrations of Inorganic Analytes in Site 38 Groundwater Samples

Location: Sample ID:	MW-38-01 38-01-01		MW-38-02 38-02-01		MW-38-03 38-03-01	
Analytes	Result	(DL)	Result	(DL)	Result	(DL)
EPA 160.1 - Total Dissolved Solids (mg/L)	15000	(10)	15000	(10)	5500	(10)
EPA 300.0 - Chloride (mg/L)	3700	(26)	3800	(26)	900	(2.6)
EPA 300.0 - Sulfate (mg/L)	4900	(5.0)	3900	(5.0)	1900	(5.0)
EPA 340.2 - Fluoride (mg/L)	1.5	(0.10)	1.4	(0.10)	2.1	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	110	(4.4)	130	(4.4)	110	(4.4)
EPA 365.2 - Total Phosphorus (mg/L)	0.33	(0.020)	0.084 @	(0.020)	0.19	(0.020)
SW6010 - Metals (mg/L)						
Antimony	ND	(0.20)	0.14 @	(0.10)	ND	(0.10)
Copper	0.047 @	(0.040)	ND	(0.020)	0.059 @	(0.020)
Nickel	0.047 @	(0.040)	ND	(0.020)	ND	(0.020)
Zinc	0.047 @	(0.040)	ND	(0.020)	0.027 @	(0.020)
SW7421 - Lead (mg/L)	0.0078 @	(0.0060)	ND	(0.0060)	0.013 @	(0.0060)

NOTE: Table presents only constituents detected in groundwater at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.

Table 4-85

Concentrations of Organic Analytes in Site 38 Groundwater Samples

Location: Sample ID:	MW-38-01 38-01-01		MW-38-02 38-02-01		MW-38-03 38-03-01	
Analyte/Method	Result	(DL)	Result	(DL)	Result	(DL)
SW8240 - Volatile Organics (µg/L)						
Chloroform	1.3 J	(5.0)	2.0 J	(5.0)	ND	(5.0)
Methylene chloride	30	(5.0)	49	(5.0)	18 @	(5.0)
Trichloroethene	3.1 J	(5.0)	2.8 J	(5.0)	ND	(5.0)

NOTE: Table presents only constituents detected in groundwater at this site.
J = Detected below the detection limit.
ND = Not Detected, at the reported detection limit.
@ = Measured result is less than five times the detection limit.

Table 4-86

Groundwater Analytes Detected Above Risk-Based Action Levels at Site 38

Analyte	Location ID	Result		Action Level
Groundwater Results (mg/L)				
Antimony	MW-38-02	0.14	@	0.01
Fluoride	MW-38-03	2.1		2
Methylene chloride[a]	MW-38-01	0.03		0.005
Methylene chloride[a]	MW-38-02	0.049		0.005
Methylene chloride[a]	MW-38-03	0.018	@	0.005
Trichloroethene	MW-38-01	0.0031	J	0.003

Note: Result units were changed to match action level units for this table.

@ = Measured result is less than five times the detection limit.
[a] Methylene chloride was determined to be a laboratory contaminant in a QA/QC review and is, therefore, not considered to be above the action level in samples from the site.
J = Detected below the detection limit.

DRILLING LOG

Field	Value
HOLE NO.	SB-38-01
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET	1 OF 2 SHEETS
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686043.76(Y), 532166.32(X)
9. SURFACE ELEVATION	4060.48
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	22.0 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	27 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: / UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: / METALS: / OTHER (SPECIFY): / OTHER (SPECIFY): / OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: / MONITORING WELL: / OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SILT: greyish-orange (5YR 7/4), low plasticity, dry, 0-.3 ft gravel fill. (ML)	HS=0.3ppm		91JULH038-001	5,6,8,9	1.0/2.0 ft composite 0-10 ft on 2.5' intervals
	2.5	SILT: light brown (5YR 5/6), dry, low plasticity, trace fine sand. (ML)	HS=0.6ppm			6,9,6,5	1.9/2.0 ft
	5	SILT, as above: moist, no sand. (ML)	HS=1.3ppm			3,14,8,7	1.7/2.0 ft VOAs from interval 5-7 ft
	5.5	SILT: very pale orange (10YR 8/2), dry, low plasticity, caliche. (ML)					
	6.5	CLAYEY SILT: light brown (5YR 5/6), moist, medium plasticity, gypsum. (ML)					
	7.5	CLAYEY SILT, as above.	HS=0.3ppm			8,12,10,9	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

DRILLING LOG

HOLE NO. SB-38-01

F2413

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		CLAYEY SILT, as above	HS=0.0ppm		91JULH038 -002	4,10,30,40	2.0/2.0 ft Composite of 10 20 ft on 5.0 ft intervals
	11	SAND: very pale orange (10YR 8/2), very fine grained, clorly graded, dry. (SP)					
	12						
	13						
	14						
	15	SAND, as above.	HS=0.0ppm			43,50	0.5/2.0 ft not enough recovery for work
	16						
	17						
	18						
	19						
	20	SAND, as above: have rust color staining.	HS=0.0ppm			35,50	VOA from 20-22 ft interval
	21						
	22						water at 22.0 ft bgl
	23						
	24						
	25	SAND: greyish-orange (10YR 7/4), fine to very fine, poorly graded, wet. (SP)				35,50	1.8/2.0 ft
	26						
	27						TD= 27.0 ft

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-38-01

DRILLING LOG

HOLE NO.	SB-38-02
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET	1 OF 2 SHEETS
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686052.24(Y), 532156.26(X)
9. SURFACE ELEVATION	4060.73
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	22.5 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	25 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: ; OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	HTH

F2414

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SILT: greyish-orange (10YR 7/4), dry, low plasticity (gravel fill from 0-0.3'), stain on surface above boring. (ML)	HS=25.5ppm SC=5.4ppm		91JULH038 -003	6,6,10,9	1.2/2.0 ft chemical odor
	2.5	SILT: moderate yellowish-brown (10YR 5/4), low plasticity, dry, gypsum layers. (ML)	HS=81.3ppm			4,4,3,4	1.8/2.0 ft VOA sample interval 2.5-4.5 ft
	5	SILT: very pale orange (!0YR 8/2), low plasticity, dry. (ML)	HS=5.7ppm			11,10,7,8	1.7/2.0 ft
	6	SILT: light brown (5YR 5/6), low plasticity, dry, gypsum mottling, some clay. (ML)					
	7.5	SILT, as above: clay content increases with depth. (ML)	HS=2.7ppm			4,7,7,9	
	9	CLAYEY SILT, as above: medium plasticity. (ML)					

DRILLING LOG

HOLE NO. SB-38-02

F2414

PROJECT HOLLOMAN AFB RI/FS | INSPECTOR HTH | SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILTY CLAY: moderate brown (5YR 4/4), moderate plasticity, moist, gypsum mottling. (CL)	HS=0.3ppm		91JULH038 -004	24,6,24,50	1.8/2.0 ft composite 10-20' on 5 ft intervals
	11	SAND: very pale orange (1)YR 8/2), very fine grained, poorly graded, dry. (SP)					
	12						
	13						
	14						
	15	SAND, as above: pale yellowish-orange (10YR 8/6).	HS=0.3ppm			29,50	0.5/2.0 ft VOA sample interval 15-17 ft
	16						
	17						
	18						
	19						
	20	SAND, as above.	HS=0.0ppm			50	0.4/2.0 ft no VOA collected because of little recovery
	21						
	22						water at 22.5 ft bgl
	23						
	24						
	25	SAND: light brown (5YR 6/4), fine to very fine grained, poorly graded, wet. (SP)				37,50	
	26						
	27						TD= 27.0 ft

DRILLING LOG

HOLE NO.	MW-38-01	F2395	
1. COMPANY NAME	RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS			
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA	6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"	8. HOLE LOCATION	686092.55(Y), 532175.89(X)
		9. SURFACE ELEVATION	4061.03
		10. DATE STARTED	24 SEP 91
		11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS		15. DEPTH GROUNDWATER ENCOUNTERED	22 ft bgl
13. DEPTH DRILLED INTO ROCK		16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 25.24 ft bmp
14. TOTAL DEPTH OF HOLE	30 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		X	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SANDY SILT: brown (10YR 5/4), organic with gravels, fill (?). (ML)					3.0/5.0 ft
	1	SAND: tan-brown (10YR 7/4) very fine, moist, crumbly, clean, poorly graded, homogeneous. (SP)					
	2	changes to brown (5YR 6/4) with white mottles.					
	3						
	4						
	5	tan zone (~1'), minor caliche.					3.0/5.0 ft
	6	changes to brown (5YR 6/4), minor caliche.					
	7	changes to SAND: fine to medium, clean					
	8						
	9						

DRILLING LOG

HOLE NO.	MW-38-01
PROJECT	HOLLOMAN AFB RI/FS
INSPECTOR	ACD
SHEET	2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	10–12	small (1"), brown (5YR 4/4), hard silt/very fine sand zone.					3.0/5.0 ft
	13	some tan zones, more of a tan-pink (5YR 8/4) color.					
	15	SAND: brown (5YR 6/4), very fine, caliche zones interbedded with SILT: brown (5YR 5/6), gypsum crystals present, no loose sand, all caliche, very hard. (SM)					4.5/5.0 ft
	19	SAND: yellow-green (5YR 7/6), to grey-yellow (5Y 8/4) laminae, fine to very fine, black streaks, moist, loose, crumbly. (SP)					
	20	SAND and SILT: interbedded, tan to brown to red brown, predominantly sand, some caliche, sand is very fine to medium, some orange to yellow staining at 20-21 ft. (SM)					3.5/5.0 ft
	22	SAND: brown (5YR 6/4), fine to medium, clean, wet, subrounded. (SP)					-water at 22.74 ft
	27.5			MW-038-01-27.5-30.0			

PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES	HOLE NO.	MW-38-01

f2395

DRILLING LOG

HOLE NO.	MW-38-01
PROJECT	HOLLOMAN AFB RI/FS
INSPECTOR	ACD
SHEET	3 OF 3 SHEETS

F2395

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						TD=30.0 ft
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

DRILLING LOG

HOLE NO.	MW-38-02
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	685992.12(Y), 532222.78(X)
9. SURFACE ELEVATION	4061.19
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	23 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 26.32 ft bmp
14. TOTAL DEPTH OF HOLE	30 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: ; UNDISTURBED: X
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: ; METALS: ; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: ; MONITORING WELL: X ; OTHER (SPECIFY):
23. SIGNATURE OF INSPECTOR	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	0	SILTY SAND: yellow-orange (10YR 6/5), very fine, some ribbons, firm, moist, crumbly, soft. (SM)					3.5/5.0 ft may be a sandy silt (borderline)
	2.5	changes to light brown (5YR 6/4), with white mottles					
	5						4.0/5.0 ft
	5.5	some gypsum crystals; grades to					
	7	grades to CLAYEY SILT: brown (5YR 5/6), gypsum cystals, high plasticity, stiff. (MH)					
	8	SANDY, CLAYEY SILT: brown (5YR 4/4), medium plasticity, crumbly, moist, soft. (ML)					

DRILLING LOG

HOLE NO.	MW-38-02
PROJECT	HOLLOMAN AFB RI/FS
INSPECTOR	ACD
SHEET	2 OF 3 SHEETS

F2396

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11	CLAYEY SILT, and clay: gypsum crystals, brown and grey/olive. (MH)					
	11.5–15	SAND: tan (10YR 8/2), clean, moist, fine to medium grained. (SP)					
	15–20	SAND: tan (10YR 8/2) to brown (5YR 6/4), very fine to medium zones, caliche dominant, some brown zones, some silty zones, mainly a clean, poorly graded sand caliche. (SP)					
	20–21	SANDY SILT: brown (5YR 5/6), low plasticity. (ML)					
	21–22	SAND: tan/olive (10YR 8/2), caliche, fine, clean. (SP)					
	22–23	SAND: brown (5YR 4/6 and tan (10YR 8/2), interbedded, medium grained, moist, clean. (SP)					
	23–25	SAND: olive (5Y 6/4), clean, fine to very fine, wet, poorly graded. (SP)					looks "stressed" ▽ -water at 23.82 ft
	25–28	SAND: very fine, tan and brown, saturated. (SP)		MW-038-02-27.5-30.0			

PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES	HOLE NO.	MW-38-02

DRILLING LOG

HOLE NO.	MW-38-02
PROJECT	HOLLOMAN AFB RI/FS
INSPECTOR	ACD
SHEET	3 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						TD= 30.0 ft
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

F2396

DRILLING LOG

HOLE NO.	MW-38-03
1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET	1 OF 3 SHEETS
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	685974.75(Y), 532168.57(X)
9. SURFACE ELEVATION	4060.72
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	23.08 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 25.88 ft bmp
14. TOTAL DEPTH OF HOLE	30 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED: / UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: / METALS: / OTHER (SPECIFY): / OTHER (SPECIFY): / OTHER (SPECIFY):
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED: / MONITORING WELL: X / OTHER (SPECIFY):
23. SIGNATURE OF INSPECTOR	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1						
	2						
	3						
	4						
	5	CLAYEY SILT: pale yellowish-orange (10YR 8/6), medium plasticity, dry, some caliche. (ML)				9,10,9,7	1.6/2.0 ft
	6						
	7						
	8						
	9						

DRILLING LOG

HOLE NO. MW-38-03

F2415

PROJECT: HOLLOMAN AFB RI/FS | INSPECTOR: HTH | SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	10–11	CLAY: light brown (5YR 5/6), medium plasticity, dry, hard, gypsum mottling, increasing silt content at 11-12 ft. (CL)				4,8,11,14	2.0/2.0 ft
	11.5	SILT: light brown (5YR 5/6), low plasticity, dry, 11.5-12.0 ft no clay all silt. (ML)					
	15	SAND: yellowish-grey (5Y 7/2), very fine grained, almost silty, poorly graded, dry, some caliche. (SP)				24,41,42, 50	1.8/2.0 ft
	20	SAND: as above, fine to very fine grained, dry. (SP)				50	0.5/2.0 ft
	23						water at 23.08 ft bgl
	25	SANDY CLAY : yellowish-grey (5Y 7/2), medium plasticity, wet, hard. (CL)				4,22,36,50	
	25.5	SAND: yellowish grey (5Y 7/2), medium to very fine grained, moderately sorted, wet, trace clay near 25.5 ft, some silt below 25.5 ft. (SP)					

DRILLING LOG

HOLE NO.	MW-38-03
PROJECT	HOLLOMAN AFB RI/FS
INSPECTOR	HTH
SHEET	3 OF 3 SHEETS

F2415

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						TD= 30.0 ft
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

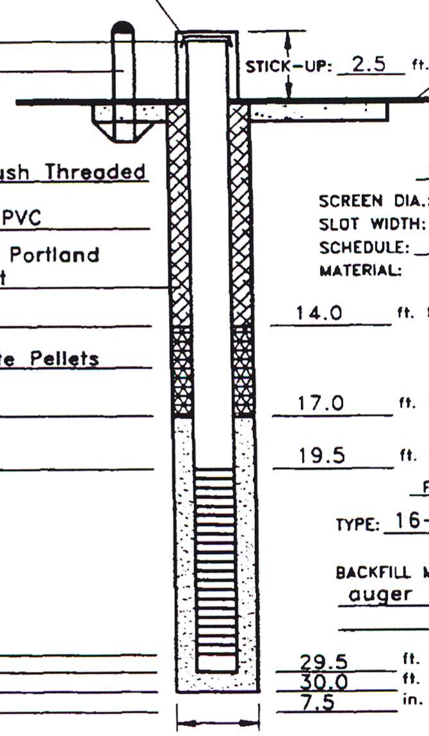
ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 24 SEPT 91 — STARTED — COMPLETED	LOCATION (Coordinates or Station) 38
ELEVATION TOP OF CASING 4062.85	SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-38-01

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox



TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

LENGTH OF SOLID PIPE: 22 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC.: Type I Portland Cement

TOP OF SEAL: 14.0 ft. bgl

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK: 17.0 ft. bgl

TOP OF SCREEN: 19.5 ft. bgl

WELL SCREEN LENGTH: 9.5 ft.

FILTER PACK

BOTTOM OF WELL: 29.5 ft. bgl

BOTTOM OF BORING: 30.0 ft. bgl

BORING DIAMETER: 7.5 in.

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1525/25.24 ft. bmp

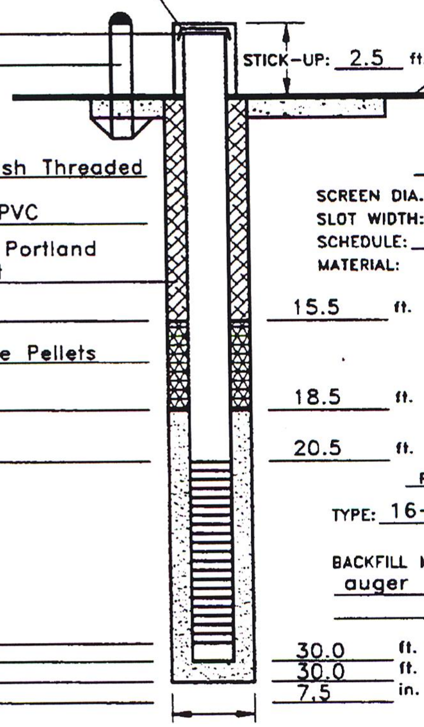
DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738G

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 24 SEPT 91	STARTED	COMPLETED	LOCATION (Coordinates or Station) 38
ELEVATION TOP OF CASING 4063.56			SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-38-02

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 2.5 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

LENGTH OF SOLID PIPE: 23.0 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC.: Type I Portland Cement

TOP OF SEAL: 15.5 ft. bgl

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK: 18.5 ft. bgl

TOP OF SCREEN: 20.5 ft. bgl

WELL SCREEN LENGTH: 9.5 ft.

FILTER PACK

BOTTOM OF WELL: 30.0 ft. bgl

BOTTOM OF BORING: 30.0 ft. bgl

BORING DIAMETER: 7.5 in.

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1527/26.32 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738H

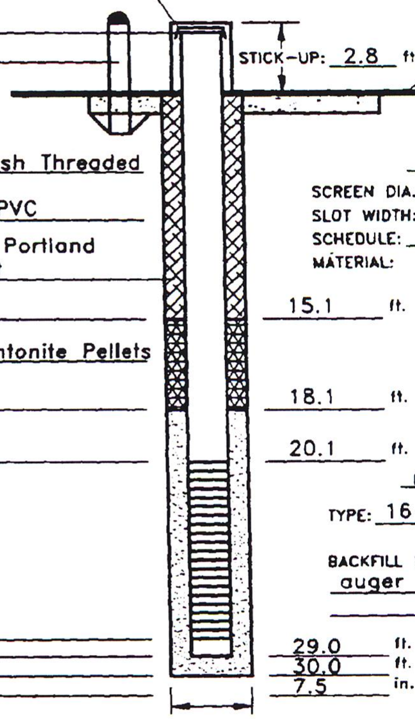
ELEVATION GROUND WATER	PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 24 SEPT 91 | STARTED 1500 | COMPLETED 1700	LOCATION (Coordinates or Station) 38
ELEVATION TOP OF CASING 4063.10	SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number) MW-38-03

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox



TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 2.8 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

LENGTH OF SOLID PIPE 21.9 ft.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

SCREEN INFORMATION

SCREEN DIA.: 2 in.
SLOT WIDTH: 0.010 in.
SCHEDULE: 40
MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

TOP OF SEAL 15.1 ft. bgl

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK 18.1 ft. bgl

TOP OF SCREEN 20.1 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Pour through auger

WELL SCREEN LENGTH 9.5 ft.

FILTER PACK

BOTTOM OF WELL 29.0 ft. bgl

BOTTOM OF BORING 30.0 ft. bgl

BORING DIAMETER 7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 20 OCT 91/0930/25.87 ft. bmp
4 NOV 91/1530/25.88 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738N

Appendix B-5-2

Portions of: *Accelerated Corrective Measures Completion Report for Multiple Sites,* Bhate Environmental Associates, Inc. conducted in June 2007 (report not completed as of the date of this Work Plan)

Table 4-11
Soil Analytical Data (June 2007)
Test Sled Maintenance Area, OT-38
Holloman Air Force Base, New Mexico

Client Sample Identification:	Soil Screening Levels	OT38-DP01-5	OT38-DP01-10	OT38-DP01-23	OT38-DP02-5	OT38-DP02-10	OT38-DP02-10A	OT38-DP02-23	OT38-DP03-5	OT38-DP03-10	OT38-DP03-10
Lab Sample Identification:	NMED Residential[1]	D7F060363-023	D7F060363-024	D7F060363-025	D7F060363-026	D7F060363-027	D7F060363-028	D7F060363-018	D7F060363-019	D7F060363-020	D7F120221-031
Date Sampled:		6/5/2007	6/5/2007	6/5/2007	6/5/2007	6/5/2007	6/5/2007	6/5/2007	6/5/2007	6/5/2007	6/11/2007
Analyte		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
General Chemistry	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Percent Moisture	NV	16	19	22	19	25	15	24	19	NS	19
RCRA Metals Analysis	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Barium	15,600	97	44	33	69	19	53	31	39	NS	24
Cadmium	39	0.067 J	0.074 J	ND	0.067 J	ND	0.13 J	ND	ND	NS	ND
Chromium	234	9.5	11	3.5	7	2.4	10	2.7	4.2	NS	2.8
Arsenic	3.9	2.8	3	ND	1.1 J	ND	2.1 J	ND	ND	NS	ND
Lead	400	5.3	6	3.3	4.8	3.2	4.8	3	6.3	NS	2
PCBs	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
All	NV	ND	ND	ND	ND	ND	ND	UJ	ND	NS	ND
Total Petroleum Hydrocarbons	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Diesel Range Organics (C10-C22)	940 [2]	2.1 J	2.2 J	2.1 J	2.0 J	2.5 J	2.0 J	2.4 J	2.0 J	NS	2.2 J
Gasoline Range Organics (C6 -C10)	940 [2]	0.73 J	0.99 J	1.0 J	0.81 J	1.2 J	0.87 J	0.96 J	1.3 J	NS	UJ
Volatile Organic Compounds	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
Acetone	28,100	ND	ND	8.1 J	ND	ND	ND	8.2 J	ND	ND	ND
1,2,4-Trichlorobenzene	69.3	0.95 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	12.2	0.73 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	NV [3]	1.2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	79.5	1.5 J	0.86 J	ND	ND	ND	ND	ND	ND	ND	ND
Semi-Volatile Organic Compounds	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
Benzo(a)anthracene	6.21	39 J	ND	ND	ND	ND	ND	ND	ND	NS	ND
Benzo(b)fluoranthene	6.21	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND
Benzo(g,h,i)perylene	NV [3]	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND
Benzo(a)pyrene	0.621	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND
Chrysene	615	44 J	ND	ND	ND	ND	ND	ND	ND	NS	ND
Fluoranthene	2,290	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND
Indeno(1,2,3-cd)pyrene	6.21	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND
Phenanthrene	1,830	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND
Pyrene	2,290	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND

Notes:

NMED = New Mexico Environment Department
RCRA = Resource Conservation and Recovery Act
PCB = Polychlorinated Biphenyls
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
% = percent
ND = Not Detected
NS = Not Sampled
NV = No Value
OT38 = Test Sled Maintenance Area
DP = Direct Push
A = sample suffix denoting a field duplicate sample

J = Estimated result. Result is between the Method Detection Limit (MDL) and the Reporting Limit (RL), and/or qualified by the validating chemist (see Appendix E).
UJ = For non detected compounds, the sample quantitaion limit is qualified as approximate.
[1] NMED, June 2006. Technical Background Document for Development of Soil Screening Levels (SSL), Revision 4.0.
[2] NMED TPH Screening Guidelines for Kerosene and Jet Fuel, Residential Direct Exposure, Table 2b (October, 2006)
[3] No Value established for NMED SSL (June, 2006) and EPA Region 6 Human Health Medium Specific Screening Levels (HHMSSL) (Sept, 2008)
Bold value indicates analytes above NMED SSLs (Rev 4.0, June 2006) or TPH results above NMED TPH Screening Guidelines (October, 2006)
Note: The last digit(s) of the client sample identification equal the ending depth of the sampled interval (feet below ground surface)

Table 4-11
Soil Analytical Data (June 2007)
Test Sled Maintenance Area, OT-38
Holloman Air Force Base, New Mexico

Client Sample Identification:	**Soil Screening Levels**	**OT38-DP03-23**	**OT38-DP04-4**	**OT38-DP04-9**	**OT38-DP05-4**	**OT38-DP05-9**	**OT38-DP05-9A**	**OT38-DP06-4**	**OT38-DP06-9**
Lab Sample Identification:	**NMED Residential[1]**	**D7F060363-021**	**D7F070201-001**	**D7F070201-002**	**D7F070201-003**	**D7F070201-004**	**D7F070201-005**	**D7F070201-006**	**D7F070201-007**
Date Sampled:		**6/5/2007**	**6/5/2007**	**6/5/2007**	**6/5/2007**	**6/5/2007**	**6/5/2007**	**6/5/2007**	**6/5/2007**
Analyte		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
General Chemistry	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Percent Moisture	NV	24	22	26	18	16	15	18	18
RCRA Metals Analysis	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Barium	15,600	25	43	25	72	58	61	83	65
Cadmium	39	ND	0.057 J	ND	0.079 J	0.24 J	0.14 J	0.086 J	0.18 J
Chromium	234	1.7 J	3.5	3.1	6.4	6.5	13	7	16
Arsenic	3.9	ND	ND	1.5 J	1.9 J	1.6 J	3	1.9 J	**5.5**
Lead	400	2.6	3.1	2.3	3.7	4.3	5.4	4	6.5
PCBs	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
All	NV	ND	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Diesel Range Organics (C10-C22)	940 [2]	2.2 J	2.1 J	2.2 J	2.1 J	2.0 J	1.9 J	2.1 J	1.9 J
Gasoline Range Organics (C6 -C10)	940 [2]	1.3 J	0.79 J	0.82 J	0.78 J	0.71 J	0.67 J	0.74 J	0.71 J
Volatile Organic Compounds	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
Acetone	28,100	7.7 J	ND	ND	ND	ND	6.8 J	ND	ND
1,2,4-Trichlorobenzene	69.3	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	12.2	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	NV [3]	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	79.5	ND	ND	ND	ND	ND	ND	ND	ND
Semi-Volatile Organic Compounds	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
Benzo(a)anthracene	6.21	ND	ND	ND	ND	110 J	ND	ND	ND
Benzo(b)fluoranthene	6.21	ND	ND	ND	ND	190 J	ND	ND	ND
Benzo(g,h,i)perylene	NV [3]	ND	ND	ND	ND	56 J	ND	ND	ND
Benzo(a)pyrene	0.621	ND	ND	ND	ND	97 J	ND	ND	ND
Chrysene	615	ND	45 J	ND	ND	130 J	ND	ND	ND
Fluoranthene	2,290	ND	ND	ND	ND	170 J	ND	ND	ND
Indeno(1,2,3-cd)pyrene	6.21	ND	ND	ND	ND	45 J	ND	ND	ND
Phenanthrene	1,830	ND	ND	ND	ND	64 J	ND	ND	ND
Pyrene	2,290	ND	ND	ND	ND	130 J	ND	ND	ND

Notes:

NMED = New Mexico Environment Department
RCRA = Resource Conservation and Recovery Act
PCB = Polychlorinated Biphenyls
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
% = percent
ND = Not Detected
NS = Not Sampled
NV = No Value
OT38 = Test Sled Maintenance Area
DP = Direct Push
A = sample suffix denoting a field duplicate sample

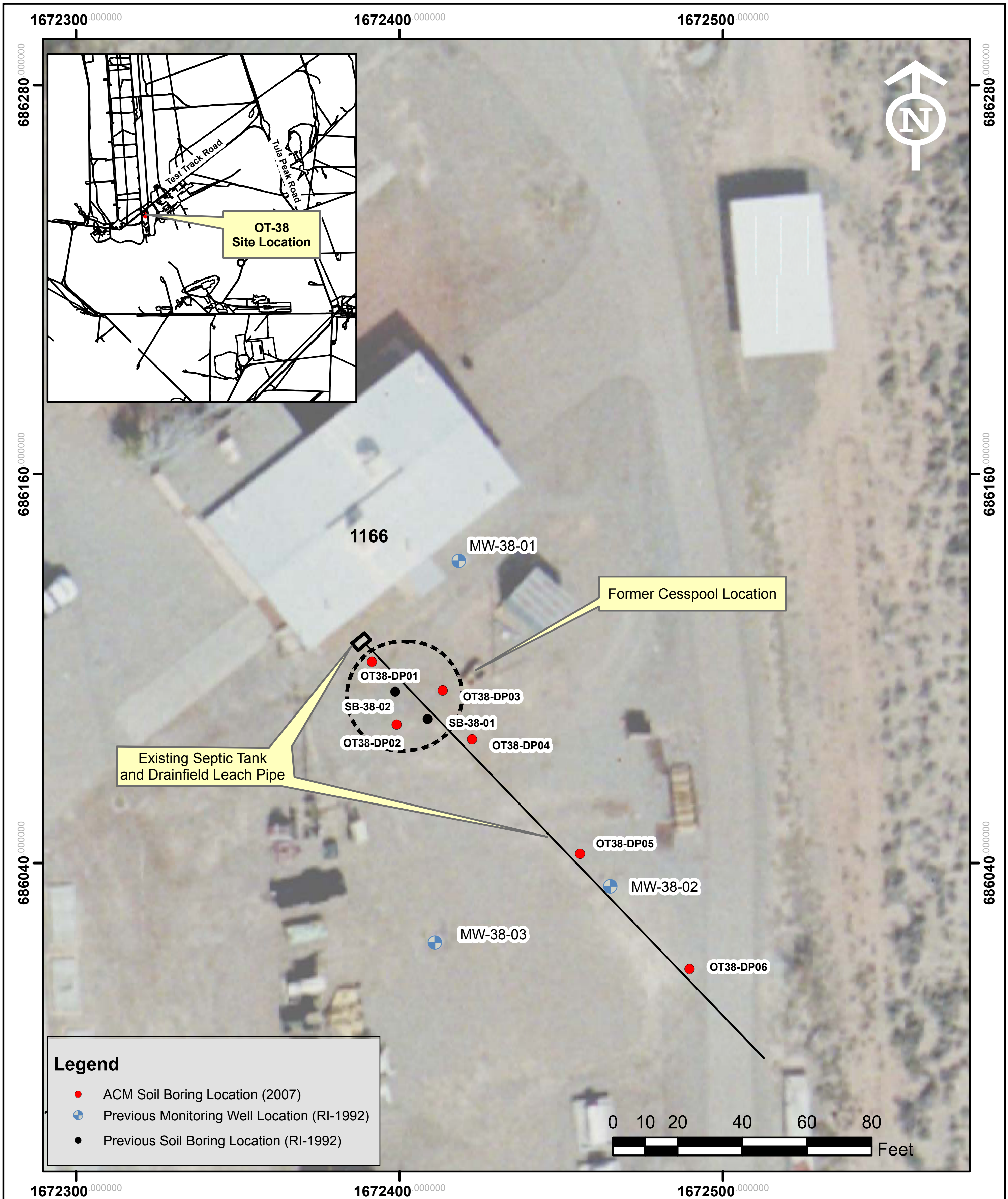
J = Estimated result. Result is between the Method Detection Limit (MDL) and the Reporting Limit (RL), and/or qualified by the validating chemist (see Appendix E).
UJ = For non detected compounds, the sample quantitaion limit is qualified as approximate.
[1] NMED, June 2006. Technical Background Document for Development of Soil Screening Levels (SSL), Revision 4.0.
[2] NMED TPH Screening Guidelines for Kerosene and Jet Fuel, Residential Direct Exposure, Table 2b (October, 2006)
[3] No Value established for NMED SSL (June, 2006) and EPA Region 6 Human Health Medium Specific Screening Levels (HHMSSL) (Sept, 2008)
Bold value indicates analytes above NMED SSLs (Rev 4.0, June 2006) or TPH results above NMED TPH Screening Guidelines (October, 2006)
Note: The last digit(s) of the client sample identification equal the ending depth of the sampled interval (feet below ground surface)

Table 4-13
Groundwater Analytical Data (June 2007)
Test Sled Maintenance Area, OT-38
Holloman Air Force Base, New Mexico

Client Sample Identification:	**Groundwater Screening Levels**		**MW38-01**	**MW38-01A**	**MW38-02**	**MW-38-03**
Lab Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**D7F060363-001**	**D7F060363-002**	**D7F060363-003**	**D7F070201-021**
Date Sampled:			**6/5/2007**	**6/5/2007**	**6/5/2007**	**6/5/2007**
Analyte			**Result**	**Result**	**Result**	**Result**
General Chemistry	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Total Dissolved Solids	1,000	500 [3]	**10,000 Q**	**10,000 Q**	**12,000 Q**	**8,400 Q**
RCRA Metals Analysis	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
Selenium	50	50	ND	ND	8.5 J	ND
Barium	1,000	2,000	12	11	12	12
Arsenic	100	10	9.1 J	9.8 J	**11 J**	ND
Perchlorate	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
Perchlorate	NV	24.5 [4]	4.9	4.8	5	5.1
PCBs	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
All	NV	NV	ND	ND	ND	ND
Volatile Organic Compounds	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
Chloroform	100	NV	1.5	1.5	1.1	0.67 J
Trichloroethene	100	5	1.2	1.2	0.68 J	0.43 J
Semi-Volatile Organic Compounds	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
bis(2-Ethylhexyl)phthalate	NV	NV	ND	ND	ND	2.6 J

Notes:
NMWQCC = New Mexico Water Quality Control Commision
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
RCRA = Resource Conservation and Recovery Act
PCB = Polychlorinated Biphenyls
µg/L = micrograms per liter
mg/L = milligrams per liter
J = Estimated result. Result is between the Method Detection Limit (MDL) and the Reporting Limit (RL), and/or qualified by the validating chemist (see Appendix E).
Q = Elevated reporting limit. The reporting limit is elevated due to high analyte levels.
ND = Not Detected
NV = No Value
% = percent
MW = Monitoring Well
A = sample suffix denoting a field duplicate sample
[1]Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2]USEPA National Primary Drinking Water Standards MCLs (816-F-03-016, June 2003 updated March 18, 2009)
[3]USEPA Secondary Drinking Water Standard
[4] USEPA Reference Dose (RfD) for Perchlorate. RfD of 0.0007 mg/kg/day translates to a Drinking Water Equivalent Level (DWEL) of 24.5 ppb (µg/L),
(http://yosemite.epa.gov/opa/admpress.nsf/0de87f2b4bcbe56e852572a000651fde/c1a57d2077c4bfda85256fac005b8b32!OpenDocument&Highlight=0,perchlorate

Bold value indicates analytes above New Mexico Groundwater Quality Standard or USEPA MCL



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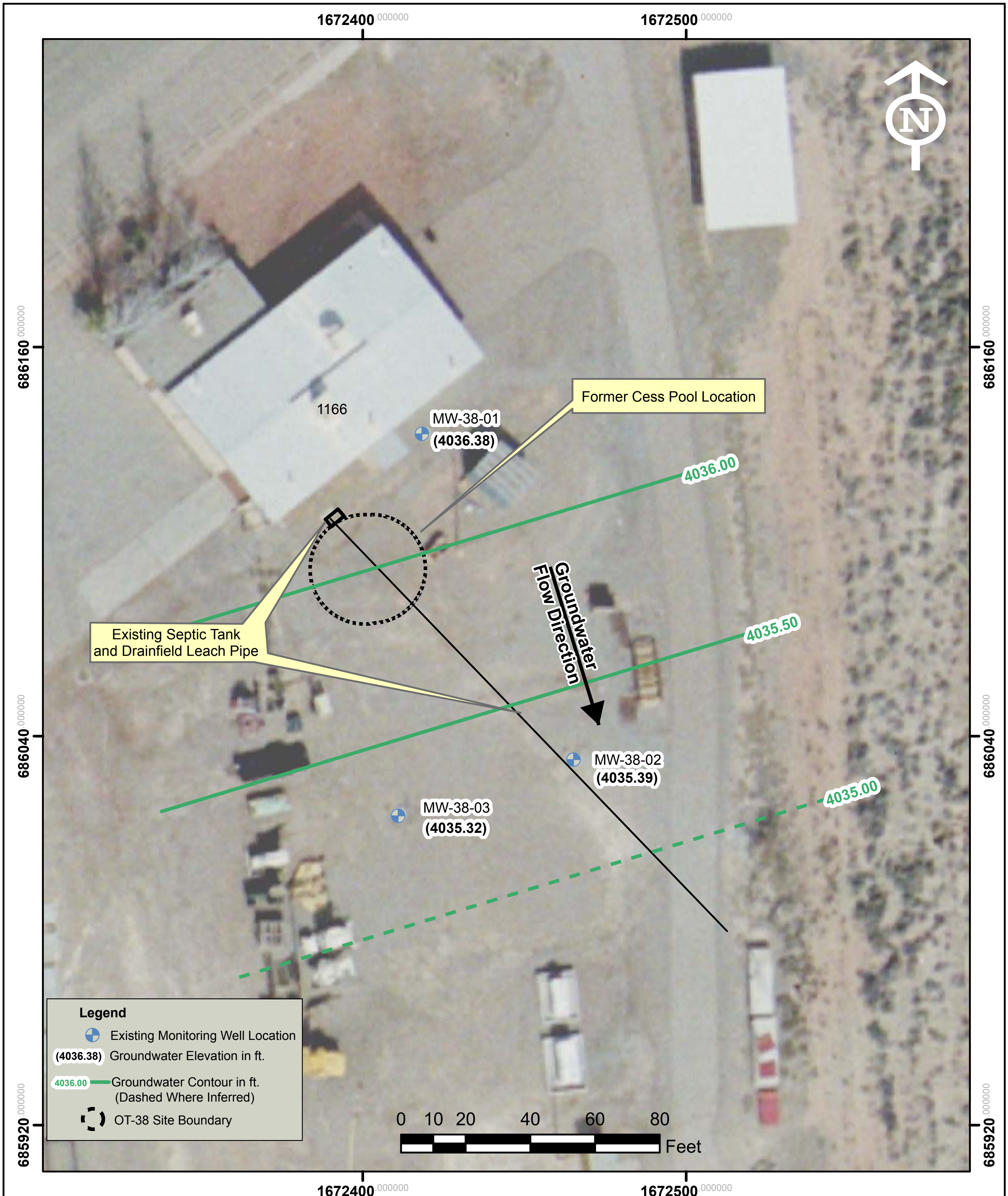
OT-38
ACM and Previous Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=40'	11/5/07	cm	fig2-10

Accelerated Corrective Measures
Completion Report
Holloman AFB, New Mexico

Figure 2-10



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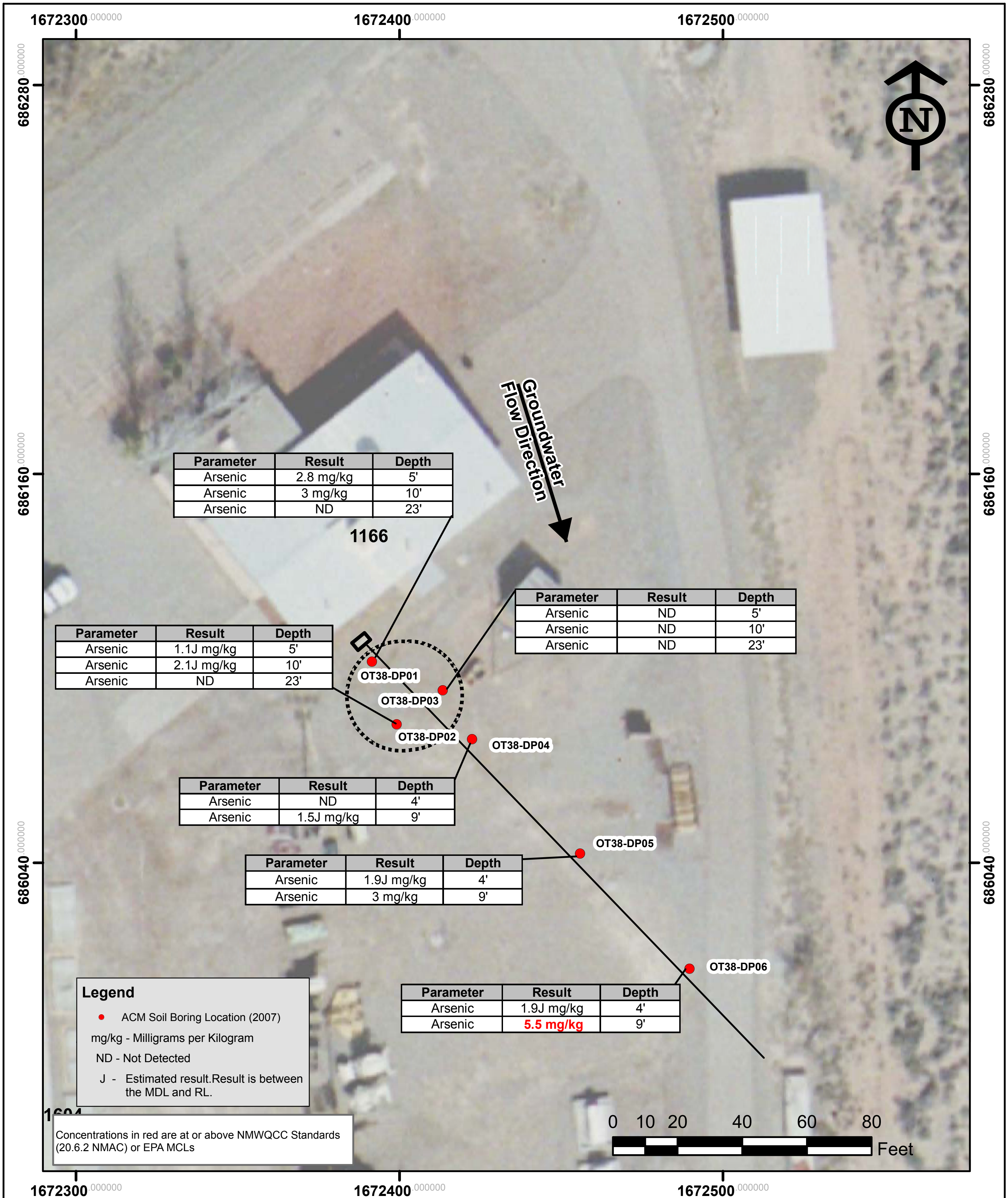
OT-38 Potentiometric Surface Map
June 2007

PROJECT NO.	SCALE	DATE	DRAWN BY: cm / DRAWING NO: fig3-10
9050361	1"=40'	11/6/07	

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 3-10



Parameter	Result	Depth
Arsenic	2.8 mg/kg	5'
Arsenic	3 mg/kg	10'
Arsenic	ND	23'

Parameter	Result	Depth
Arsenic	ND	5'
Arsenic	ND	10'
Arsenic	ND	23'

Parameter	Result	Depth
Arsenic	1.1J mg/kg	5'
Arsenic	2.1J mg/kg	10'
Arsenic	ND	23'

Parameter	Result	Depth
Arsenic	ND	4'
Arsenic	1.5J mg/kg	9'

Parameter	Result	Depth
Arsenic	1.9J mg/kg	4'
Arsenic	3 mg/kg	9'

Parameter	Result	Depth
Arsenic	1.9J mg/kg	4'
Arsenic	**5.5 mg/kg**	9'

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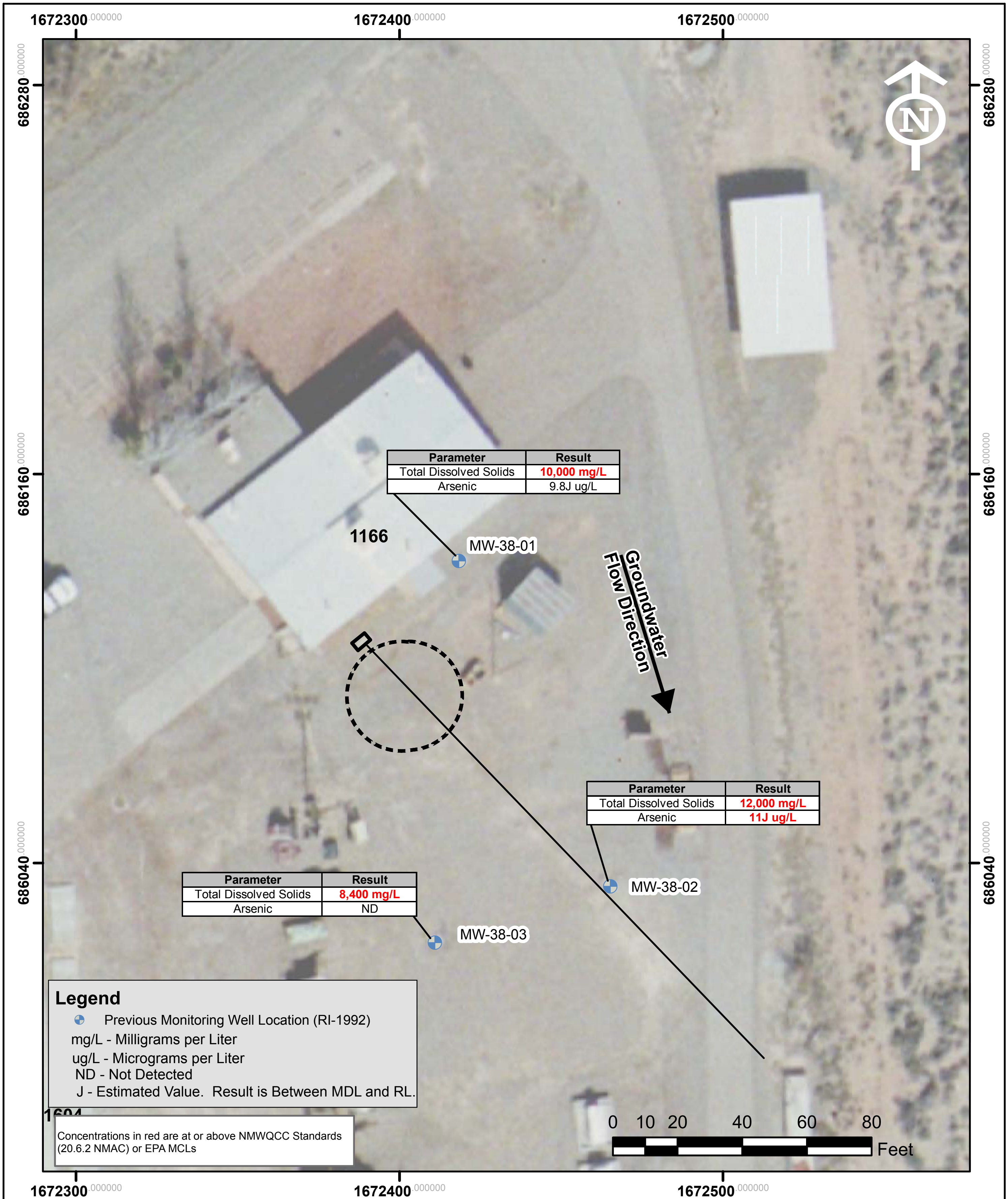
OT-38
Soil Analytical Results

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=40'	12/4/07	cm	fig4-7

Accelerated Corrective Measures Completion Report
Holloman AFB, New Mexico

Figure 4-7



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OT-38
Groundwater Analytic Results

PROJECT NO.	SCALE	DATE	DRAWN BY:	DRAWING NO:
9050361	1"=40'	12/4/07	cm	fig4-8

Accelerated Corrective Measures
Completion Report
Holloman AFB, New Mexico

Figure 4-8

B-6

SS-39 (SWMUs 165, 177, 179, and 181)

Appendix B-6-1

Portions of: *Draft Final Remedial Investigation (RI) Report Investigation, Study and Recommendation for 29 Waste Sites Holloman Air Force Base, NM,* Radian Corporation, June 1992

RADIAN
CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

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REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 North MoPac Blvd.
P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

June 1992

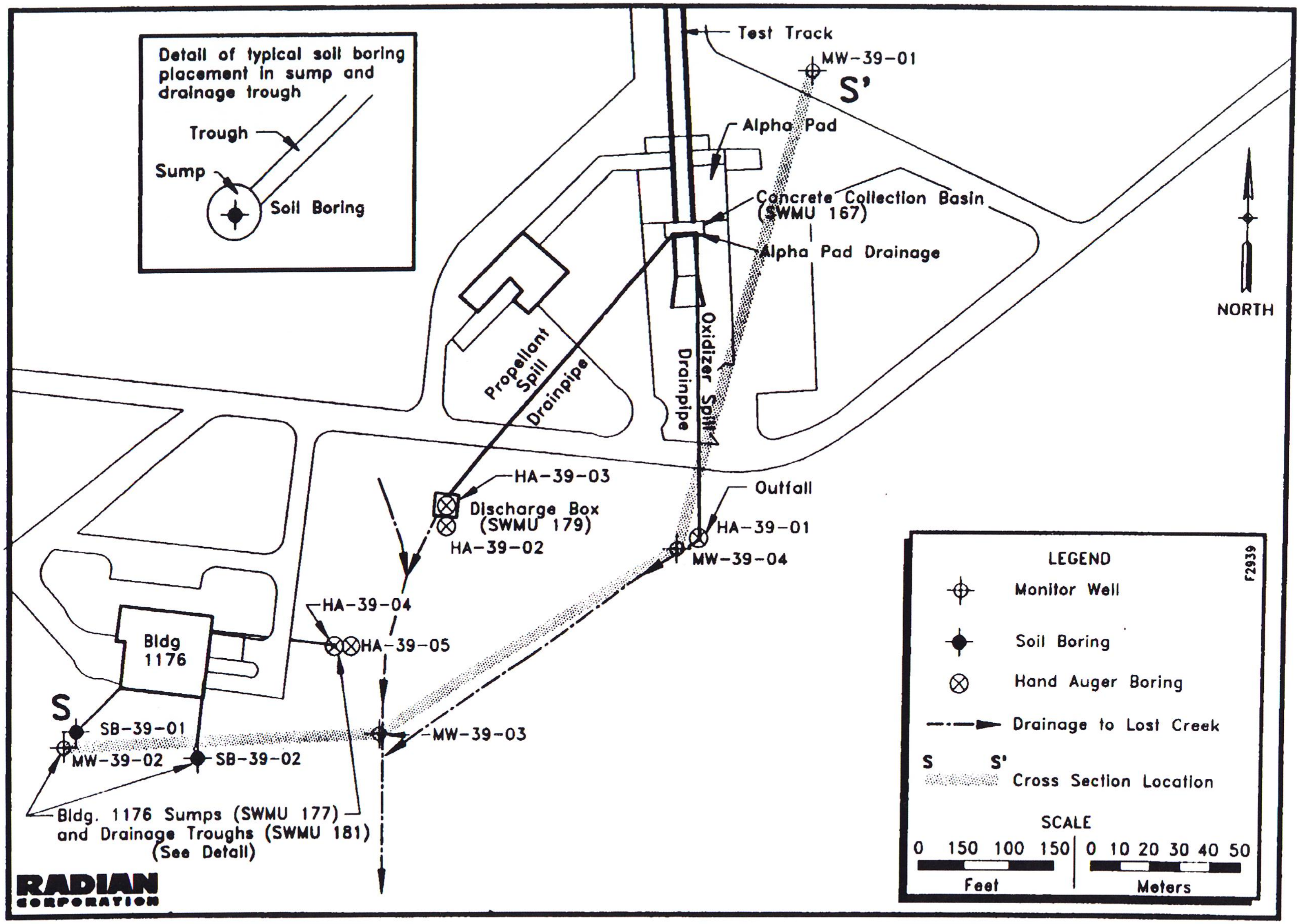


Figure 4-64. Hand Auger Boring, Soil Boring, Monitor Well, and Cross Section Locations for Site 39

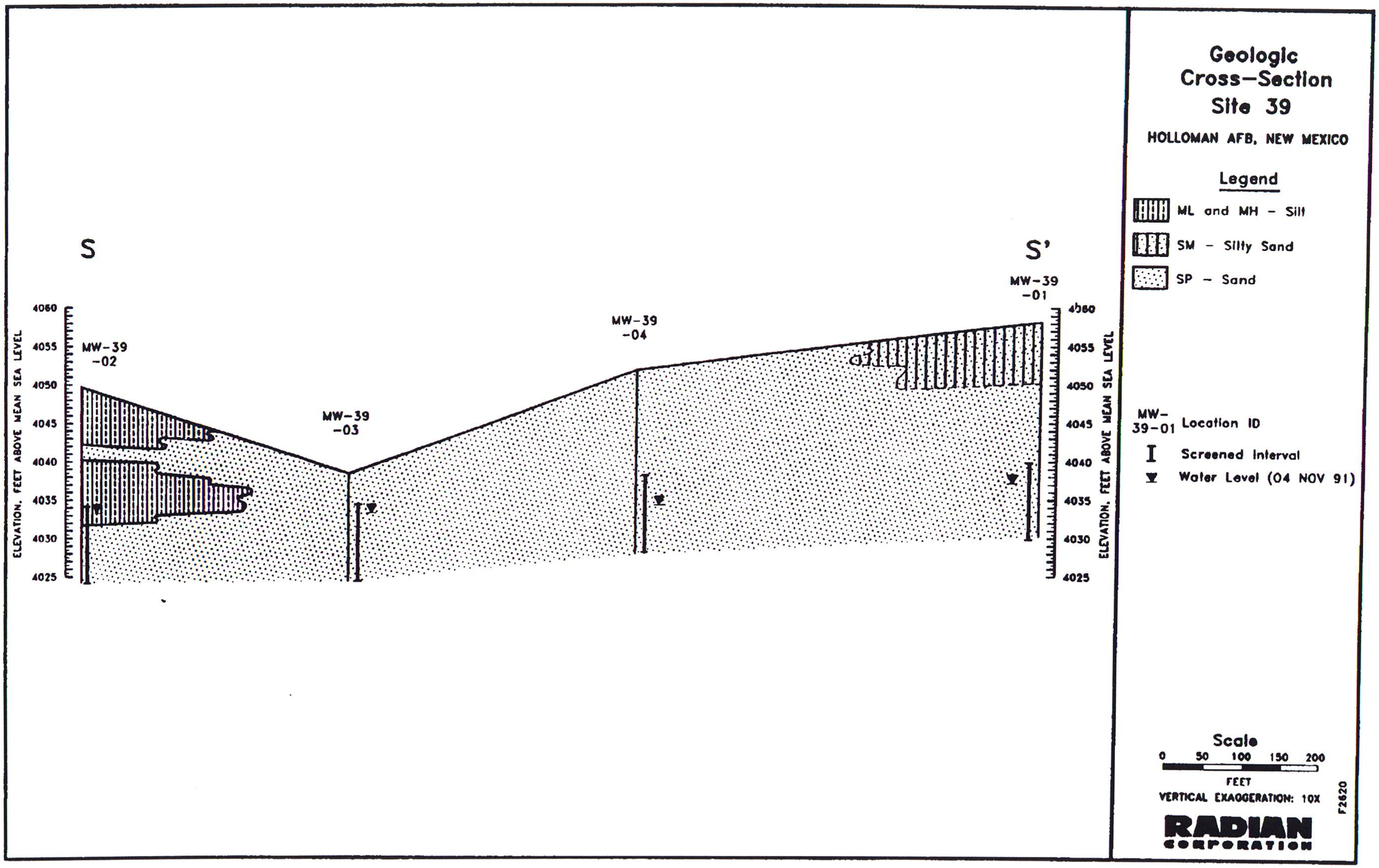


Figure 4-65. Geologic Cross Section for Site 39

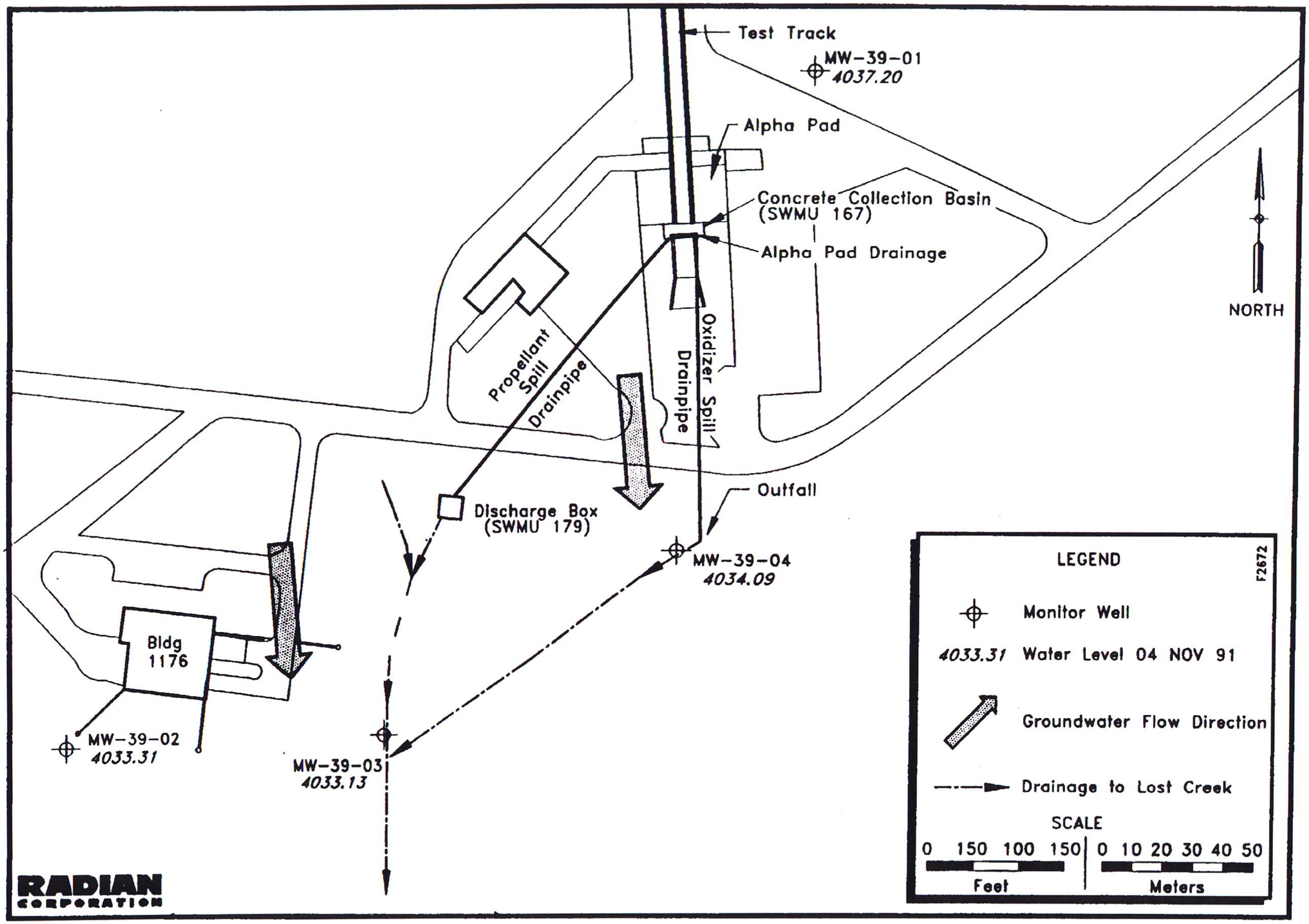


Figure 4-66. Monitor Well Locations and Groundwater Flow Direction for Site 39

Table 4-87

Concentrations of Inorganic Analytes in Site 39 Soil Samples

Location:	SB-39-01				SB-39-02			
Sample ID: Depth:	91JUL1H039-001 7.5 - 9.5 ft		91JUL1H039-002 10 - 12 ft		91JUL1H039-003 10 - 12 ft		91JUL1H039-004 15 - 17 ft	
Analytes	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)								
Beryllium	ND	(0.36)	ND	(0.49)	ND	(0.45)	0.58 @	(0.49)
Cadmium	0.98 @	(0.89)	ND	(1.2)	30	(1.1)	4.3 @	(1.2)
Chromium	5.6 @	(1.8)	3.2 @	(2.4)	78	(2.3)	25	(2.4)
Copper	6.0 @	(3.6)	ND	(4.9)	82	(4.5)	5.1 @	(4.9)
Nickel	ND	(3.6)	ND	(4.9)	14 @	(4.5)	8.6 @	(4.9)
Silver	ND	(1.8)	ND	(2.4)	ND	(2.3)	ND	(2.4)
Zinc	52	(3.6)	8.4 @	(4.9)	380	(4.5)	60	(4.9)
SW7060 - Arsenic (mg/kg)	2.6	(0.45)	0.66 @	(0.43)	2.0	(0.40)	2.0 @	(0.44)
SW7421 - Lead (mg/kg)	16	(1.1)	1.0 @	(0.24)	77	(4.3)	9.2	(0.98)
SW7471 - Mercury (mg/kg)	ND	(0.056)	ND	(0.064)	ND	(0.068)	ND	(0.060)

Table 4-87

(Continued)

Location	HA-[illegible]-01		HA-[illegible]-02		HA-[illegible]-03	
Sample ID / Depth	[illegible] [illegible]		[illegible] [illegible]		[illegible] [illegible]	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)						
Beryllium	ND	(0.46)	0.57 @	(0.37)	0.58 @	(0.57)
Cadmium	ND	(1.2)	7.3	(0.92)	7.8	(1.4)
Chromium	8.6 @	(2.3)	26	(1.8)	47	(2.9)
Copper	14 @	(4.6)	91	(3.7)	140	(5.7)
Nickel	6.5 @	(4.6)	23	(3.7)	21 @	(5.7)
Silver	ND	(2.3)	ND	(1.8)	12 @	(2.9)
Zinc	30	(4.6)	250	(3.7)	180	(5.7)
SW7060 - Arsenic (mg/kg)	1.6 @	(0.44)	28	(3.6)	34 @	(9.3)
SW7421 - Lead (mg/kg)	180	(13)	1300	(110)	1100	(140)
SW7471 - Mercury (mg/kg)	ND	(0.064)	0.063 @	(0.050)	ND	(0.069)

Table 4-87

(Continued)

Location:	HA-39-04		HA-39-05	
Sample ID: Depth:	91JULH039-005 0 - 2 ft		91JULH039-006 0 - 2 ft	
Analyses	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)				
Beryllium	ND	(0.48)	ND	(0.47)
Cadmium	38	(1.2)	4.0 @	(1.2)
Chromium	190	(2.4)	130	(2.4)
Copper	110	(4.8)	19 @	(4.7)
Nickel	31	(4.8)	58	(4.7)
Silver	ND	(2.4)	ND	(2.4)
Zinc	540	(4.8)	130	(4.7)
SW7060 - Arsenic (mg/kg)	3.7	(0.45)	0.99 @	(0.45)
SW7421 - Lead (mg/kg)	210	(14)	10	(0.68)
SW7471 - Mercury (mg/kg)	0.074 @	(0.053)	ND	(0.060)

NOTE: Table presents only constituents detected in soil at this site.
ND = Not Detected, at the reported detection limit.
@ = Measured result is less than five times the detection limit.

Table 4-88

Concentrations of Organic Analytes in Site 39 Soil Samples

Location:	SB-39-01				SB-39-02			
Sample ID: Depth:	91JUL1H039-001 7.5 - 9.5 ft		91JUL1H039-002 10 - 12 ft		91JUL1H039-003 10 - 12 ft		91JUL1H039-004 15 - 17 ft	
Analytes	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	678	(25.5)	26.3 @	(13.3)	2620	(283)	543	(14.4)
SW8240 - Volatile Organics (ug/kg)								
1,1,1-Trichloroethane	ND	(130)	430000 D	(17000)	87000 D	(3500)	900	(140)
1,1,2-Trichloroethane	ND	(130)	95 J	(130)	ND	(140)	ND	(140)
1,1-Dichloroethane	ND	(130)	260 @	(130)	170 @	(140)	69 J	(140)
1,1-Dichloroethene	ND	(130)	ND	(130)	ND	(140)	44 J	(140)
1,2-Dichloroethane	ND	(130)	140 @	(130)	ND	(140)	ND	(140)
Chloromethane	44 J	(250)	ND	(270)	ND	(280)	ND	(270)
Ethyl benzene	2.9 J	(130)	4.3 J	(130)	81 J	(140)	ND	(140)
Methylene chloride	510 B@	(130)	630 B@	(130)	1400 B	(140)	530 B@	(140)
Tetrachloroethene	ND	(130)	430 @	(130)	95000 D	(3500)	300 @	(140)
Toluene	12 JB	(130)	3400 B	(130)	82 JB	(140)	12 JB	(140)
Trichloroethene	ND	(130)	40000 D	(3400)	11000 D	(1400)	47 J	(140)
Xylenes	8.1 J	(130)	23 J	(130)	290 @	(140)	ND	(140)

Table 4-88

(Continued)

[illegible]	[illegible]		HA-30-02		[illegible]	
[illegible]	[illegible]		[illegible]		[illegible]	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	50.2 @	(13.4)	660	(24)	811	(35)
SW8240 - Volatile Organics (µg/kg)						
1,1,1-Trichloroethane	ND	(140)	ND	(110)	ND	(150)
1,1,2-Trichloroethane	ND	(140)	ND	(110)	ND	(150)
1,1-Dichloroethane	ND	(140)	ND	(110)	ND	(150)
1,1-Dichloroethene	ND	(140)	18 J	(110)	ND	(150)
1,2-Dichloroethane	ND	(140)	ND	(110)	ND	(150)
Chloromethane	ND	(280)	ND	(230)	ND	(300)
Ethyl benzene	ND	(140)	ND	(110)	ND	(150)
Methylene chloride	720	(140)	350 @	(110)	36 J	(150)
Tetrachloroethene	ND	(140)	ND	(110)	ND	(150)
Toluene	9.1 J	(140)	8.0 J	(110)	9.1 J	(150)
Trichloroethene	ND	(140)	ND	(110)	ND	(150)
Xylenes	ND	(140)	ND	(110)	ND	(150)

Table 4-88

(Continued)

Location:	HA-39-04		[illegible]	
Sample ID: Depth:	91JUL1H039-005 0 - 2 ft		[illegible] 0 - 2 ft	
Analyses	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	20700	(610)	95.6	(12.4)
SW8240 - Volatile Organics (μg/kg)				
1,1,1-Trichloroethane	ND	(120)	ND	(130)
1,1,2-Trichloroethane	ND	(120)	ND	(130)
1,1-Dichloroethane	ND	(120)	ND	(130)
1,1-Dichloroethene	ND	(120)	22 J	(130)
1,2-Dichloroethane	ND	(120)	ND	(130)
Chloromethane	ND	(240)	ND	(260)
Ethyl benzene	ND	(120)	5.9 J	(130)
Methylene chloride	54 J	(120)	260 @	(130)
Tetrachloroethene	ND	(120)	28 J	(130)
Toluene	8.9 J	(120)	9.3 J	(130)
Trichloroethene	ND	(120)	ND	(130)
Xylenes	38 J	(120)	13 J	(130)

NOTE: Table presents only constituents detected in soil at this site.
ND = Not Detected, at the reported detection limit.
D = Secondary dilution required for this analyte.
J = Detected below the detection limit.
@ = Measured result is less than five times the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Table 4-89

Concentrations of Inorganic Analytes in Site 39 Groundwater Samples

Location: Sample ID:	MW-39-01 39-01-01		MW-39-02 39-02-01		MW-39-03 39-03-01		MW-39-04 39-04-01	
Analytes	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 160.1 - Total Dissolved Solids (mg/L)	11000	(10)	13000	(10)	14000	(10)	2600	(10)
EPA 300.0 - Chloride (mg/L)	2200	(26)	4200	(26)	4500	(26)	39	(0.26)
EPA 300.0 - Sulfate (mg/L)	4300	(5.0)	4400	(5.0)	3500	(5.0)	ND	(0.050)
EPA 340.2 - Fluoride (mg/L)	1.8	(0.10)	1.5	(0.10)	1.9	(0.10)	0.77	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	48	(1.1)	87	(1.1)	49	(1.1)	0.52	(0.022)
EPA 365.2 - Total Phosphorus (mg/L)	0.22	(0.020)	0.18	(0.020)	0.21	(0.020)	0.093 @	(0.020)
SW6010 - Metals (mg/L)								
Beryllium	ND	(0.0020)	0.0029 @	(0.0020)	0.0025 @	(0.0020)	ND	(0.0020)
Cadmium	ND	(0.0050)	0.0059 @	(0.0050)	ND	(0.0050)	ND	(0.0050)
Chromium	ND	(0.010)	0.020 @	(0.010)	0.021 @	(0.010)	ND	(0.010)
Copper	ND	(0.020)	ND	(0.020)	0.12	(0.020)	ND	(0.020)
Nickel	ND	(0.020)	0.030 @	(0.020)	0.038 @	(0.020)	ND	(0.020)
Zinc	ND	(0.020)	0.071 @	(0.020)	0.058 @	(0.020)	0.024 @	(0.020)
SW7421 - Lead (mg/L)	ND	(0.0030)	0.0078 @	(0.0030)	0.011 @	(0.0030)	0.019	(0.0030)
SW7740 - Selenium (mg/L)	0.015 @	(0.0050)	0.015 @	(0.0050)	0.013 @	(0.0050)	ND	(0.0050)

NOTE: Table presents only constituents detected in groundwater at this site.
ND = Not Detected, at the reported detection limit.
@ = Measured result is less than five times the detection limit.

Table 4-90

Concentrations of Organic Analytes in Site 39 Groundwater Samples

Location / Sample ID	MW-39-01 / 39-01-01		MW-39-02 / 39-02-01		MW-39-03 / 39-03-01		MW-39-04 / 39-04-01	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SW8240 - Volatile Organics (ug/L)								
1,1,1-Trichloroethane	ND	(5.0)	240 D	(10)	ND	(5.0)	1.8 J	(5.0)
1,1-Dichloroethane	ND	(5.0)	0.59 J	(5.0)	ND	(5.0)	ND	(5.0)
1,1-Dichloroethene	ND	(5.0)	9.6 @	(5.0)	ND	(5.0)	ND	(5.0)
Acetone	24 J	(100)	ND	(100)	3.5 J	(100)	ND	(100)
Carbon tetrachloride	ND	(5.0)	5.8 @	(5.0)	ND	(5.0)	ND	(5.0)
Chloroform	0.35 J	(5.0)	2.1 J	(5.0)	0.81 J	(5.0)	ND	(5.0)
Chloromethane	ND	(10)	0.72 J	(10)	ND	(10)	ND	(10)
Methylene chloride	14 B@	(5.0)	10 B@	(5.0)	15 B@	(5.0)	15 B@	(5.0)
Tetrachloroethene	0.19 J	(5.0)	1.1 J	(5.0)	0.37 J	(5.0)	ND	(5.0)
Trichloroethene	0.25 J	(5.0)	59	(5.0)	2.7 J	(5.0)	ND	(5.0)

NOTE: Table presents only constituents detected in groundwater at this site.
ND = Not Detected, at the reported detection limit.
D = Secondary dilution required for this analyte.
J = Detected below the detection limit.
@ = Measured result is less than five times the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Appendix B-6-2

Portions of: *Draft Final Phase I RCRA Facility Investigation Report Table 2 Solid Waste Management Units*, Radian Corporation, October 1994

PHASE I RCRA FACILITY INVESTIGATION REPORT

TABLE 2 SOLID WASTE MANAGEMENT UNITS

VOLUME I

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 N. Mopac Blvd.
Austin, TX 78759

Under Contract No. DACA45-93-D-0027
with
U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

October 1994

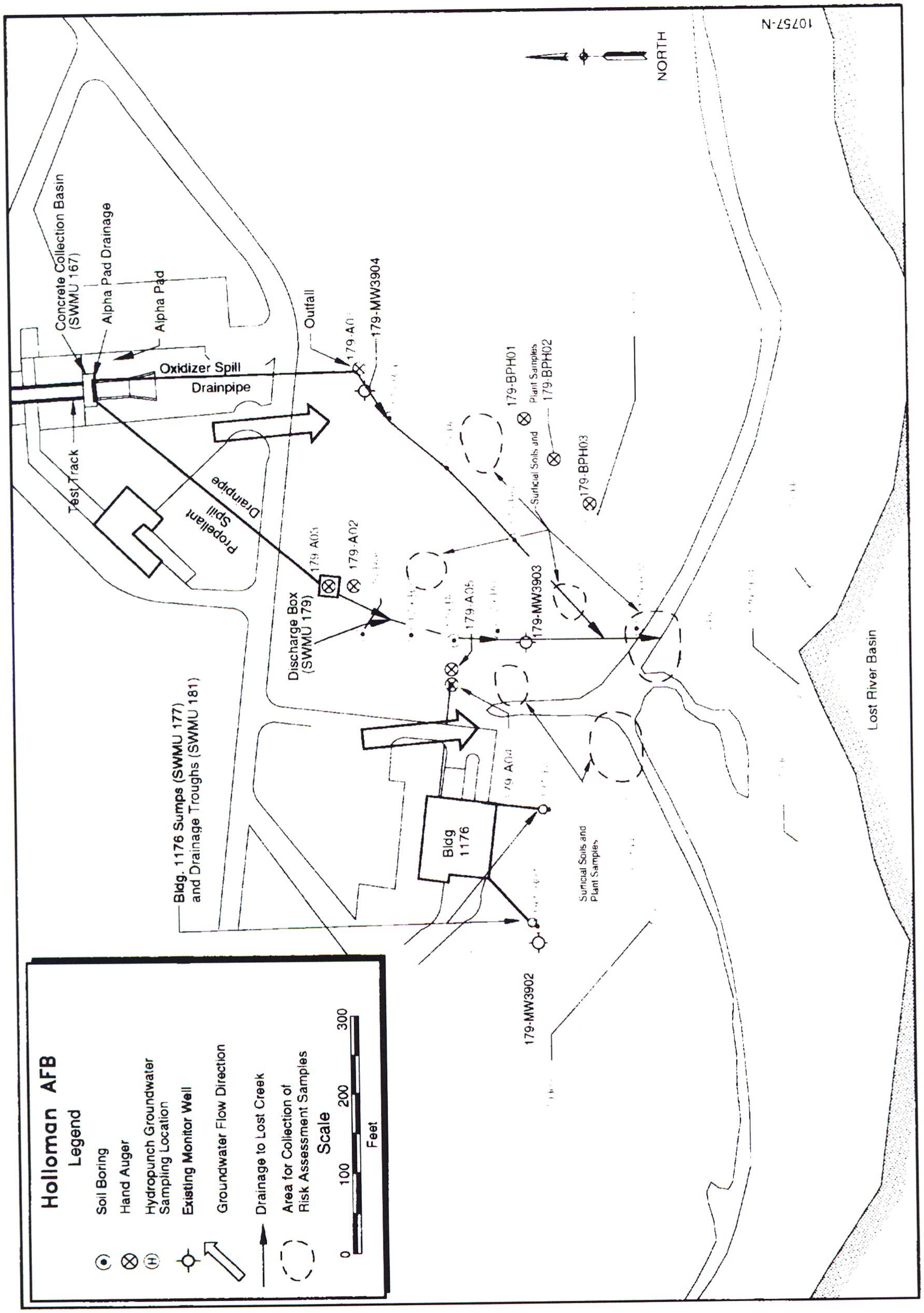


Figure 5.3-1. Features and Sampling Locations at SWMUs 165, 177, 179, and 181

Table 5.3-1
Analytical Results for Soil Samples—SWMU 179

Location ID		**179-A01**		**179-A01**		**179-A01**		**179-A02**	
Sample ID		**179-A01-01-01**		**179-A01-02-01**		**179-A01-03-01**		**179-A02-01-01**	
Beg. Depth-End Depth (ft)		**0-2**		**2-4**		**8-10**		**2-4**	
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	84	(0.0502)	80	(0.0403)	143	(0.0524)	41.7	(0.0535)
Cadmium	[80]	11.3	(0.249)	22.4	(0.2)	6.3	(0.26)	2.33	(0.265)
Chromium	[6.6,8x10^4]	47.8	(0.237)	188	(0.19)	38.6	(0.247)	12.8	(0.252)
Silver	[0.73,400]	< DL	(0.159)	1.5	(0.127)	0.282	(0.166)	< DL	(0.169)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	109 S	(3.96)	94.2 S	(3.62)	22.6 SB	(0.836)	5.84 S	(0.208)
Location ID		**179-A02**		**179-A02**		**179-A03**		**179-A03**	
Sample ID		**179-A02-02-01**		**179-A02-03-01**		**179-A03-01-01**		**179-A03-02-01**	
Beg. Depth-End Depth (ft)		**4-6**		**8-10**		**2-4**		**4-6**	
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	32	(0.0634)	48	(0.0565)	36.6	(0.0569)	30.7	(0.058)
Cadmium	[80]	< DL	(0.314)	< DL	(0.28)	0.296	(0.282)	< DL	(0.288)
Chromium	[6.6,8x10^4]	4.05 B	(0.299)	8.71	(0.266)	8.14	(0.268)	4.59	(0.274)
Silver	[0.73,400]	< DL	(0.2)	< DL	(0.179)	< DL	(0.18)	< DL	(0.183)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	0.592 S	(0.112)	0.11 SB	(0.0799)	6.77 S	(0.2)	1.1 S	(0.105)
Location ID		**179-A03**		**179-A04**		**179-A04**		**179-A04**	
Sample ID		**179-A03-03-01**		**179-A04-01-01**		**179-A04-02-01**		**179-A04-03-01**	
Beg. Depth-End Depth (ft)		**8-10**		**2-4**		**4-6**		**8-10**	
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	25.2	(0.054)	33.1	(0.0485)	22.9	(0.0535)	57.5	(0.051)
Cadmium	[80]	< DL	(0.267)	1.09	(0.24)	0.582	(0.265)	< DL	(0.253)
Chromium	[6.6,8x10^4]	3.67	(0.254)	4.84	(0.228)	4.61	(0.252)	11.1	(0.24)
Silver	[0.73,400]	< DL	(0.171)	< DL	(0.153)	< DL	(0.169)	< DL	(0.161)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	0.535 SB	(0.0772)	43.8 S	(2.01)	44.4 S	(2.02)	13.6 S	(0.325)

Table 5.3-1 (Continued)

Location ID		179-A05		179-A05		179-A05		179-B01	
Sample ID		179-A05-01-01		179-A05-02-01		179-A05-03-01		179-B01-01-01	
Beg. Depth-End Depth (ft)		0-2		4-6		8-10		0-2	
SW8270 - Semivolatile Organics ($\mu g/g$)									
Acetophenone	[8000]	NA		NA		NA		ND	(0.0193)
Anthracene	[$2.4x10^4$]	NA		NA		NA		ND	(0.0262)
Benzo(a)anthracene	[.96]	NA		NA		NA		ND	(0.0245)
Benzo(a)pyrene	[.096]	NA		NA		NA		ND	(0.031)
Benzo(b)fluoranthene	[.96]	NA		NA		NA		ND	(0.0313)
Benzo(g,h,i)perylene	[NS]	NA		NA		NA		ND	(0.0301)
Benzo(k)fluoranthene	[9.59]	NA		NA		NA		ND	(0.0393)
Chrysene	[96]	NA		NA		NA		ND	(0.0324)
Di-n-octylphthalate	[1600]	NA		NA		NA		ND	(0.0355)
bis(2-Ethylhexyl)phthalate	[50]	NA		NA		NA		ND	(0.0663)
Fluoranthene	[3200]	NA		NA		NA		ND	(0.0279)
Indeno(1,2,3-cd)pyrene	[0.96]	NA		NA		NA		ND	(0.0236)
Phenanthrene	[NS]	NA		NA		NA		ND	(0.0362)
Pyrene	[2400]	NA		NA		NA		ND	(0.0198)
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	52.9	(0.0439)	38.8	(0.0479)	62	(0.0386)	44	(0.0584)
Cadmium	[80]	0.364 B	(0.218)	0.332 B	(0.237)	0.796 B	(0.191)	< DL	(0.29)
Chromium	[$6.6,8x10^4$]	10.6	(0.207)	15.8	(0.226)	7.74	(0.182)	7.18	(0.276)
Silver	[0.73,400]	< DL	(0.139)	< DL	(0.151)	< DL	(0.122)	0.239	(0.185)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	275	(7.52)	59.2	(2.06)	46.3	(1.05)	14.4 S	(0.163)

Table 5.3-1 (Continued)

Location ID		**179-B01**		**179-B01**		**179-B01**		**179-B02**	
Sample ID		**179-B01-02-01**		**179-B01-03-01**		**179-B01-04-01**		**179-B02-01-01**	
Beg. Depth-End Depth (ft)		**2-4**		**4-6**		**6-8**		**0-2**	
SW8270 - Semivolatile Organics ($\mu g/g$)									
Acetophenone	[8000]	NA		NA		NA		ND	(0.0229)
Anthracene	[2.4x10^4]	NA		NA		NA		ND	(0.0339)
Benzo(a)anthracene	[.96]	NA		NA		NA		ND	(0.0264)
Benzo(a)pyrene	[.096]	NA		NA		NA		ND	(0.0353)
Benzo(b)fluoranthene	[.96]	NA		NA		NA		ND	(0.0467)
Benzo(g,h,i)perylene	[NS]	NA		NA		NA		ND	(0.0502)
Benzo(k)fluoranthene	[9.59]	NA		NA		NA		ND	(0.0489)
Chrysene	[96]	NA		NA		NA		ND	(0.0441)
Di-n-octylphthalate	[1600]	NA		NA		NA		ND	(0.0229)
bis(2-Ethylhexyl)phthalate	[50]	NA		NA		NA		ND	(0.118)
Fluoranthene	[3200]	NA		NA		NA		ND	(0.0262)
Indeno(1,2,3-cd)pyrene	[0.96]	NA		NA		NA		ND	(0.0393)
Phenanthrene	[NS]	NA		NA		NA		ND	(0.0293)
Pyrene	[2400]	NA		NA		NA		ND	(0.0315)
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	60.8	(0.0562)	77.1	(0.0538)	37.4	(0.0551)	41.2	(0.0569)
Cadmium	[80]	< DL	(0.279)	< DL	(0.266)	< DL	(0.273)	< DL	(0.282)
Chromium	[6.6,8x10^4]	6.43	(0.265)	7.09	(0.253)	5.97	(0.26)	6.68	(0.268)
Silver	[0.73,400]	0.282	(0.178)	< DL	(0.17)	0.207	(0.174)	< DL	(0.18)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	2.29 S	(0.143)	2.28 S	(0.158)	1.84 S	(0.147)	5.38	(0.0718)
Location ID		**179-B02**		**179-B02**		**179-B02**		**179-B03**	
Sample ID		**179-B02-02-01**		**179-B02-03-01**		**179-B02-04-01**		**179-B03-01-01**	
Beg. Depth-End Depth (ft)		**2-4**		**4-6**		**6-8**		**0-2**	
SW8270 - Semivolatile Organics ($\mu g/g$)									
Acetophenone	[8000]	NA		NA		NA		ND	(0.0225)
Anthracene	[2.4x10^4]	NA		NA		NA		ND	(0.0334)
Benzo(a)anthracene	[.96]	NA		NA		NA		ND	(0.026)
Benzo(a)pyrene	[.096]	NA		NA		NA		ND	(0.0348)
Benzo(b)fluoranthene	[.96]	NA		NA		NA		ND	(0.046)
Benzo(g,h,i)perylene	[NS]	NA		NA		NA		ND	(0.0495)

Table 5.3-1 (Continued)

Location ID	179-B02	179-B02	179-B02	179-B03
Sample ID	**179-B02-02-01**	**179-B02-03-01**	**179-B02-04-01**	**179-B03-01-01**
Beg. Depth-End Depth (ft)	**2-4**	**4-6**	**6-8**	**0-2**
SW8270 - Semivolatile Organics (µg/g) (Continued)				
Benzo(k)fluoranthene [9.59]	NA	NA	NA	ND (0.0482)
Chrysene [96]	NA	NA	NA	0.0167 J (0.0434)
Di-n-octylphthalate [1600]	NA	NA	NA	ND (0.0226)
bis(2-Ethylhexyl)phthalate [50]	NA	NA	NA	ND (0.116)
Fluoranthene [3200]	NA	NA	NA	0.0169 J (0.0258)
Indeno(1,2,3-cd)pyrene [0.96]	NA	NA	NA	ND (0.0387)
Phenanthrene [NS]	NA	NA	NA	ND (0.0289)
Pyrene [2400]	NA	NA	NA	0.0159 J (0.031)
SW6010 - Metals (mg/kg)				
Barium [84.36,5600]	38.5 (0.0468)	67.8 (0.0512)	34.7 (0.0544)	50.6 (0.0516)
Cadmium [80]	< DL (0.232)	< DL (0.254)	< DL (0.27)	0.499 B (0.256)
Chromium [6.6,$8x10^4$]	7.18 (0.221)	8.96 (0.241)	5.61 (0.256)	8.36 (0.243)
Silver [0.73,400]	0.183 B (0.148)	< DL (0.162)	< DL (0.172)	0.178 B (0.163)
SW7421 - Lead (mg/kg)				
Lead [12.3,500]	1.57 (0.0764)	1.46 (0.0727)	0.43 (0.0757)	0.256 (0.00749)
Location ID	**179-B03**	**179-B03**	**179-B03**	**179-B04**
Sample ID	**179-B03-02-01**	**179-B03-03-01**	**179-B03-04-01**	**179-B04-01-01**
Beg. Depth-End Depth (ft)	**2-4**	**4-6**	**6-8**	**0-2**
SW8270 - Semivolatile Organics (µg/g)				
Acetophenone [8000]	NA	NA	NA	ND (0.0251)
Anthracene [$2.4x10^4$]	NA	NA	NA	ND (0.0372)
Benzo(a)anthracene [.96]	NA	NA	NA	ND (0.029)
Benzo(a)pyrene [.096]	NA	NA	NA	ND (0.0388)
Benzo(b)fluoranthene [.96]	NA	NA	NA	ND (0.0513)
Benzo(g,h,i)perylene [NS]	NA	NA	NA	ND (0.0551)
Benzo(k)fluoranthene [9.59]	NA	NA	NA	ND (0.0537)
Chrysene [96]	NA	NA	NA	ND (0.0484)
Di-n-octylphthalate [1600]	NA	NA	NA	ND (0.0251)

Table 5.3-1 (Continued)

Location ID	**179-B03**	**179-B03**	**179-B03**	**179-B04**
Sample ID	**179-B03-02-01**	**179-B03-03-01**	**179-B03-04-01**	**179-B04-01-01**
Beg. Depth-End Depth (ft)	**2-4**	**4-6**	**6-8**	**0-2**
SW8270 - Semivolatile Organics ($\mu g/g$) (Continued)				
bis(2-Ethylhexyl)phthalate [50]	NA	NA	NA	ND (0.13)
Fluoranthene [3200]	NA	NA	NA	ND (0.0288)
Indeno(1,2,3-cd)pyrene [0.96]	NA	NA	NA	ND (0.0431)
Phenanthrene [NS]	NA	NA	NA	ND (0.0322)
Pyrene [2400]	NA	NA	NA	ND (0.0345)
SW6010 - Metals (mg/kg)				
Barium [84.36,5600]	44.5 (0.0587)	37.7 (0.0548)	73.1 (0.0531)	38.9 (0.0613)
Cadmium [80]	< DL (0.291)	< DL (0.272)	< DL (0.263)	< DL (0.304)
Chromium [6.6,8x10^4]	6.73 (0.277)	5.82 (0.258)	8.79 (0.25)	7.84 (0.289)
Silver [0.73,400]	0.238 B (0.186)	< DL (0.173)	0.392 B (0.168)	0.55 B (0.194)
SW7421 - Lead (mg/kg)				
Lead [12.3,500]	4.91 (0.0766)	0.494 (0.0769)	1.62 (0.072)	5.22 (0.0823)
Location ID	**179-B04**	**179-B05**	**179-B05**	**179-B05**
Sample ID	**179-B04-02-01**	**179-B05-01-01**	**179-B05-02-01**	**179-B05-03-01**
Beg. Depth-End Depth (ft)	**2-4**	**0-2**	**2-4**	**4-6**
SW8270 - Semivolatile Organics ($\mu g/g$)				
Acetophenone [8000]	NA	ND (0.0184)	NA	NA
Anthracene [2.4X10^4]	NA	ND (0.025)	NA	NA
Benzo(a)anthracene [.96]	NA	ND (0.0234)	NA	NA
Benzo(a)pyrene [.096]	NA	ND (0.0295)	NA	NA
Benzo(b)fluoranthene [.96]	NA	ND (0.0298)	NA	NA
Benzo(g,h,i)perylene [NS]	NA	ND (0.0287)	NA	NA
Benzo(k)fluoranthene [9.59]	NA	ND (0.0375)	NA	NA
Chrysene [96]	NA	ND (0.0309)	NA	NA
Di-n-octylphthalate [1600]	NA	ND (0.0339)	NA	NA
Fluoranthene [3200]	NA	ND (0.0266)	NA	NA
Indeno(1,2,3-cd)pyrene [0.96]	NA	ND (0.0225)	NA	NA
Phenanthrene [NS]	NA	ND (0.0346)	NA	NA
Pyrene [2400]	NA	ND (0.0189)	NA	NA
bis(2-Ethylhexyl)phthalate [50]	NA	ND (0.0633)	NA	NA

Table 5.3-1 (Continued)

Location ID		**179-B04**		**179-B05**		**179-B05**		**179-B05**	
Sample ID		**179-B04-02-01**		**179-B05-01-01**		**179-B05-02-01**		**179-B05-03-01**	
Beg. Depth-End Depth (ft)		**2-4**		**0-2**		**2-4**		**4-6**	
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	54.6	(0.0475)	39.9	(0.0529)	56	(0.058)	22.9	(0.0498)
Cadmium	[80]	< DL	(0.236)	< DL	(0.262)	< DL	(0.287)	< DL	(0.247)
Chromium	[6.6,$8x10^4$]	4.93	(0.224)	5.73	(0.249)	8.95	(0.273)	4.11	(0.235)
Silver	[0.73,400]	< DL	(0.15)	< DL	(0.167)	0.286	(0.183)	< DL	(0.158)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	0.531	(0.0584)	6.07 S	(0.153)	4.44 S	(0.153)	2.48 S	(0.16)
Location ID		**179-B05**		**179-B06**		**179-B06**		**179-B06**	
Sample ID		**179-B05-04-01**		**179-B06-01-01**		**179-B06-02-01**		**179-B06-03-01**	
Beg. Depth-End Depth (ft)		**12-14**		**0-2**		**2-4**		**4-6**	
SW8270 - Semivolatile Organics ($\mu g/g$)									
Acetophenone	[8000]	NA		0.0234	(0.017)	NA		NA	
Anthracene	[$2.4x10^4$]	NA		0.024	(0.0231)	NA		NA	
Benzo(a)anthracene	[.96]	NA		0.119	(0.0216)	NA		NA	
Benzo(a)pyrene	[.096]	NA		0.0985	(0.0273)	NA		NA	
Benzo(b)fluoranthene	[.96]	NA		0.17 F	(0.0276)	NA		NA	
Benzo(g,h,i)perylene	[NS]	NA		0.0232 J	(0.0266)	NA		NA	
Benzo(k)fluoranthene	[9.59]	NA		0.17 F	(0.0347)	NA		NA	
Chrysene	[96]	NA		0.152	(0.0286)	NA		NA	
Di-n-octylphthalate	[1600]	NA		1.02	(0.0313)	NA		NA	
bis(2-Ethylhexyl)phthalate	[50]	NA		0.281	(0.0585)	NA		NA	
Fluoranthene	[3200]	NA		0.23	(0.0246)	NA		NA	
Indeno(1,2,3-cd)pyrene	[0.96]	NA		0.0351	(0.0208)	NA		NA	
Phenanthrene	[NS]	NA		0.124	(0.032)	NA		NA	
Pyrene	[2400]	NA		0.206	(0.0175)	NA		NA	

Table 5.3-1 (Continued)

Location ID	**179-B05**	**179-B06**	**179-B06**	**179-B06**
Sample ID	**179-B05-04-01**	**179-B06-01-01**	**179-B06-02-01**	**179-B06-03-01**
Beg. Depth-End Depth (ft)	**12-14**	**0-2**	**2-4**	**4-6**
SW6010 - Metals (mg/kg)				
Barium [84.36,5600]	114 (0.0443)	50.1 (0.0474)	55 (0.0568)	19.1 (0.0493)
Cadmium [80]	< DL (0.219)	0.57 B (0.235)	0.578 B (0.281)	< DL (0.245)
Chromium [6.6,8x10^{4}]	14.3 (0.209)	10.7 (0.223)	8.71 (0.268)	3.88 (0.233)
Silver [0.73,400]	< DL (0.14)	0.233 (0.15)	0.382 (0.179)	< DL (0.156)
SW7421 - Lead (mg/kg)				
Lead [12.3,500]	5.98 S (0.133)	288 S (7.25)	28.6 S (0.73)	0.782 S (0.142)
Location ID	**179-B06**	**179-B07**	**179-B07**	**179-B07**
Sample ID	**179-B06-04-01**	**179-B07-01-01**	**179-B07-02-01**	**179-B07-03-01**
Beg. Depth-End Depth (ft)	**12-14**	**4-6**	**6-8**	**8-10**
SW8270 - Semivolatile Organics (μg/g)				
Acetophenone [8000]	NA	ND (0.019)	NA	NA
Anthracene [2.4x10^{4}]	NA	ND (0.0257)	NA	NA
Benzo(a)anthracene [.96]	NA	ND (0.0241)	NA	NA
Benzo(a)pyrene [.096]	NA	ND (0.0304)	NA	NA
Benzo(b)fluoranthene [.96]	NA	ND (0.0307)	NA	NA
Benzo(g,h,i)perylene [NS]	NA	ND (0.0296)	NA	NA
Benzo(k)fluoranthene [9.59]	NA	ND (0.0386)	NA	NA
Chrysene [96]	NA	ND (0.0319)	NA	NA
Di-n-octylphthalate [1600]	NA	ND (0.0349)	NA	NA
bis(2-Ethylhexyl)phthalate [50]	NA	ND (0.0651)	NA	NA
Fluoranthene [3200]	NA	ND (0.0274)	NA	NA
Indeno(1,2,3-cd)pyrene [0.96]	NA	ND (0.0232)	NA	NA
Phenanthrene [NS]	NA	ND (0.0356)	NA	NA
Pyrene [2400]	NA	ND (0.0195)	NA	NA

Table 5.3-1 (Continued)

Location ID		179-B06		179-B07		179-B07		179-B07	
Sample ID		**179-B06-04-01**		**179-B07-01-01**		**179-B07-02-01**		**179-B07-03-01**	
Beg. Depth-End Depth (ft)		**12-14**		**4-6**		**6-8**		**8-10**	
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	18.8	(0.0554)	47	(0.058)	35	(0.0509)	19.2	(0.0509)
Cadmium	[80]	0.29 B	(0.275)	< DL	(0.288)	< DL	(0.252)	< DL	(0.252)
Chromium	[6.6,8x10^4]	4.41	(0.261)	5.75	(0.273)	5.96	(0.24)	3.9	(0.24)
Silver	[0.73,400]	< DL	(0.175)	< DL	(0.183)	< DL	(0.161)	< DL	(0.161)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	0.56 S	(0.149)	0.933 SB	(0.156)	1.42 SB	(0.139)	0.616 SB	(0.141)
Location ID		**179-B07**		**179-B08**		**179-B08**		**179-B08**	
Sample ID		**179-B07-04-01**		**179-B08-01-01**		**179-B08-02-01**		**179-B08-03-01**	
Beg. Depth-End Depth (ft)		**14-16**		**0-2**		**2-4**		**4-6**	
SW8270 - Semivolatile Organics ($\mu g/g$)									
Acetophenone	[8000]	NA		ND	(0.0185)	NA		NA	
Anthracene	[2.4x10^4]	NA		ND	(0.0251)	NA		NA	
Benzo(a)anthracene	[.96]	NA		ND	(0.0235)	NA		NA	
Benzo(a)pyrene	[.096]	NA		ND	(0.0297)	NA		NA	
Benzo(b)fluoranthene	[.96]	NA		ND	(0.03)	NA		NA	
Benzo(g,h,i)perylene	[NS]	NA		ND	(0.0288)	NA		NA	
Benzo(k)fluoranthene	[9.59]	NA		ND	(0.0377)	NA		NA	
Chrysene	[96]	NA		ND	(0.0311)	NA		NA	
Di-n-octylphthalate	[1600]	NA		ND	(0.034)	NA		NA	
bis(2-Ethylhexyl)phthalate	[50]	NA		ND	(0.0635)	NA		NA	
Fluoranthene	[3200]	NA		ND	(0.0267)	NA		NA	
Indeno(1,2,3-cd)pyrene	[0.96]	NA		ND	(0.0226)	NA		NA	
Phenanthrene	[NS]	NA		ND	(0.0347)	NA		NA	
Pyrene	[2400]	NA		ND	(0.019)	NA		NA	

Table 5.3-1 (Continued)

Location ID		**179-B07**		**179-B08**		**179-B08**		**179-B08**	
Sample ID		**179-B07-04-01**		**179-B08-01-01**		**179-B08-02-01**		**179-B08-03-01**	
Beg. Depth-End Depth (ft)		**14-16**		**0-2**		**2-4**		**4-6**	
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	21.2	(0.0538)	38.1	(0.0557)	46.4	(0.0503)	46.7	(0.0424)
Cadmium	[80]	< DL	(0.267)	< DL	(0.276)	< DL	(0.249)	< DL	(0.21)
Chromium	[6.6,8x10^4]	5.39	(0.254)	5.3	(0.262)	5.97	(0.237)	6.35	(0.2)
Silver	[0.73,400]	< DL	(0.17)	0.6	(0.176)	< DL	(0.159)	0.178	(0.134)
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	1.36 SB	(0.138)	12.5 S	(0.317)	1.56 SB	(0.141)	2.05 S	(0.128)
Location ID		**179-B08**		**179-BPH01**		**179-BPH02**		**179-BPH03**	
Sample ID		**179-B08-04-01**		**179-BPH-01**		**179-BPH-02**		**179-BPH-03**	
Beg. Depth-End Depth (ft)		**10-12**		**0-1**		**0-1**		**0-1**	
SW6010 - Metals (mg/kg)									
Barium	[84.36,5600]	33.4	(0.056)	NA		NA		NA	
Cadmium	[80]	< DL	(0.277)	NA		NA		NA	
Chromium	[6.6,8x10^4]	6.13	(0.264)	NA		NA		NA	
Silver	[0.73,400]	0.555 B	(0.177)	NA		NA		NA	
SW7421 - Lead (mg/kg)									
Lead	[12.3,500]	3.54 S	(0.133)	NA		NA		NA	

Note: The UTLs and the trigger criteria are presented, respectively, in brackets [ ]; [ ] = trigger criteria for organics; [,] = UTL, trigger criteria for inorganics.

( ) = Detection limit.
NS = Not specified.
NA = Not analyzed.
ND = Not detected.
DL = Detection limit.
B = Analyte detected in associated blank analyses.
S = Analyte concentration obtained using the MSA.
J = Estimated concentrations, analyte detected at concentration below the detection limit.
F = Benzo(b)fluoranthene and benzo(k)fluoranthene co-elute. The result reported is the sum of both compounds.

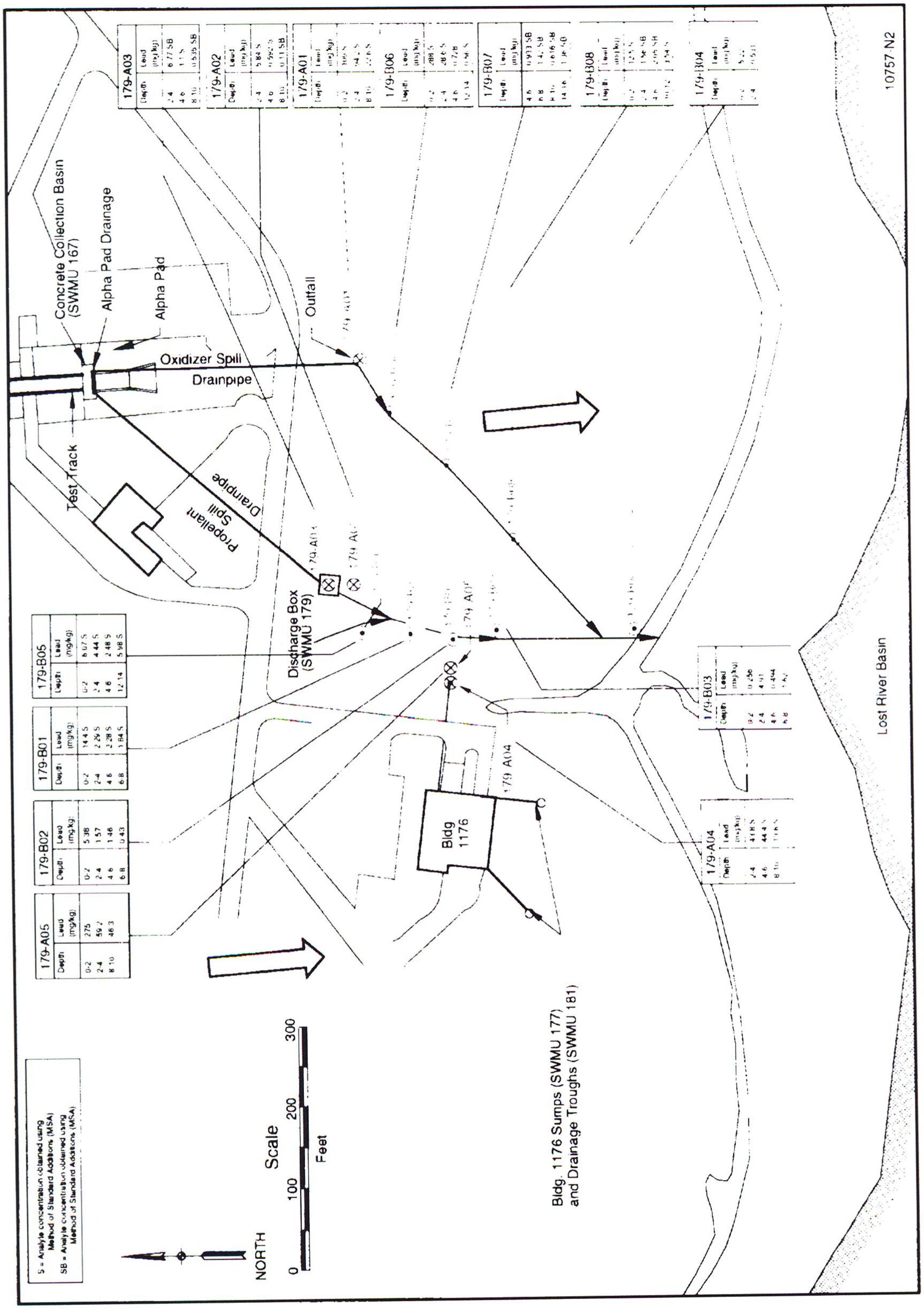


Figure 5.3-2. Occurrences of Lead in the Soil at SWMU 179

Table 5.3-2
Analytical Results for Soil Samples—SWMU 181

Location ID		181-B01		181-B02	
Sample ID		**181-B01-01-01**		**181-B02-01-01**	
Beg. Depth-End Depth (ft)		**6-8**		**8-10**	
SW8270 - Semivolatile Organics ($\mu g/g$)					
4-Chloro-3-methylphenol	[NS]	ND	(0.0169)	4.25	(0.522)
p-Chloroaniline	[3.2x10^{5}]	ND	(0.0396)	1.69	(1.23)
bis(2-Ethylhexyl)phthalate	[50]	ND	(0.112)	19.7 B	(3.46)
2-Methylnaphthalene	[NS]	ND	(0.0245)	6.05	(0.757)
Naphthalene	[NS]	ND	(0.0325)	1.91	(1.01)
SW8270 - Semivolatile Organics TICs ($\mu g/g$)					
Ethylmethylbenzene	[NS]	ND	(NS)	50	(NS)
Trimethylbenzene	[NS]	ND	(NS)	20	(NS)

Note: The UTLs and the trigger criteria are presented, respectively, in brackets [ ]; [ ] = trigger criteria for organics; [,] = UTL, trigger criteria for inorganics.

( ) = Detection limit.
NS = Not specified.
NA = Not analyzed.
ND = Not detected.
B = Analyte detected in associated blank analyses.

Table 5.3-3
Analytical Results for Groundwater Samples—SWMU 177

Location ID		177-H01		177-H02		177-H03		177-H04	
Sample ID		177-H01-01-01		177-H02-01-01		177-H03-01-01		177-H04-01-01	
SW8010 - Halogenated Volatile Organics (µg/L)									
1,1,1-Trichloroethane	[NS]	3.73 KBJ	(8.3)	0.842 KBJ	(8.3)	418	(36.8)	1.76 KBJ	(8.3)
1,1-Dichloroethane	[3500]	ND	(1.11)	ND	(1.11)	65.4	(5.55)	ND	(1.11)
Chloroethane	[NS]	ND	(4)	ND	(4)	ND	(20)	0.442 KJ	(5.75)
Chloromethane	[26.92]	2.38 KJ	(7.55)	ND	(7.55)	ND	(37.8)	0.761 KJ	(7.55)
Tetrachloroethene	[6.73]	ND	(3.75)	ND	(3.75)	2.19 KJ	(19)	0.353 KJ	(3.8)
Trichloroethene	[NS]	245	(3.66)	597	(3.66)	2730	(18.3)	324	(3.66)
Vinyl chloride	[0.018]	ND	(7.55)	3.83 KJ	(7.55)	ND	(37.8)	ND	(7.55)
trans-1,3-Dichloropropene	[0.19]	0.492 KJ	(3.6)	ND	(3.6)	ND	(18)	ND	(3.6)

Note: The UTLs and the trigger criteria are presented, respectively, in brackets [ ]; [ ] = trigger criteria for organics; [,] = UTL, trigger criteria for inorganics.

Results greater than trigger criteria are shaded.

( ) = Detection limit.
B = Analyte detected in associated blank analyses.
J = Analyte detected at concentration below the detection limit.
K = Peak did not meet method identification criteria. Analyte not detected on other GC column.
ND = Not detected.
NS = Not specified.

Table 5.3-4
Analytical Results for Groundwater Samples—SWMU 179

Location ID		179-H01		179-H02		179-H03		179-H04	
Sample ID		179-H01-01-01		179-H02-01-01		179-H03-01-01		179-H04-01-01	
SW8010 - Halogenated Volatile Organics (µg/L)									
Trichloroethene	[NS]	38.8	(3)	27.6	(3)	< DL	(3)	4.5	(3)

Note: The UTLs and the trigger criteria are presented, respectively, in brackets [ ]; [ ] = trigger criteria for organics; [,] = UTL, trigger criteria for inorganics.

( ) = Detection limit.
DL = Detection limit.
NS = Not specified.

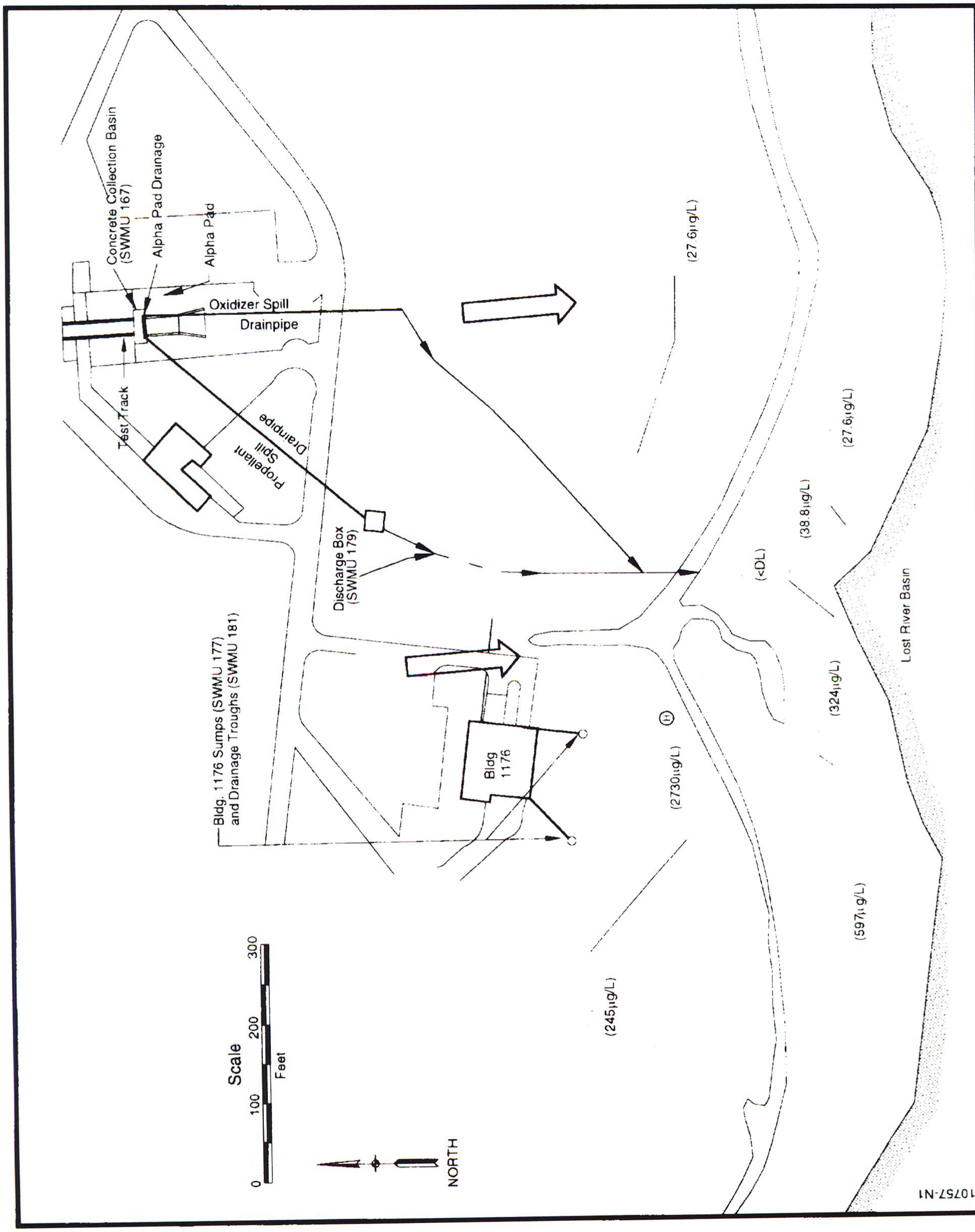


Figure 5.3-3. Occurrences of Trichloroethene in Groundwater at SWMUs 177 and 179

Appendix B-6-3

Portions of: *Results of Additional Groundwater Sampling at Site SS-39, Holloman Air Force Base, New Mexico, Delivery Order 11, Work Authorization Directive 01,* Groundwater Technology Government Services, Inc., September 30, 1998

17-A-74
AR 1140

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Groundwater Technology Government Services, Inc.
2501 Yale Boulevard SE, Suite 204 Albuquerque, NM 87106 USA
Tel· (505) 242-3113 Fax· (505) 242-1103

September 30, 1998

Mr Michael J Bone, P E.
Foster Wheeler Environmental Corporation
143 Union Blvd, Suite 1010
Lakewood, CO 80228

FINAL

RE: Results of Additional Groundwater Sampling at Site SS-39, Holloman Air Force Base, New Mexico, Delivery Order 11, Work Authorization Directive 01

Prime Contract No. DACW-45-94-D-0003
MOA NO. DENS-94-11159JM

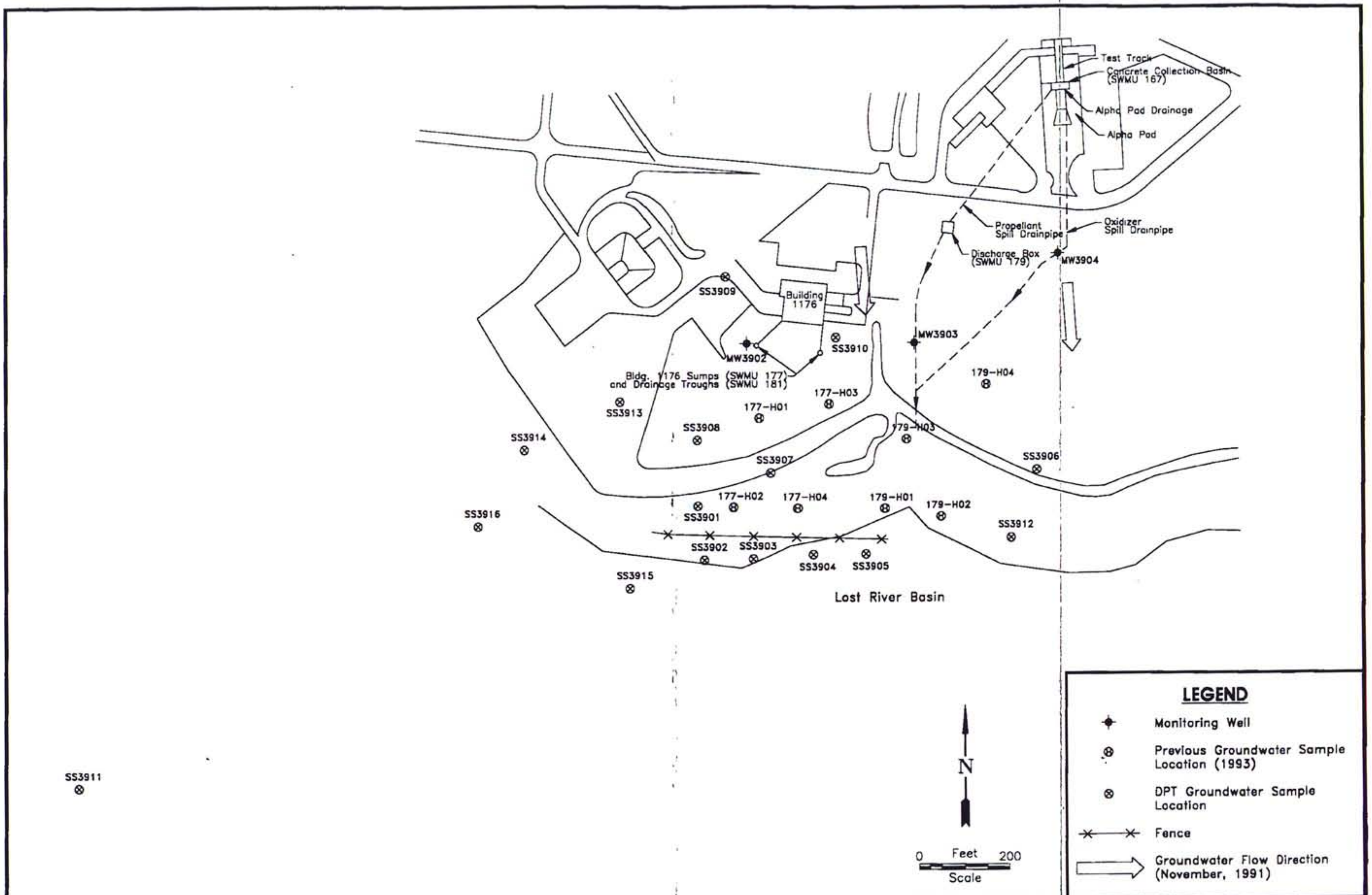
Dear Mr. Bone:

This letter describes the scope of work performed at Site SS-39 (Solid Waste Management Unit [SWMU] 177 and SWMU 179), Holloman Air Force Base (AFB), New Mexico in May-June 1998. The work consisted of collecting direct push technology (DPT) groundwater samples to delineate the extent of trichloroethene (TCE) previously characterized during the Phase II, Table 2 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) (Radian, 1994). The work was performed to fulfill a request for supplemental information by the New Mexico Environment Department (NMED) on the Phase II, Table 2 RFI Report Since the work performed was similar to the Area of Concern (AOC)-Ritas Draw work plan, it was conducted concurrently with the AOC-Ritas Draw field activities and in accordance with applicable standard operating procedures (SOPs) established in the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) for Preliminary Assessment/Site Inspection for AOC-Ritas Draw, Holloman AFB, New Mexico (Foster Wheeler Environmental Corporation [FWENC] and Groundwater Technology, 1998).

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of the investigation was to delineate the extent of TCE previously detected during the Phase II, Table 2 RFI (Radian, 1994). A total of 16 groundwater samples were collected



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Figur 1. SS-39 SITE MAP WITH DPT GROUNDWATER SAMPLING LOCATIONS

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
SITE SS-39
HOLLOMAN AFB, NEW MEXICO
MAY AND JUNE 1998

Sample ID	SS39-1-5	SS39-2-1	SS39-3-2	SS39-4-3	SS39-5-4	SS39-6-4	SS39-7-4	SS39-8-8	SS39-9-18	SS39-9-18DP
VOCs-EPA SW-846 Method 8260A (μg/L)										
Acetone	ND<50	ND<20	ND<10	ND<10	ND<10	ND<10	ND<71	ND<36	5 9J	4 9J
Benzene	ND<5 0	ND<2 0	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<7 1	ND<3 6	**1.0**	0 75J
Carbon disulfide	ND<5 0	ND<2 0	ND<1 0	ND<1 0	ND<1.0	ND<1 0	ND<7 1	ND<3 6	0 22J	ND<1 0
Carbon tetrachloride	1 4J	ND<2 0	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<7 1	2 1J	ND<1 0	ND<1 0
Chloroform	1 3J	ND<2 0	ND<1 0	ND<1.0	ND<1.0	0 17J	1.9J	1 4J	ND<1 0	ND<1 0
Chloromethane	ND<10	ND<4 0	ND<2 0	0.11J	ND<2 0	ND<2.0	ND<14	ND<7.1	ND<2 0	ND<2 0
1,1-Dichloroethene	1 5J	ND<2 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	2 1J	1 3J	ND<1 0	ND<1 0
Ethylbenzene	ND<5 0	ND<2 0	ND<1.0	ND<1 0	ND<1 0	ND<1 0	ND<7.1	ND<3 6	0 15J	0 11J
Methylene chloride	0 98J,B	0 27J,B	ND<1 0	ND<1 0	0.10J,B	ND<1 0	1.1J,B	0 53J,B	0 19J,B	0.19J,B
Tetrachloroethene	ND<5.0	ND<2.0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<7 1	ND<3 6	ND<1.0	ND<1 0
Toluene	ND<5 0	ND<2 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<7 1	ND<3 6	0 79J	0.56J
1,1,1-Trichloroethane	ND<5 0	ND<2.0	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<7 1	ND<3 6	ND<1 0	ND<1 0
Trichloroethene	**230**	**66**	0 63J	**27**	ND<1 0	0.32J	**280**	**130**	0 18J	0 15J
2-Butanone (MEK)	ND<25	ND<10	ND<5 0	ND<5 0	ND<5 0	ND<5 0	ND<36	ND<18	3 8J	ND<5 0

TABLE 1 (continued)
GROUNDWATER ANALYTICAL RESULTS
SITE SS-39
HOLLOMAN AFB, NEW MEXICO
MAY AND JUNE 1998

Sample ID	SS39-10-17	SS39-11-8	SS39-12-3	SS39-13-11	SS39-14-5	SS39-15	SS39-16	TB-01 (5/18/98)	SS39-TB-1 (5/19/98)	Trip Blank (5/22/98)	Trip Blank (6/24/98)
VOCs-EPA SW-846 Method 8260A (μg/L)											
Acetone	5 1J	ND<10	ND<10	ND<50	ND<17	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Benzene	0 42J	ND<1 0	ND<1 0	ND<5 0	ND<1 7	ND<1.0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Carbon disulfide	ND<1 0	0 37J	ND<1 0	ND<5 0	ND<1 7	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Carbon tetrachloride	ND<1 0	ND<1 0	ND<1.0	0 86J	ND<1 7	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Chloroform	0 29J	ND<1 0	ND<1 0	1 3J	0 22J	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Chloromethane	ND<2.0	ND<2 0	ND<2 0	ND<10	ND<3 3	ND<2.0	ND<2 0	ND<2 0	ND<2 0	ND<2 0	ND<2 0
1,1-Dichloroethene	ND<1 0	ND<1 0	ND<1.0	1.2J	ND<1 7	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Ethylbenzene	0 12J	ND<1 0	ND<1 0	ND<5 0	ND<1 7	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Methylene chloride	ND<1 0	ND<1 0	ND<1 0	ND<5 0	ND<1.7	ND<1 0	ND<1 0	0 35J,B	0 42J,B	0 39J	**1.3**
Tetrachloroethene	0 14J	ND<1 0	ND<1 0	ND<5 0	ND<1 7	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Toluene	0 50J	ND<1 0	ND<1 0	ND<5 0	ND<1 7	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
1,1,1-Trichloroethane	0 18J	ND<1 0	ND<1 0	ND<5 0	ND<1 7	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
Trichloroethene	0 29J	ND<1 0	**1.1**	**210**	**70**	ND<1 0	ND<1.0	ND<1 0	ND<1 0	ND<1 0	ND<1 0
2-Butanone (MEK)	ND<5 0	1 2J	ND<5 0	ND<25	ND<8 3	ND<5 0	ND<5 0	ND<5 0	ND<5 0	ND<5 0	ND<5 0

Note	Compounds detected at or above the RL are shown in bold
<	Indicates compound not detected at or above the RL
B	Method blank contamination, the associated method blank contains the target analyte at a reportable level
J	Estimated result, result is less than RL.
ND	Not detected
RL	Reporting limit
μg/L	Micrograms per liter
VOCs	Volatile organic compounds

Appendix B-6-4

Portions of: *Supplemental RCRA Facility Investigation DP-30/SD-33 (SWMU 113B), SS-39 (SWMUs 165, 177, 179, and 181), and SD-27 (SWMU 141) Holloman Air Force Base Alamogordo, New Mexico,* HydroGeoLogic, Inc., July 2007

Supplemental RCRA Facility Investigation DP-30/SD-33 (SWMU 113B), SS-39 (SWMUs 165, 177, 179, and 181), and SD-27 (SWMU 141)

Holloman Air Force Base Alamogordo, New Mexico

Prepared for

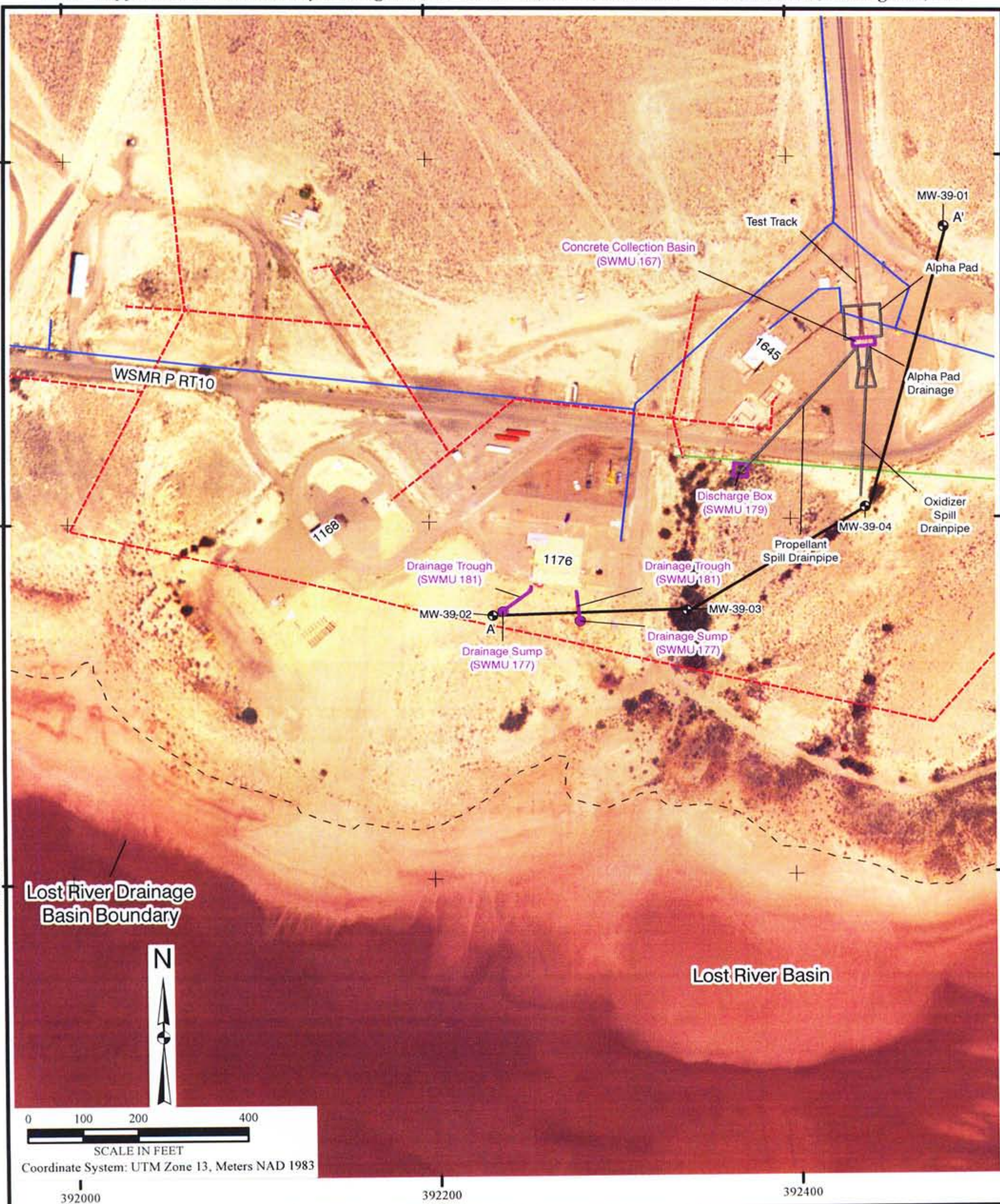
Air Force Center for Environmental Excellence
3300 Sidney Brooks
Brooks City-Base, Texas 78235-5344

Prepared by

HydroGeoLogic, Inc.
11107 Sunset Hills Road, Suite 400
Reston, Virginia 20190

Contract No. F41624-03-D-8602
Task Order No. 037

July 2007



File X:\AFC002\Holloman AFB\TO37\Maps\DP-30 SD-33 SS-39 SD-27 Supp RFI\SS-39.mxd
Project: AFC002-037-04-11-05
Revised: 05/16/07 PS
Map Source: Holloman AFB

Legend

- Below-Ground Electric
- Lost River Drainage Basin Boundary
- Potable Water
- Waste Water
- SWMU Boundary
- A —— A' Line of Section
- Monitoring Well (Existing)

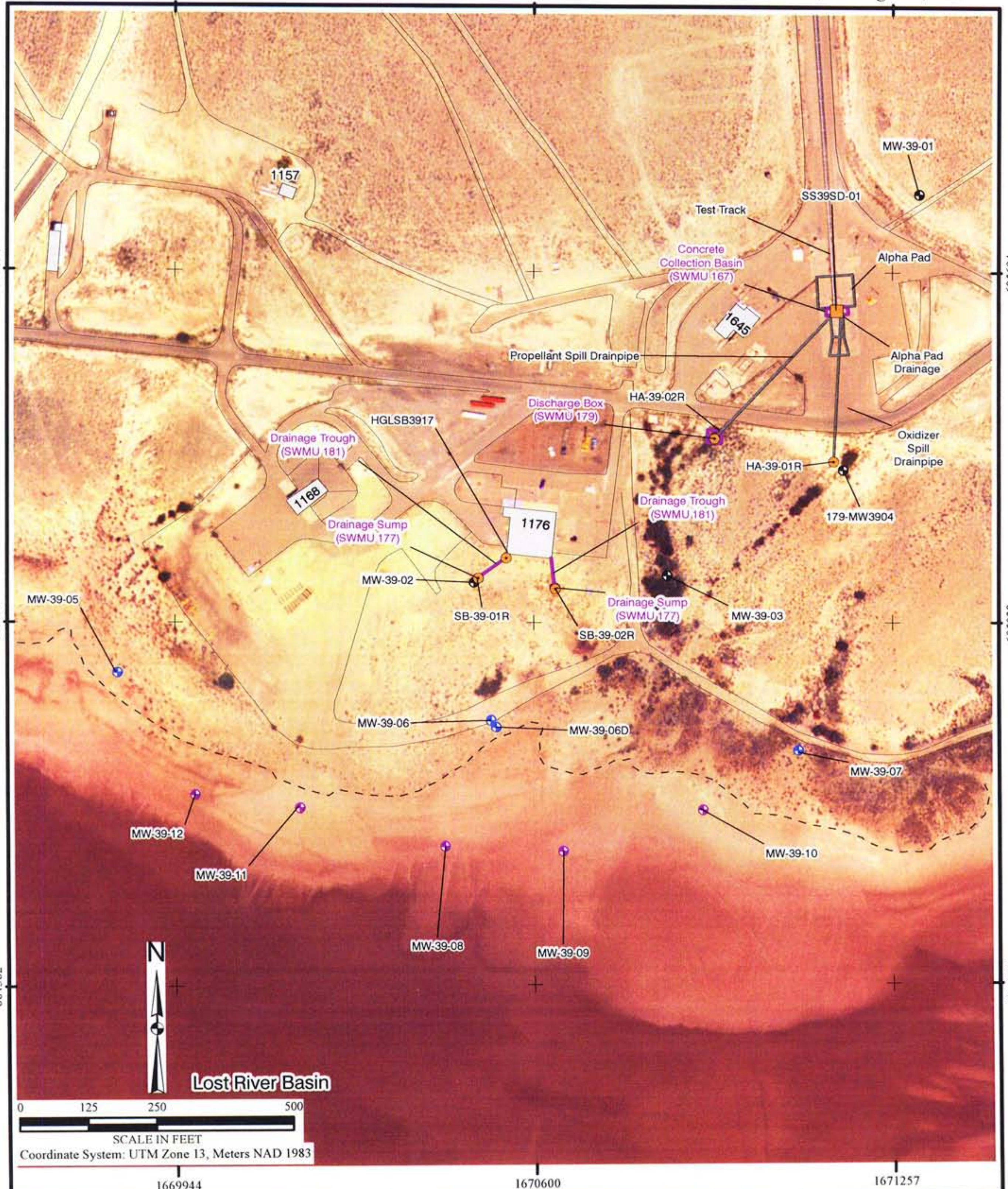
Figure 4.1
SS-39
Layout Map

File X:\AFC002\Holloman_AFB\TO37\Maps\DP-30_SD-33_SS-39_SD-27_Supp_RFI\SS-39_GW_July_2006.mxd
Project: AFC002-037-04-11-05
Revised: 05/18/07 PS
Map Source: Holloman AFB

Legend

- Monitoring Well (Existing)
- Pre-Pack Monitoring Well (Supp RFI)
- Permanent Monitoring Well (Supp RFI)
- SWMU Boundary
- 4028 Groundwater Elevation Contour (ft msl)
- 4032.86 Groundwater Elevation

Figure 4.3 Groundwater Potentiometric Surface Map July 2006



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Project: AFC002-037-04-11-05
Revised: 05/18/07 PS
Map Source: Holloman AFB

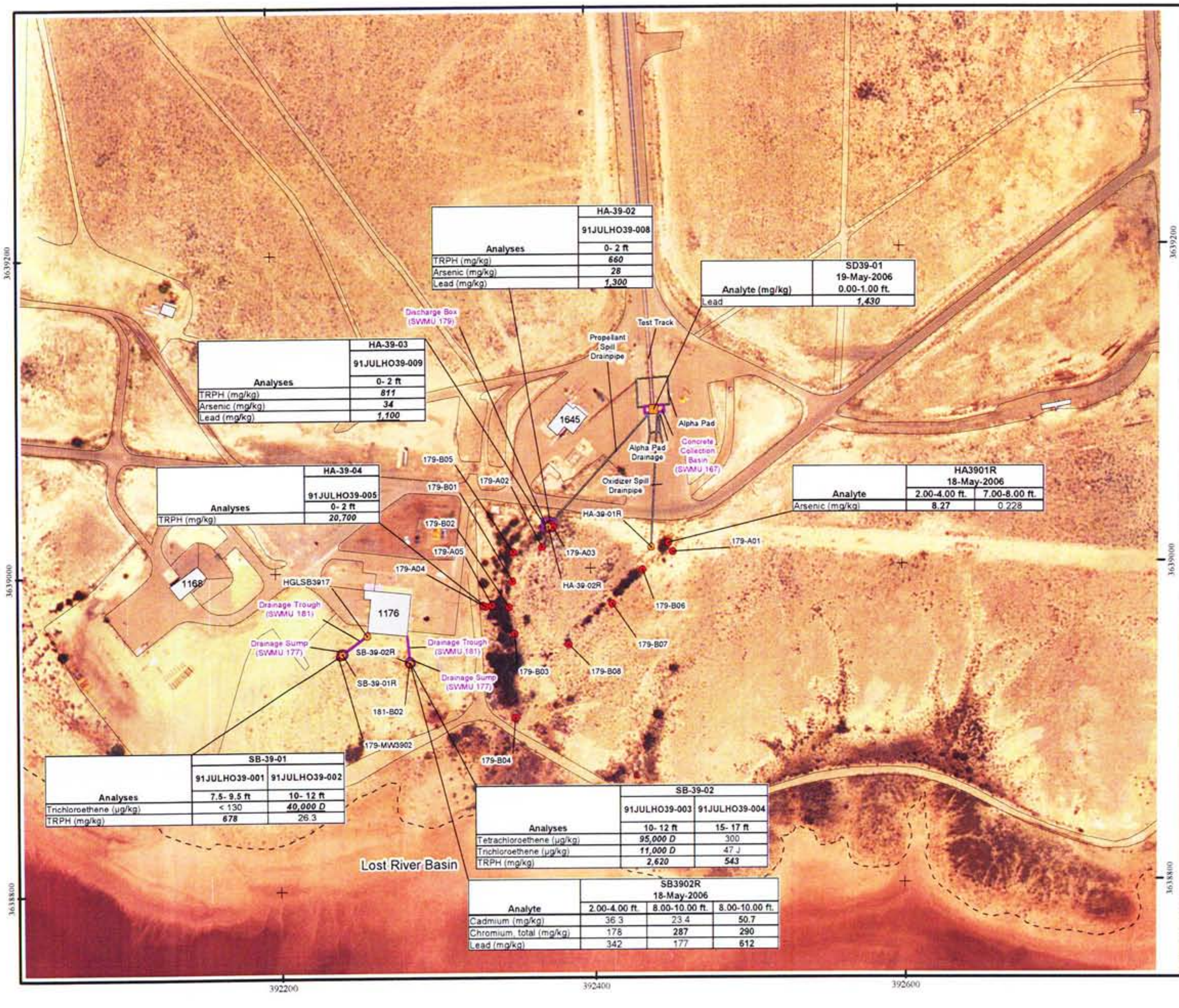
Legend

- Monitoring Well (Existing)
- Pre-Pack Monitoring Well (Supp RFI)
- Permanent Monitoring Well (Supp RFI)
- Soil Boring
- Lost River Basin Boundary
- SWMU Boundary
- Sediment Sample

Figure 4.9
SS-39 Supplemental RFI Sample Locations

HGL—Supplemental RCRA Facility Investigation,
DP-30/SD-33, SS-39, and SD-27
Holloman AFB, Alamogordo, NM

Figure 4.10
SS-39
Soil and Sediment Analyte Exceedances



Analyses	HA-39-02 91JULHO39-008 0- 2 ft
TRPH (mg/kg)	***660***
Arsenic (mg/kg)	***28***
Lead (mg/kg)	***1,300***

Analyte (mg/kg)	SD39-01 19-May-2006 0.00-1.00 ft.
Lead	***1,430***

Analyses	HA-39-03 91JULHO39-009 0- 2 ft
TRPH (mg/kg)	***811***
Arsenic (mg/kg)	***34***
Lead (mg/kg)	***1,100***

Analyses	HA-39-04 91JULHO39-005 0- 2 ft
TRPH (mg/kg)	***20,700***

Analyte	HA3901R 18-May-2006	
	2.00-4.00 ft.	7.00-8.00 ft.
Arsenic (mg/kg)	**8.27**	0.228

Analyses	SB-39-01	
	91JULHO39-001	91JULHO39-002
	7.5- 9.5 ft	10- 12 ft
Trichloroethene (µg/kg)	< 130	***40,000 D***
TRPH (mg/kg)	**678**	26.3

Analyses	SB-39-02	
	91JULHO39-003	91JULHO39-004
	10- 12 ft	15- 17 ft
Tetrachloroethene (µg/kg)	***95,000 D***	300
Trichloroethene (µg/kg)	***11,000 D***	47 J
TRPH (mg/kg)	***2,620***	**543**

Analyte	SB3902R 18-May-2006		
	2.00-4.00 ft.	8.00-10.00 ft.	8.00-10.00 ft.
Cadmium (mg/kg)	36.3	23.4	**50.7**
Chromium, total (mg/kg)	178	**287**	**290**
Lead (mg/kg)	342	177	**612**

Legend

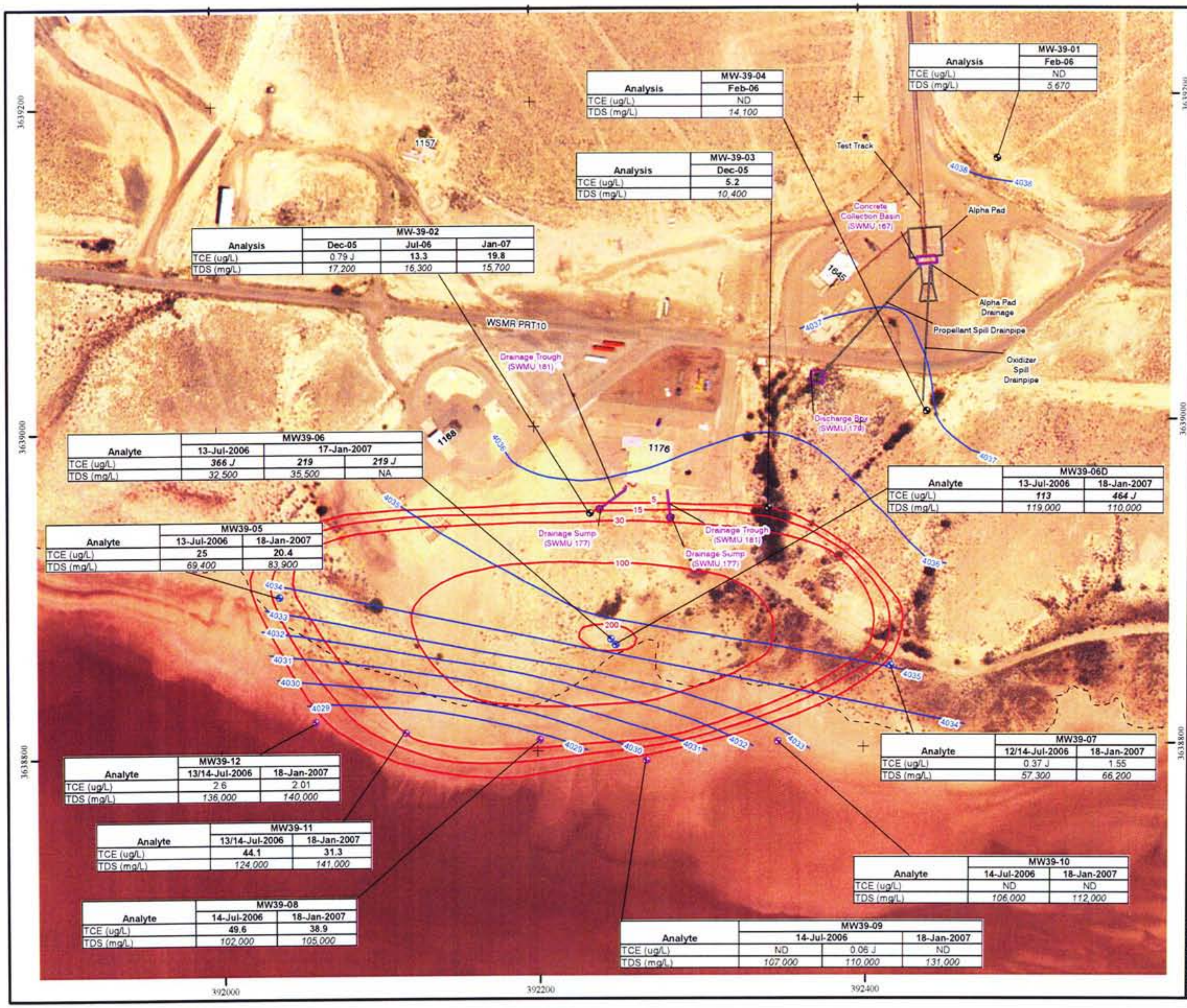
- Soil Boring (1994 Table 2 Phase I RFI)
- Supplemental RFI Soil Boring
- Sediment Sample
- Lost River Basin Boundary
- SWMU Boundary

Notes:
Bolded text indicates analyte concentration exceeding NMED residential SSLs
Bolded and italicized values indicates analyte concentration exceeding NMED residential and industrial SSLs
Bolded, italicized, and underlined values indicates analyte concentration exceeding NMED residential, industrial, and construction worker SSLs
< = Analyte not detected above reporting limit
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
TRPH = total recoverable petroleum hydrocarbons

N

0 100 200 400
SCALE IN FEET
Coordinate System: NAD 1983 StatePlane NM Central Feet

File X:/AFC002/Holloman_AFB/TO37/Maps/DP-30_SD-33_SS-39_SD-27_Supp_RFI/SS-39_Soil_Sed_Exceed.mxd
Project: AFC002-037-04-11-02
Revised: 05/29/07 PS
Map Source: Holloman AFB



Analysis	MW-39-01 Feb-06
TCE (ug/L)	ND
TDS (mg/L)	*5,670*

Analysis	MW-39-04 Feb-06
TCE (ug/L)	ND
TDS (mg/L)	*14,100*

Analysis	MW-39-03 Dec-05
TCE (ug/L)	**5.2**
TDS (mg/L)	*10,400*

Analysis	MW-39-02 Dec-05	Jul-06	Jan-07
TCE (ug/L)	0.79 J	**13.3**	**19.8**
TDS (mg/L)	*17,200*	*16,300*	*15,700*

Analyte	MW39-06 13-Jul-2006	17-Jan-2007	
TCE (ug/L)	***366 J***	***219***	***219 J***
TDS (mg/L)	*32,500*	*35,500*	NA

Analyte	MW39-06D 13-Jul-2006	18-Jan-2007
TCE (ug/L)	***113***	***464 J***
TDS (mg/L)	*119,000*	*110,000*

Analyte	MW39-05 13-Jul-2006	18-Jan-2007
TCE (ug/L)	**25**	**20.4**
TDS (mg/L)	*69,400*	*83,900*

Analyte	MW39-07 12/14-Jul-2006	18-Jan-2007
TCE (ug/L)	0.37 J	1.55
TDS (mg/L)	*57,300*	*66,200*

Analyte	MW39-12 13/14-Jul-2006	18-Jan-2007
TCE (ug/L)	2.6	2.01
TDS (mg/L)	*136,000*	*140,000*

Analyte	MW39-11 13/14-Jul-2006	18-Jan-2007
TCE (ug/L)	**44.1**	**31.3**
TDS (mg/L)	*124,000*	*141,000*

Analyte	MW39-10 14-Jul-2006	18-Jan-2007
TCE (ug/L)	ND	ND
TDS (mg/L)	*106,000*	*112,000*

Analyte	MW39-08 14-Jul-2006	18-Jan-2007
TCE (ug/L)	**49.6**	**38.9**
TDS (mg/L)	*102,000*	*105,000*

Analyte	MW39-09 14-Jul-2006		18-Jan-2007
TCE (ug/L)	ND	0.06 J	ND
TDS (mg/L)	*107,000*	*110,000*	*131,000*

HGL—Supplemental RCRA Facility Investigation, DP-30/SD-33, SS-39, and SD-27 Holloman AFB, Alamogordo, NM

Figure 4.11 SS-39 TCE Concentration in Groundwater 2007

Legend

- Monitoring Well (1997 Data)
- Pre-Pack Monitoring Well (Supp RFI)
- Permanent Monitoring Well (Supp RFI)
- Lost River Basin Boundary
- SWMU Boundary
- TCE Isopleth
- Groundwater Elevation Contour (January 2007)
- Groundwater Elevation

Notes:
Bolded value indicates analyte concentration exceeds U.S. EPA MCL.
Italicized value indicates analyte concentration exceeds NMGWQ standard.
Bolded and italicized value indicates analyte concentration exceeds U.S. EPA MCL and NMGWQ standard.
NA = not analyzed
ND = not detected
R = data rejected
µg/L = micrograms per liter

N

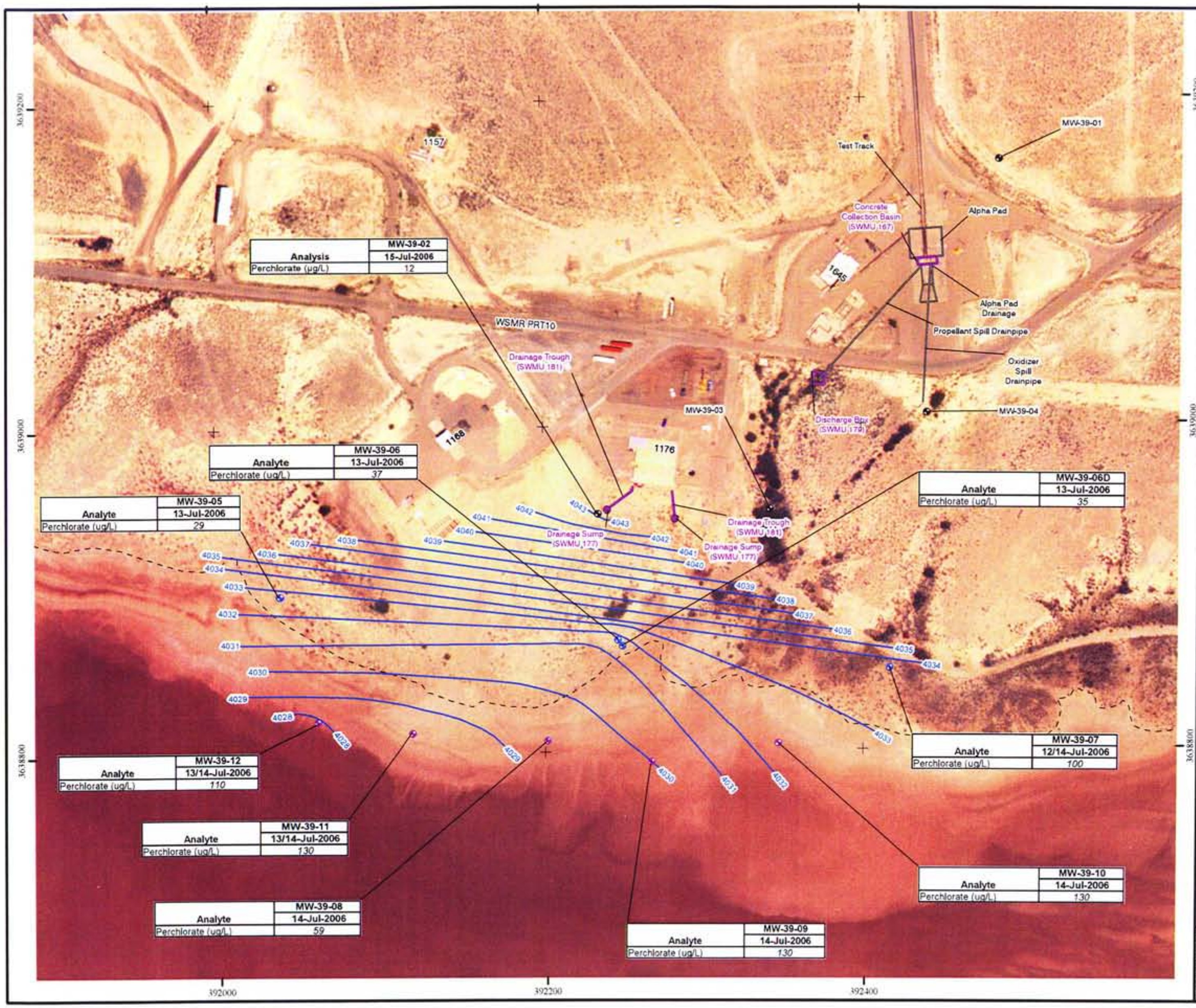
0 100 200 400
SCALE IN FEET

Coordinate System: NAD 1983 StatePlane NM Central Feet

File: X:/AFC002/Holloman_AFB/TO37/Maps/DP-30_SD-33_SS-39_SD-27_Supp_RFI/SS-39_GW_Jan_2007_Tags.mxd
Project: AFC002-037-04-11-02
Revised: 02/13/06 TB
Map Source: Holloman AFB

HGL—Supplemental RCRA Facility Investigation, DP-30/SD-33, SS-39, and SD-27 Holloman AFB, Alamogordo, NM

Figure 4.12
SS-39
Perchlorate Concentrations in Groundwater
July 2006



Legend

- Monitoring Well (1997 Data)
- Pre-Pack Monitoring Well (Supp RFI)
- Permanent Monitoring Well (Supp RFI)
- Lost River Basin Boundary
- SWMU Boundary
- Groundwater Elevation Contour (July 2006)
- Groundwater Elevation

Notes:
Italicized value indicates analyte concentration exceeds NMGWQ standard
µg/L = micrograms per liter

N

0 100 200 400
SCALE IN FEET

Coordinate System: NAD 1983 StatePlane NM Central Feet

File X:\AFC002\Holloman_AFB\TO37\Maps DP-30_SD-33_SS-39_SD-27_Supp_RFI SS-39_GW_Perch_Tags.mxd
Project: AFC002-037-04-11-02
Revised: 05/29/07 PS
Map Source: Holloman AFB

Table 4.9
Sediment Analytical Results
SS-39 (SWMUs 165, 177, 179, and 181) – Missile Fuel Spill Area
Supplemental RFI
Holloman AFB, New Mexico

Analyte [1]	Background [2]	NMED Soil Screening Level [3]			SD39-01 19-May-2006 0.00-1.00 ft.	
		Residential	Industrial	Construction Worker	Val	Q
Semi-Volatile Organic Compounds (µg/kg)						
Acetophenone	NA	1,480,000	1,480,000	1,480,000	2,680	
Diethyl phthalate	NA	48,900,000	100,000,000	100,000,000	932	J
Dimethyl phthalate	NA	100,000,000	100,000,000	100,000,000	1,120	J
Metals (mg/kg)						
Barium	84.4	15,600	100,000	60,200	168	
Cadmium	1.0	39	564	154	7.31	
Chromium, total	24.6	210 [4]	450 [4]	500 [4]	43.2	
Lead	12.3	400	800	800	***1,430***	
Mercury	--	6.11 [5]	68.4 [5]	23.8 [5]	0.0516	
Silver	0.73	391	5,680	1,550	0.136	J

Notes:
(1) Sample analyzed for SVOCs (UDMH), aniline, and RCRA metals. UDMH and aniline not detected.
(2) Radian, 1992 and 1993. Background provided for reference only.
(3) Obtained from Table A-1 (NMED, 2006c)
(4) Obtained from Region 6 Human Health Medium Specific Screening Levels (EPA Reg VI, 2007)
(5) Methyl mercury screening criteria used as a surrogate for mercury

NMED = New Mexico Environment Department
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
-- = not detected
NA = not analyzed
ft = feet
UDMH = unsymmetrical dimethylhydrazine
Val = validated result
Q = data qualifier
J = estimated positive detection

Bolded and *italicized* value indicates analyte concentration exceeds NMED residential and industrial SSL

Table 4.10
Soil Analytical Results
SS-39 (SWMUs 165, 177, 179, and 181) – Missile Fuel Spill Area
Supplemental RFI
Holloman AFB, New Mexico

Analyte [1]	Background [2]	NMED Soil Screening Levels [3]			SB3901R 18-May-2006				SB3902R 18-May-2006						SB39-17 18-May-2006			
					2.00-4.00 ft.		8.00-10.00 ft.		2.00-4.00 ft.		8.00-10.00 ft.		8.00-10.00 ft.		2.00-4.00 ft.		9.00-10.00 ft.	
		Residential	Industrial	Construction Worker	Val	Q	Val	Q	Val	Q	Val	Q	Val [4]	Q [4]	Val	Q	Val	Q
Metals (mg/kg)																		
Arsenic	6.90	3.90	17.70	85.2	0.228	U	0.228	U	0.228	U	0.228	U	0.228	U	0.228	U	0.228	U
Barium	84.4	15,600	100,000	60,200	25.6		19.9		124		70.7		78.8		19.6		11.5	
Cadmium	1.0	39.0	564	154	2.25		0.0795	U	36.3		23.4		**50.7**		0.0795	U	0.0795	U
Chromium, total	24.6	210 [5]	450 [5]	500 [5]	16.9		3.01		178		**287**		**290**		0.528	J	0.615	J
Lead	12.3	400	800	800	18.8		0.65	U	342		177		**612**		0.65	U	0.65	U
Mercury	--	6.11 [6]	68.4 [6]	23.8 [6]	0.0879		0.0088	U	0.435		0.0802		0.0625		0.0088	U	0.0088	U
Silver	0.73	391	5,680	1,550	0.787		0.834		6.34		0.0444	U	0.0444	U	0.991		0.536	

Analyte [1]	Background [2]	NMED Soil Screening Levels [3]			HA3901R 18-May-2006				HA3902R 18-May-2006			
					2.00-4.00 ft.		7.00-8.00 ft.		2.00-4.00 ft.		8.00-9.00 ft.	
		Residential	Industrial	Construction Worker	Val	Q	Val	Q	Val	Q	Val	Q
Metals (mg/kg)												
Arsenic	6.90	3.90	17.70	85.2	**8.27**		0.228	U	0.228	U	0.228	U
Barium	84.4	15,600	100,000	60,200	36.8		21.6		64.4		33.1	
Cadmium	1.0	39.0	564	154	0.294		0.0795	U	0.0795	U	0.0795	U
Chromium, total	24.6	210 [5]	450 [5]	500 [5]	10.4		3.82		6.48		4.38	
Lead	12.3	400	800	800	102		53		20.7		5.05	
Mercury	--	6.11 [6]	68.4 [6]	23.8 [6]	0.0095	J	0.0088	U	0.0094	J	0.0088	U
Silver	0.73	391	5,680	1,550	0.994		1.09		0.0444	U	0.473	

Notes:
(1) Samples analyzed for UDMH, aniline, and RCRA metals. UDMH and aniline not detected.
(2) Radian, 1992 and 1993. Background provided for reference only.
(3) Obtained from Table A-1 (NMED, 2006c)
(4) Duplicate
(5) Obtained from Region 6 Human Health Medium Specific Screening Levels (EPA Reg VI, 2007)
(6) Methyl mercury screening criteria used as a surrogate for mercury

NMED = New Mexico Environment Department
mg/kg = milligrams per kilogram
ft = feet
Val = validated result
Q = data qualifier
U = non-detect result, value presented indicates reporting limit
J = estimated positive detection
UDMH = unsymmetrical dimethylhydrazine
-- = not detected

Bolded value indicates analyte concentration exceeds NMED residential SSL

Table 4.12
Groundwater Analytical Results
SS-39 (SWMUs 165, 177, 179, and 181) – Missile Fuel Spill Area
Supplemental RFI and January 2007 Groundwater Compliance Long Term Monitoring
Holloman AFB, New Mexico

Analyte	Background [1]	U.S. EPA MCL [2]	NMGWQ Standard [2][3]	MW39-02				MW39-05				MW39-06					
				15-Jul-2006		17-Jan-2007		13-Jul-2006		18-Jan-2007		13-Jul-2006		17-Jan-2007			
				Val	Q	Val	Q	Val	Q	Val	Q	Val	Q	Val	Q	Val [4]	Q [4]
Volatile Organic Compounds (ug/L)																	
1-Bromo-4-Fluorobenzene (4-Bromofluorobenzene)	NA	--	--	NA		48		NA		44.8		NA		47.2		47.3	
1,1-Dichloroethane	NA	--	25	0.0299	U	1	U	0.0299	U	1	U	0.03	J	1	U	1	U
1,1-Dichloroethene	NA	7	5	0.0736	U	0.54	J	0.0736	U	1	U	2.02		1.83		1.88	
Acetone	NA	--	--	0.854	U	10	UJ	0.854	U	10	UJ	0.854	U	10	UJ	10	UJ
Benzene	NA	5	10	0.0495	U	1	U	0.07	J	1	U	0.09	J	1	U	1	U
Bromodichloromethane	NA	--	--	0.0651	U	1	U	0.0651	U	1	U	0.14	J	1	U	1	U
Bromoform	NA	--	--	0.0859	U	1	U	0.0859	U	1	U	0.0859	U	1	U	1	U
Carbon tetrachloride	NA	5	10	3.13		3.08		0.121	U	1	U	1.51		1.93		1.88	
Chlorobenzene	NA	100	--	0.0217	U	1	U	0.03	J	1	U	0.0217	U	1	U	1	U
Chloroform	NA	--	100	1.38		1.44		0.0475	U	1	U	2.85		2.52		2.52	J
Chloromethane	NA	--	--	0.23	U	1	U	0.23	U	1	U	0.37	J	1	U	1	U
cis-1,2-Dichloroethene	NA	70	--	0.101	U	1	U	0.101	U	1	U	0.12	J	1	U	1	U
Dibromofluoromethane	NA	--	--	NA		52.4		NA		53.5		NA		51.9		51.6	
m,p-Xylene (sum of isomers)	NA	10,000 [5]	620 [5]	0.04	J	1	U	1	U	1	U	1	U	1	U	1	U
Methylene chloride	NA	--	100	0.689	U	5	U	0.689	U	5	U	0.689	U	5	U	5	U
Toluene-D8	NA	1,000	750	NA		47.2		NA		46.5		NA		46.9		46.8	
Trichloroethene (TCE)	NA	5	100	**13.3**		**19.8**		**25**		**20.4**		***366***	***J***	***219***		***219***	***J***
Metals (ug/L)																	
Arsenic	72.3	10	100	NA		5	U	NA		5	U	NA		5	U	5	U
Barium	929	2,000	1,000	NA		14		NA		19		NA		37		26	J
Chromium, total	234	100	50	NA		14		NA		5	U	NA		5	U	5	U
Lead	19.9	15	50	NA		5	U	NA		5	U	NA		5	U	5	U
Filtered Metals (ug/L)																	
Arsenic (Filtered)	35.4	10	100	R [7]		5	U	R [7]		5	U	R [7]		5	U	5	U
Barium (Filtered)	85.2	2,000	1,000	R [7]		14	J	R [7]		15	J	R [7]		12	J	12	J
Cadmium (Filtered)	7.4	5	10	R [7]		1	UJ	R [7]		1	UJ	R [7]		1	UJ	1	UJ
Chromium, total (Filtered)	7.2	100	50	R [7]		7	J	R [7]		5	UJ	R [7]		5	UJ	5	UJ
Selenium (Filtered)	85.3	50	50	R [7]		10	UJ	R [7]		10	UJ	R [7]		10	UJ	10	UJ
Silver (Filtered)	6.7	--	50	R [7]		2	UJ	R [7]		2	UJ	R [7]		2	UJ	2	UJ
Perchlorate (ug/L)																	
Perchlorate	NA	--	<24.5 [6]	*12*		*75*	*U*	*29*		*600*	*U*	*37*		*300*	*U*	*300*	*U*
Other Compounds (mg/L)																	
TDS	NA	--	1,000	*16,300*		*15,700*		*69,400*		*83,900*		*32,500*		*35,500*		NA	

Notes
(1) Radian, 1992 and 1993. Background provided for reference only.
(2) US EPA MCLs and NMGWQ standards are provided for refernce only since TDS exceeds 10,000 mg/L
(3) NMAC 20.6.2.3103
(4) Duplicate
(5) Total xylenes EPA MCL and NMGWQ Standard used as surrogate for m,p-Xylene
(6) Human Health Medium Specific Screening Levels 2007 (EPA Reg VI, 2007)
(7) Dissolved metals data rejected (see Section 4.7.4)

µg/L = micrograms per liter
mg/L = milligrams per liter
TDS = total dissolved solids
Val = analytical result
Q = data qualifier
J = positive detection, value between RL and the MDL
U = non-detect result
NA = not analyzed
-- = not applicable; not detected
MDL = method detection limit
RL = reporting limit
U.S. EPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
NMAC = New Mexico Administrative Code

Bolded value indicates analyte concentration exceeds U.S. EPA MCL
Italicized value indicates analyte concentration exceeds NMGWQ standard
Bolded and italicized value indicates analyte concentration exceeds U.S. EPA MCL and NMGWQ standard

Table 4.12 (continued)
Groundwater Analytical Results
SS-39 (SWMUs 165, 177, 179, and 181) – Missile Fuel Spill Area
Supplemental RFI and January 2007 Groundwater Compliance Long Term Monitoring
Holloman AFB, New Mexico

Analyte	Background [1]	U.S. EPA MCL [2]	NMGWQ Standard [2][3]	MW39-06D				MW39-07				MW39-08			
				13-Jul-2006		18-Jan-2007		12/14-Jul-2006		18-Jan-2007		14-Jul-2006		18-Jan-2007	
				Val	Q	Val	Q	Val	Q	Val	Q	Val	Q	Val	Q
Volatile Organic Compounds (ug/L)															
1-Bromo-4-Fluorobenzene (4-Bromofluorobenzene)	NA	–	–	NA		43.4		NA		45.5		NA		43.8	
1,1-Dichloroethane	NA	–	25	0.0299	U	1	U	0.0299	U	1	U	0.0299	U	1	U
1,1-Dichloroethene	NA	7	5	0.24	J	1.42		0.0736	U	1	U	0.0736	U	1	U
Acetone	NA	–	–	1.88	J	10	UJ	0.854	U	10	UJ	0.854	U	10	UJ
Benzene	NA	5	10	0.09	J	1	U	0.0495	U	1	U	1	U	1	U
Bromodichloromethane	NA	–	–	0.0651	U	1	U	0.0651	U	1	U	0.0651	U	1	U
Bromoform	NA	–	–	0.0859	U	1	U	0.0859	U	1	U	0.0859	U	1	U
Carbon tetrachloride	NA	5	10	0.121	U	1	U	0.121	U	1	U	0.121	U	1	U
Chlorobenzene	NA	100	–	0.04	J	1	U	1	U	1	U	1	U	1	U
Chloroform	NA	–	100	0.27	J	0.65	J	0.11	J	1	U	0.23	J	1	U
Chloromethane	NA	–	–	0.23	U	0.51	J	0.23	U	1	U	0.23	U	1	U
cis-1,2-Dichloroethene	NA	70	–	0.101	U	1	U	0.101	U	1	U	0.101	U	1	U
Dibromofluoromethane	NA	–	–	NA		51.7		NA		51.7		NA		52.8	
m,p-Xylene (sum of isomers)	NA	10,000 [5]	620 [5]	1	U	1	U	1	U	1	U	1	U	1	U
Methylene chloride	NA	–	100	0.689	U	5	U	0.689	U	5	U	0.689	U	5	U
Toluene-D8	NA	1,000	750	NA		45.4		NA		45.9		NA		45.6	
Trichloroethene (TCE)	NA	5	100	***113***		***464***	*J*	0.37	J	1.55		**49.6**		**38.9**	
Metals (ug/L)															
Arsenic	72.3	10	100	NA		**17**		5	U	5	U	NA		5	U
Barium	929	2,000	1,000	NA		17	J	19		44		NA		60	
Chromium, total	234	100	50	NA		5	U	1.4	U	5	U	NA		5	U
Lead	19.9	15	50	NA		5	U	1.6	UJ	5	U	NA		5	U
Filtered Metals (ug/L)															
Arsenic (Filtered)	35.4	10	100	R [7]		5	U	R [7]		5	U	R [7]		5	U
Barium (Filtered)	85.2	2,000	1,000	R [7]		17	J	R [7]		9	J	R [7]		11	J
Cadmium (Filtered)	7.4	5	10	R [7]		1	UJ	R [7]		1	UJ	R [7]		1	UJ
Chromium, total (Filtered)	7.2	100	50	R [7]		5	UJ	R [7]		5	UJ	R [7]		5	UJ
Selenium (Filtered)	85.3	50	50	R [7]		10	UJ	R [7]		10	UJ	R [7]		10	UJ
Silver (Filtered)	6.7	–	50	R [7]		2	UJ	R [7]		2	UJ	R [7]		2	UJ
Perchlorate (ug/L)															
Perchlorate	NA	–	<24.5 [6]	*35*		*600*	*U*	*100*		*300*	*U*	*59*		*600*	*U*
Other Compounds (mg/L)															
TDS	NA	–	1,000	*119,000*		*110,000*		*57,300*		*66,200*		*102,000*		*105,000*	

Notes
(1) Radian, 1992 and 1993. Background provided for reference only.
(2) US EPA MCLs and NMGWQ standards are provided for refernce only since TDS exceeds 10,000 mg/L
(3) NMAC 20.6.2.3103
(4) Duplicate
(5) Total xylenes EPA MCL and NMGWQ Standard used as surrogate for m,p-Xylene
(6) Human Health Medium Specific Screening Levels 2007 (EPA Reg VI, 2007)
(7) Dissolved metals data rejected (see Section 4.7.4)

µg/L = micrograms per liter
mg/L = milligrams per liter
TDS = total dissolved solids
Val = analytical result
Q = data qualifier
J = positive detection, value between RL and the MDL
U = non-detect result
NA = not analyzed
– = not applicable; not detected
MDL = method detection limit
RL = reporting limit
U.S. EPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
NMAC = New Mexico Administrative Code

Bolded value indicates analyte concentration exceeds U.S. EPA MCL
Italicized value indicates analyte concentration exceeds NMGWQ standard
Bolded and italicized value indicates analyte concentration exceeds U.S. EPA MCL and NMGWQ standard

Table 4.12 (continued)
Groundwater Analytical Results
SS-39 (SWMUs 165, 177, 179, and 181) – Missile Fuel Spill Area
Supplemental RFI and January 2007 Groundwater Compliance Long Term Monitoring
Holloman AFB, New Mexico

Analyte	Background (1)	U.S. EPA MCL (2)	NMGWQ Standard (2)(3)	MW39-09						MW39-10				MW39-11			
				14-Jul-2006				18-Jan-2007		14-Jul-2006		18-Jan-2007		13/14-Jul-2006		18-Jan-2007	
				Val	Q	Val (4)	Q (4)	Val	Q	Val	Q	Val	Q	Val	Q	Val	Q
Volatile Organic Compounds (ug/L)																	
1-Bromo-4-Fluorobenzene (4-Bromofluorobenzene)	NA	--	--	NA		NA		42.8	J	NA		43.4		NA		42.9	
1,1-Dichloroethane	NA	--	25	0.0299	U	0.0299	U	1	UJ	0.0299	U	1	U	0.0299	U	1	U
1,1-Dichloroethene	NA	7	5	0.0736	U	0.0736	U	1	UJ	0.0736	U	1	U	0.0736	U	1	U
Acetone	NA	--	--	10	U	10	U	10	UJ	10	U	10	UJ	3.12	J	10	UJ
Benzene	NA	5	10	1	U	1	U	1	UJ	0.0495	U	1	U	0.06	J	1	U
Bromodichloromethane	NA	--	--	0.0651	U	0.0651	U	1	UJ	0.0651	U	1	U	0.0651	U	1	U
Bromoform	NA	--	--	0.16	J	0.0859	U	1	UJ	0.0859	U	1	U	0.0859	U	1	U
Carbon tetrachloride	NA	5	10	0.121	U	0.121	U	1	UJ	0.121	U	1	U	0.121	U	1	U
Chlorobenzene	NA	100	--	1	U	1	U	1	UJ	1	U	1	U	0.03	J	1	U
Chloroform	NA	--	100	0.0475	U	0.0475	U	1	UJ	0.0475	U	1	U	0.0475	U	1	U
Chloromethane	NA	--	--	0.37	J	0.37	J	0.59	J	0.34	J	1	U	0.36	J	0.43	J
cis-1,2-Dichloroethene	NA	70	--	0.101	U	0.101	U	1	UJ	0.101	U	1	U	0.25	J	1	U
Dibromofluoromethane	NA	--	--	NA		NA		52.1	J	NA		52.4		NA		52.2	
m,p-Xylene (sum of isomers)	NA	10,000 (5)	620 (5)	1	U	1	U	1	UJ	1	U	1	U	1	U	1	U
Methylene chloride	NA	--	100	0.689	U	0.689	U	0.58	J	0.689	U	5	U	0.689	U	5	U
Toluene-D8	NA	1,000	750	NA		NA		44.7	J	NA		45.4		NA		45.3	
Trichloroethene (TCE)	NA	5	100	0.0495	U	0.06	J	1	UJ	0.0495	U	1	U	**44.1**		**31.3**	
Metals (ug/L)																	
Arsenic	72.3	10	100	NA		NA		5	U	NA		5	U	NA		5	U
Barium	929	2,000	1,000	NA		NA		277		NA		11		NA		11	
Chromium, total	234	100	50	NA		NA		5	U	NA		5	U	NA		5	U
Lead	19.9	15	50	NA		NA		**38**		NA		5	U	NA		5	U
Filtered Metals (ug/L)																	
Arsenic (Filtered)	35.4	10	100	R (7)		R (7)		5	U	R (7)		5	U	R (7)		5	U
Barium (Filtered)	85.2	2,000	1,000	R (7)		R (7)		6	J	R (7)		9	J	R (7)		9	J
Cadmium (Filtered)	7.4	5	10	R (7)		R (7)		1	UJ	R (7)		1	UJ	R (7)		1	UJ
Chromium, total (Filtered)	7.2	100	50	R (7)		R (7)		5	UJ	R (7)		5	UJ	R (7)		5	UJ
Selenium (Filtered)	85.3	50	50	R (7)		R (7)		10	UJ	R (7)		10	UJ	R (7)		10	UJ
Silver (Filtered)	6.7	--	50	R (7)		R (7)		2	UJ	R (7)		2	UJ	R (7)		2	UJ
Perchlorate (ug/L)																	
Perchlorate	NA	--	<24.5 (6)	*110*		*130*		*600*	*U*	*130*		*600*	*U*	*130*		*750*	*U*
Other Compounds (mg/L)																	
TDS	NA	--	1,000	*107,000*		*110,000*		*131,000*		*106,000*		*112,000*		*124,000*		*141,000*	

Notes
(1) Radian, 1992 and 1993. Background provided for reference only.
(2) US EPA MCLs and NMGWQ standards are provided for refernce only since TDS exceeds 10,000 mg/L
(3) NMAC 20.6.2.3103
(4) Duplicate
(5) Total xylenes EPA MCL and NMGWQ Standard used as surrogate for m,p-Xylene
(6) Human Health Medium Specific Screening Levels 2007 (EPA Reg VI, 2007)
(7) Dissolved metals data rejected (see Section 4.7.4)

µg/L = micrograms per liter
mg/L = milligrams per liter
TDS = total dissolved solids
Val = analytical result
Q = data qualifier
J = positive detection, value between RL and the MDL
U = non-detect result
NA = not analyzed
-- = not applicable; not detected
MDL = method detection limit
RL = reporting limit
U.S. EPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
NMAC = New Mexico Administrative Code

Bolded value indicates analyte concentration exceeds U.S. EPA MCL
Italicized value indicates analyte concentration exceeds NMGWQ standard
Bolded and *italicized* value indicates analyte concentration exceeds U.S. EPA MCL and NMGWQ standard

Table 4.12 (continued)
Groundwater Analytical Results
SS-39 (SWMUs 165, 177, 179, and 181) – Missile Fuel Spill Area
Supplemental RFI and January 2007 Groundwater Compliance Long Term Monitoring
Holloman AFB, New Mexico

Analyte	Background [1]	U.S. EPA MCL [2]	NMGWQ Standard [2][3]	MW39-12 13/14-Jul-2006 Val	Q	MW39-12 18-Jan-2007 Val	Q
Volatile Organic Compounds (ug/L)							
1-Bromo-4-Fluorobenzene (4-Bromofluorobenzene)	NA	–	–	NA		42.3	
1,1-Dichloroethane	NA	–	25	0.0299	U	1	U
1,1-Dichloroethene	NA	7	5	0.0736	U	1	U
Acetone	NA	–	–	0.854	U	10	UJ
Benzene	NA	5	10	0.0495	U	1	U
Bromodichloromethane	NA	–	–	0.0651	U	1	U
Bromoform	NA	–	–	0.0859	U	1	U
Carbon tetrachloride	NA	5	10	0.121	U	1	U
Chlorobenzene	NA	100	–	0.0217	U	1	U
Chloroform	NA	–	100	0.0475	U	1	U
Chloromethane	NA	–	–	0.28	J	0.42	J
cis-1,2-Dichloroethene	NA	70	–	0.101	U	1	U
Dibromofluoromethane	NA	–	–	NA		53.8	
m,p-Xylene (sum of isomers)	NA	10,000[5]	620[5]	1	U	1	U
Methylene chloride	NA	–	100	0.689	U	5	U
Toluene-D8	NA	1,000	750	NA		45.4	
Trichloroethene (TCE)	NA	5	100	2.6		2.01	
Metals (ug/L)							
Arsenic	72.3	10	100	NA		5	U
Barium	929	2,000	1,000	NA		143	
Chromium, total	234	100	50	NA		5	U
Lead	19.9	15	50	NA		5	U
Filtered Metals (ug/L)							
Arsenic (Filtered)	35.4	10	100	R [7]		5	U
Barium (Filtered)	85.2	2,000	1,000	R [7]		9	J
Cadmium (Filtered)	7.4	5	10	R [7]		1	UJ
Chromium, total (Filtered)	7.2	100	50	R [7]		5	UJ
Selenium (Filtered)	85.3	50	50	R [7]		10	UJ
Silver (Filtered)	6.7	–	50	R [7]		2	UJ
Perchlorate (ug/L)							
Perchlorate	NA	–	<24.5[6]	*110*		*750*	*U*
Other Compounds (mg/L)							
TDS	NA	–	1,000	*136,000*		*140,000*	

Notes
(1) Radian, 1992 and 1993. Background provided for reference only.
(2) US EPA MCLs and NMGWQ standards are provided for refernce only since TDS exceeds 10,000 mg/L
(3) NMAC 20.6.2.3103
(4) Duplicate
(5) Total xylenes EPA MCL and NMGWQ Standard used as surrogate for m,p-Xylene
(6) Human Health Medium Specific Screening Levels 2007 (EPA Reg VI, 2007)
(7) Dissolved metals data rejected (see Section 4.7.4)

µg/L = micrograms per liter
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TDS = total dissolved solids
Val = analytical result
Q = data qualifier
J = positive detection, value between RL and the MDL
U = non-detect result
NA = not analyzed
– = not applicable; not detected
MDL = method detection limit
RL = reporting limit
U.S. EPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
NMGWQ = New Mexico Groundwater Quality
NMAC = New Mexico Administrative Code

Bolded value indicates analyte concentration exceeds U.S. EPA MCL
Italicized value indicates analyte concentration exceeds NMGWQ standard
Bolded and italicized value indicates analyte concentration exceeds U.S. EPA MCL and NMGWQ standard

HGL, Inc.

Photo Record - Supplemental RCRA Facility Investigation

SS-39 (SWMUs 165, 177, 179, AND 181) - MISSILE FUEL SPILL AREA

SITE LOCATION: Holloman AFB, Alamogordo, NM

PROJECT: AFC002-037

CLIENT: AFCEE

Photographer: Sarah Gillette

Date: June-06

Direction: South-southeast

Photograph: SS39-01

Description: Surface completion of monitoring well MW39-05

Photographer: Sarah Gillette

Date: September-06

Direction: South-southeast

Photograph: SS39-02

Description: View of the Lost River drainage basin when flooded (viewed from MW39-05)

B-7

LF-40 (SWMU 103)

Appendix B-7-1

Portions of: *Site LF-40, Causeway Rubble Disposal Site Holloman Air Force Base, New Mexico, Decision Document*, EA Engineering, Science, and Technology, Inc., April 1993

File: 17BKW-40
R.L.

632

U.S. AIR FORCE
INSTALLATION RESTORATION PROGRAM

FOR

SITE LF-40, CAUSEWAY RUBBLE DISPOSAL SITE
HOLLOMAN AIR FORCE BASE, NEW MEXICO

DECISION DOCUMENT

April 1993

Prepared for

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

and

HEADQUARTERS, AIR COMBAT COMMAND (HQ ACC/CEVR)
DIRECTORATE OF ENGINEERING AND SERVICES
LANGLEY AIR FORCE BASE, VA 23665

Prepared by

EA Engineering, Science, and Technology, Inc.
121 South 13th Street, Suite 701
Lincoln, NE 68508

Technical Document to Support Site Closeout

1. BASE/INSTALLATION/FACILITY

Holloman Air Force Base
Otero County, New Mexico

2. NAME AND LOCATION

Site LF-40, Causeway Rubble Disposal Site

3. STATEMENT OF BASIS

This site closeout decision is based on the following document which describes Site LF-40, Causeway Rubble Disposal Site (referred to therein as Site No. 40) conditions and potential impacts to public health and the environment.

* Installation Restoration Program, Records Search for Holloman Air Force Base, New Mexico. CH_2M Hill. August 1983.

4. DESCRIPTION OF SELECTED REMEDY

The Records Search results confirm that the site has been used for the disposal of concrete construction rubble but that no known or suspected hazardous waste materials have been associated with the rubble disposal or buried at the site. Available information indicates that the site does not present significant threat to human health or the environment. The No Action alternative is the selected remedy for Site LF-40.

5. DECLARATIONS

I have determined that the No Action alternative at Site LF-40 is a cost-effective remedy and provides adequate protection of public health, welfare, and the environment from releases of contaminants from past disposal practices. This determination is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (40 CFR 300).

SITE: LF-40, Causeway Rubble Disposal Site
Holloman AFB, New Mexico

U.S. AIR FORCE

29 APR 93
Date

By: Lloyd W. Newton

Title: ______________________

NEW MEXICO ENVIRONMENT DEPARTMENT

April 27, 1993
Date

By: ______________________

Title: ______________________

U.S. ENVIRONMENTAL PROTECTION AGENCY

____
Date

By: ______________________

Title: ______________________

APPENDIX C

HAFB CORRESPONDENCE

MEMORANDUM FOR RECORD

FROM: 49 CES/CEAN
550 Tabosa Ave
Holloman AFB NM 88330-8458

SUBJECT: Soil and water characterization through bore sampling in Lost River drainage.

1. The attached map of Lost River drainage was constructed for consultation purposes by David Rizzuto, R&R Environmental. The number of test sites needed and area of Lost River affected has increased to include more sites of historical usage in which contaminates maybe suspect. These sites are located at or near drainages which empty into the Lost River. The Lost River site consists of an ephemeral stream and a large playa with a history of anthropogenic disturbance.

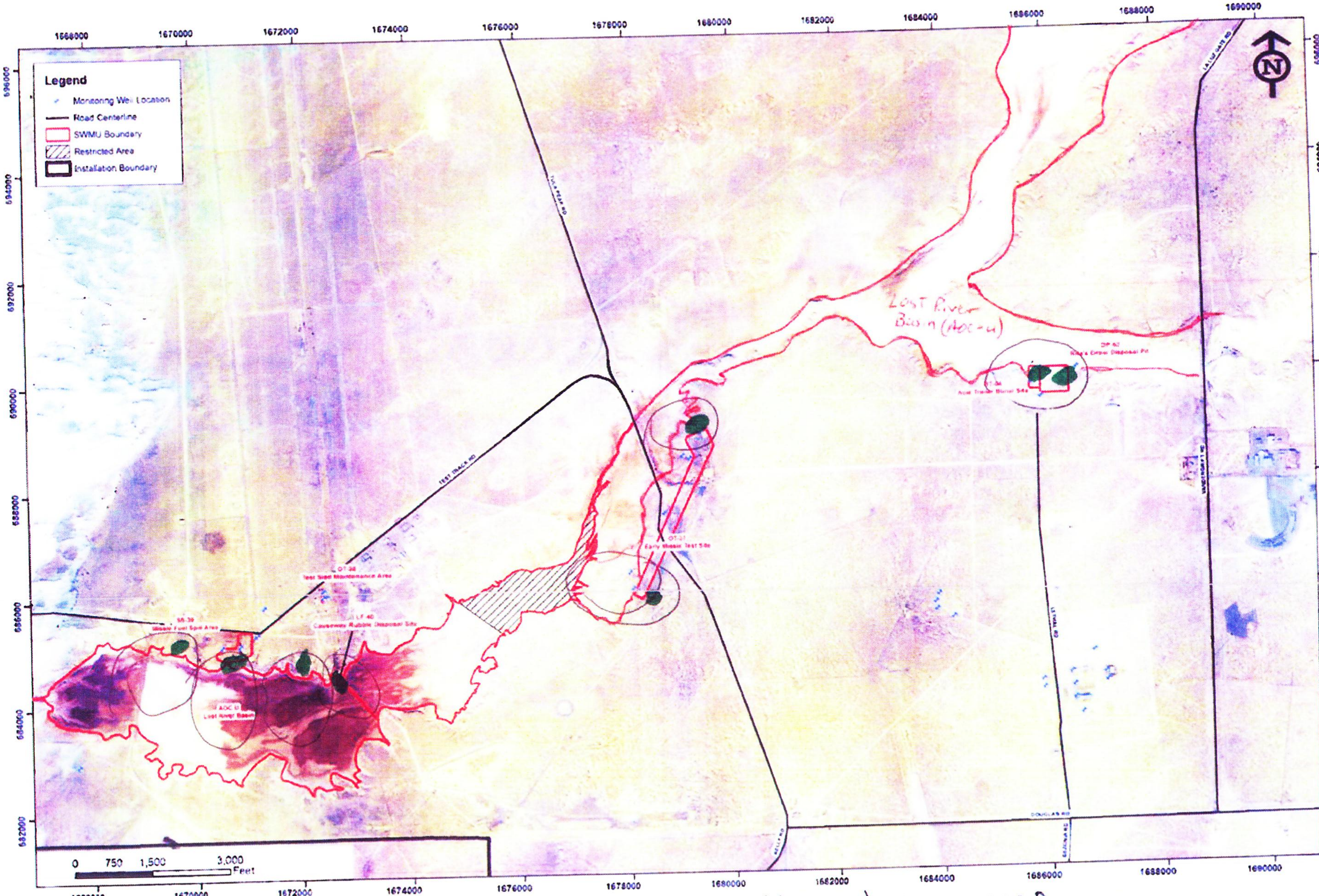
2. Species of concern for this area are White Sands pupfish. The sampling area has been expanded and may encroach within 100 yards of a known pupfish populations as needed. Sampling may proceed as planned in the area identified. Movement in this area must be limited to foot traffic only. No heavy equipment or wheeled vehicles' will be allowed.

3. Water and soil samples are needed to identify future management needs and ensure that Holloman AFB meets it obligations as a signatory to the Cooperative Agreement for Protection and Maintenance of White Sands Pupfish (May 2006). Lost River is identified as refugia for the White Sands pupfish, and as such, every effort must be taken to evaluate and maintain its ecological health and sustainability.

3. If you have any questions or comments, please contact Mr. Lonnie Britton at (505) 572-3931.

Lonnie

Lonnie J. Britton
Natural Resources Planner



LOST RIVER BASIN (AOC-U) SITE MAP

Jim Moore

From: David L. Rizzuto [rrenvironmental@zianet.com]
Sent: Tuesday, April 21, 2009 8:42 AM
To: Jim Moore
Subject: FW: Lost River Basin (AOC-U) Subsurface and Surface Soil Sampling Locations

David L. Rizzuto
575-430-3965

-----Original Message-----
From: Britton, Lonnie J Civ USAF ACC 49 CES/CEAN [mailto:Lonnie.Britton@holloman.af.mil]
Sent: Tuesday, April 21, 2009 6:45 AM
To: David L. Rizzuto
Subject: RE: Lost River Basin (AOC-U) Subsurface and Surface Soil Sampling Locations

These site locations look good. No impact on the White Sands pupfish is expected due to the low-impact foot traffic and small footprint of the actual test site. Let me know if you need something more formal than an e-mail. Thanks. B

-----Original Message-----
From: David L. Rizzuto [mailto:rrenvironmental@zianet.com]
Sent: Friday, April 17, 2009 9:40 AM
To: Britton, Lonnie J Civ USAF ACC 49 CES/CEAN
Subject: FW: Lost River Basin (AOC-U) Subsurface and Surface Soil Sampling Locations

Lonnie,
Please review this E-mail and maps (2 Page PDF).
Let me know if these locations look ok.

Thanks,
Dave

-----Original Message-----
From: Jim Moore [mailto:JMoore@bhate.com]
Sent: Thursday, April 16, 2009 5:33 PM
To: David L. Rizzuto
Subject: Lost River Basin (AOC-U) Subsurface and Surface Soil Sampling Locations

Dave,

The attached pdf.file (containing 2 figures) shows the proposed locations for 100 subsurface and 20 surface soil sample locations. As discussed, all movement within the Lost River Basin will be limited to foot traffic only.
As per Lonnie Britton, no heavy equipment or wheeled vehicles (PU trucks, drill rigs etc) will be driven into the Lost River Basin for this RCRA Facility Investigation. All of the sample locations shown on these figures will be obtained by using a hand auger or other suitable hand tool and hiking to the proposed location(s). It is estimated that the subsurface soil samples will be collected at a maximum of 6-10 ft below ground surface (bgs) and the surface soils from 1-3 ft bgs. The purpose of the investigation is to determine which upgradient ERP sites may have impacted the soil and groundwater quality within the Lost River Basin.

Please forward these figures as soon as possible to Mr. Lonnie Britton for obtaining his concurrence regarding these locations. If any of the sampling locations are within areas of known pupfish populations the
location(s) will be relocated accordingly.

Thanks for your help!

Jim Moore, PG

Project Manager

NationView, LLC

445 Union Blvd., Suite 129

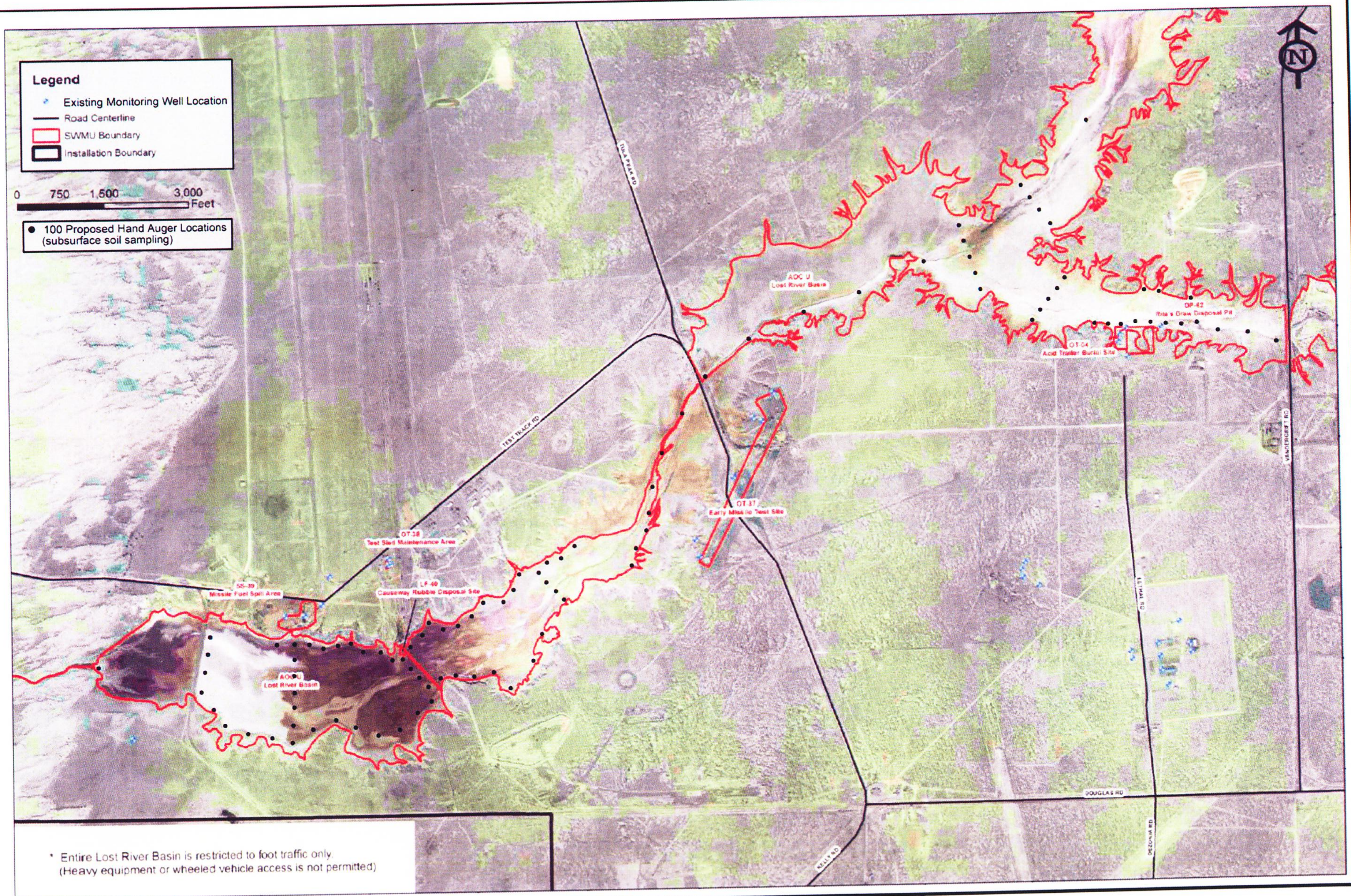
Lakewood, CO 80228

303.597.2450 main

303.597.2449 fax

303.929.4840 cell

<http://www.bhate.com/>

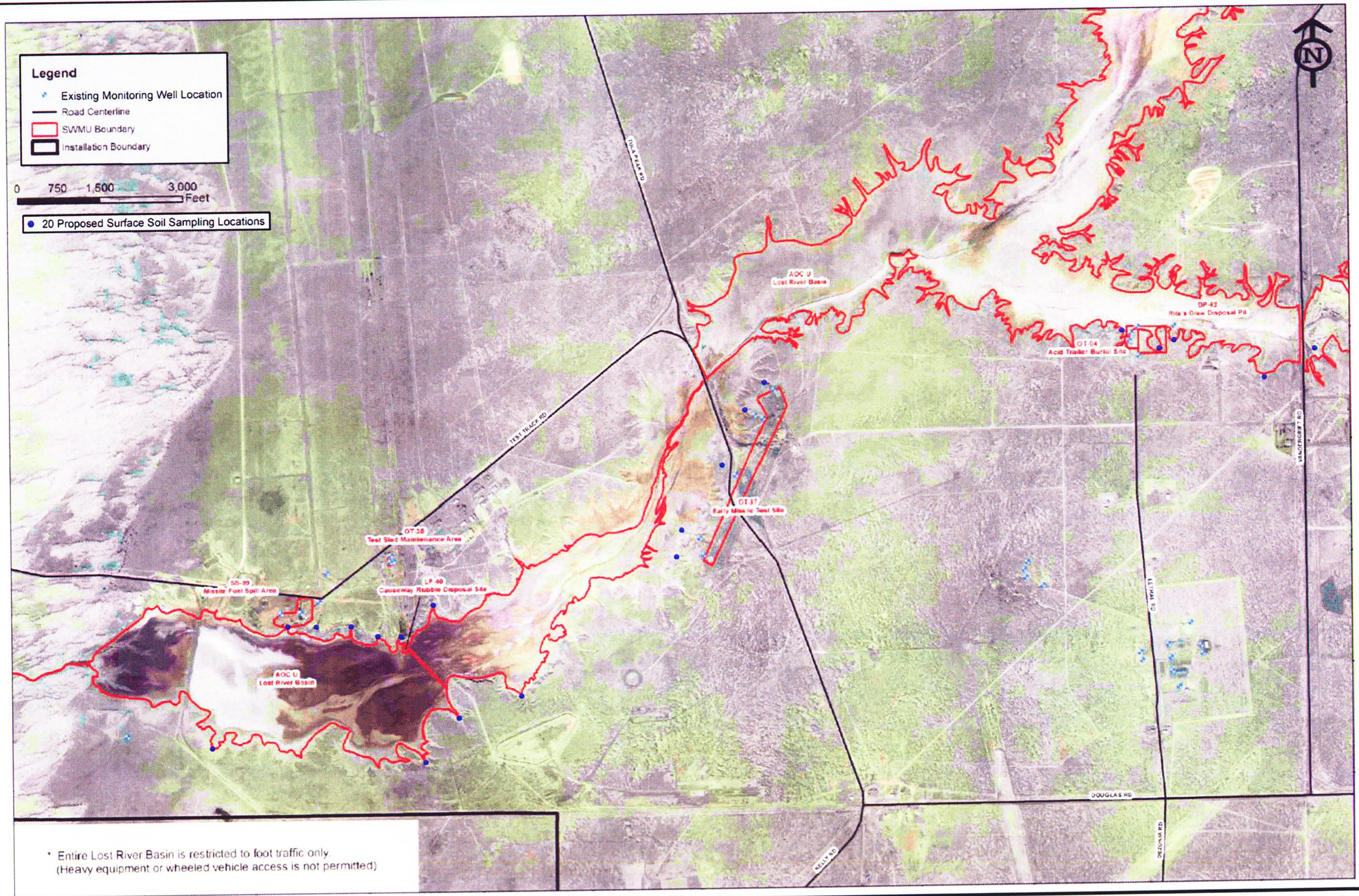


NATIONVIEW

AOC-U Hand Auger Subsurface Soil Sampling Locations
(Total Depths approximately 10 ft. below ground surface)

PROJECT NO.	SCALE	DATE	DRAWN BY:
		4/16/09	DRAWING NO:

AOC-U, Lost River Basin
RCRA Facility Investigation
Holloman AFB, New Mexico



NATIONVIEW

AOC-U Surface Soil Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:
		4/16/09	DRAWING NO:

AOC-U, Lost River Basin
RCRA Facility Investigation
Holloman AFB, New Mexico

APPENDIX D

SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

FINAL

SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

RCRA FACILITY INVESTIGATION AOC-U, LOST RIVER BASIN HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49 CES/CEA
Holloman Air Force Base
New Mexico

Under Contract To:

U.S. Army Corps of Engineers-
Albuquerque District
HTRW Branch
4101 Jefferson Plaza NE
Albuquerque, New Mexico 87109-3435

Prepared By:

NATIONVIEW

NationView, LLC
1608 13th Avenue South, Suite 160
Birmingham, Alabama 35205
NationView Project No. 8090006.01.01

July 2009

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SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

RCRA FACILITY INVESTIGATION AOC-U, LOST RIVER BASIN HOLLOMAN AIR FORCE BASE, NEW MEXICO

TABLE OF CONTENTS

Tables

Figures

Attachments

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AF Fm	Air Force Form
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
AOC	Area of Concern
Bhate	Bhate Environmental Associates, Inc.
CES/CEA	Civil Engineering Squadron/Environmental Asset Management
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
dBA	Decibels A-weighted
°F	Degrees Fahrenheit
DOT	Department of Transportation
DQO	Data Quality Objective
EM	Engineering Manual
ERP	Environmental Restoration Program
EZ	Exclusion Zone
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
HSM	Health and Safety Manager
IDW	Investigation Derived Waste
L	Liter
LEL	Lower Explosive Limit
mg/m^3	Milligrams per cubic meter
mL	Milliliter
MSDS	Material Safety Data Sheet
MUTCD	Manual on Uniform Traffic Control Devices
NIOSH	National Institute for Occupational Safety and Health
NMED	New Mexico Environment Department
NRR	Noise Reduction Rating
OSHA	Occupational Safety and Health Administration
OV	Organic Vapor
PAPR	Powered Air Purifying Respirator
PEL	Permissible exposure limit
P.G.	Professional Geologist
PID	Photoionization Detector
PM	Project Manager

PPE	Personal protective equipment
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SPF	Sun protection factor
SSA	Site-Specific Addendum
SSHO	Site Safety and Health Officer
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
SZ	Support Zone
TAL	Target Analyte List
TLV	Threshold Limit Value
TPH	Total Petroleum Hydrocarbon
TWA	Time-weighted average
USACE	U.S. Army Corps of Engineers
VOC	Volatile organic compound

1 PROJECT SAFETY COORDINATION

The NationView personnel who are responsible for safety and health issues at the Lost River Basin (Area of Concern [AOC] – U) project site are identified in Table 1-1. The respective personnel shall have reviewed and approved this Site-Specific Addendum to the Basewide Health and Safety Plan (HASP) submitted by NationView, LLC for implementation on this scope of work prior to the start of field operations. The requirements of this site-specific addendum are applicable to NationView employees, their subcontractors, and site visitors.

Table 1-1. Project Team Members with Project Health and Safety Responsibilities

Title	Name	Telephone
Corporate Sponsor	Mr. David Martin	(205) 908-0731
Project Manager	Mr. Frank Gardner, P.G.	(303) 386-6454
Field Team Leader/ Senior Geologist	Mr. Jim Moore, P.G.	(303) 929-4840
Project Geologist	Mr. Dustin McNeil, P.G.	(303) 895-1963
Site Safety and Health Officer	Mr. John Hymer	(575) 491-9171
Health and Safety Director	Ms. Sally S. Smith, MHS, CIH, CSP, CHMM, CPEA	(205) 918-4032
Notes: P.G. = Professional Geologist CIH = Certified Industrial Hygienist CSP = Certified Safety Professional CHMM = Certified Hazardous Materials Manager CPEA = Certified Professional Environmental Auditor MHS = Masters of Health Sciences		

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2 PROJECT BACKGROUND AND SCOPE

The Lost River Basin (AOC-U) is a surface water drainage that intercepts surficial runoff from several adjacent Solid Waste Management Units (SWMUs) and AOCs. These SWMUs and AOCs include the following Environmental Restoration Program (ERP) sites: OT-04 (SWMU 102) Acid Trailer Disposal Site, OT-37 (AOC L) Early Missile Test Site, OT-38 (SWMU 137) Test Sled Maintenance Area, SS-39 (collectively SWMUs 165, 177, 179, and 181) Missile Fuel Spill Area, LF-40 (SWMU 103) Causeway Rubble Disposal Area, and DP-62 (AOC-RD) Ritas Draw Disposal Pit. Previous investigations have identified a number of contaminants of concern that have impacted the soil and groundwater at these ERP sites including the Volatile Organic Compounds (VOCs) trichloroethene and 1,1-dichloroethene; metals including arsenic, chromium, and lead; Total Petroleum Hydrocarbons (TPH); and perchlorate.

The primary objectives of this Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) are to:

1. Identify potential releases to the surface soil, subsurface soil, and groundwater within the Lost River Basin from six known upgradient SWMUs and AOCs that may have impacted the Basin via surface water tributaries and/or groundwater infiltration.

2. Delineate the horizontal extent of VOCs, Semi-Volatile Organic Compounds (SVOCs), TPH, Target Analyte List (TAL) metals, and perchlorate detected above actions levels in the soil and groundwater samples collected throughout the Lost River Basin during this RFI.

3. Collect sufficient analytical data to complete a site-specific risk assessment (human health and ecological) of the groundwater and soil exposure pathways.

4. Collect the proper data to meet the data quality objectives (DQOs) to support closure of the site based on guidance from the New Mexico Environment Department (NMED).

AOC-U site access is limited to foot traffic only due to uneven rough terrain, shallow groundwater, and the presence of a species of concern (White Sands Pupfish). As a result, hand auger sampling techniques have been selected to perform the AOC-U RFI field work. For a more detailed summary of the site history and background please refer to the AOC-U RFI Work Plan (NationView, July 2009). The anticipated activities for this project include:

- Mobilization and demobilization of equipment and personnel
- Hand auger soil boring and groundwater well sampling point installation
- Surface soil sampling, subsurface soil sampling, and groundwater sampling
- Surface water sampling (if encountered)

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3 HAZARD ASSESSMENT AND CONTROLS

3.1 Task Hazard(s) Summary

The potential health and safety hazards of this task are summarized below in Table 3-1. The potential for encountering these hazards is ranked (high, moderate, or low) based on the work to be performed and the hazard control measures to be used.

Table 3-1. Task Hazards Summary

Summary	Hazard potential [High, Moderate, or Low]	Description of potential hazards
__√__Safety (i.e. Uneven walking and working surfaces, traffic, slips and falls, power and hand tools, materials handling, electrical safety, etc.)	• Moderate All tasks and their control measures are addressed in Task Specific Activity Hazard Analyses (AHAs) in Attachment A	• Walking and uneven surfaces • Vehicular traffic • Materials handling • Slips, trips, and falls
__√__Utilities	• Moderate	• Buried • Overhead • Building Although these hazards should not be associated with this particular scope of work, it is necessary to verify that the hazards can be controlled.
__√__Chemical	• Moderate	• VOCs: trichloroethene and 1,1-dichloroethene; Metals: Arsenic, Chromium, and Lead; TPH; and Perchlorate (see Attachment B) • Sample preservatives (acids)
__√__Physical	• Moderate	• Thermal stressors • Labor intensive activities • Large site area, access limited to foot traffic only
__√__Biological (i.e. Plants, animals, insects, spiders, infectious waste)	• Low	• Insect stings and bites • Poisonous snakes/reptiles (Potential for contact should be minimal)

3.2 Hazard Control Measures

General safe work practices and control measures are identified and summarized in the *Basewide HASP* (Bhate Environmental Associates, Inc. [Bhate], December 2003).

Additional task-specific hazards and control measures are identified for non-routine tasks as part of the Activity Hazard Analysis (AHA) process. AHAs have been developed for each of the following activities and are included in Attachment A of this Site-Specific HASP Addendum:

- General site activities/mobilization and demobilization
- Soil boring, groundwater sampling point installation, soil, groundwater, and surface water sampling, and investigation derived waste (IDW) handling

3.3 Written Safety Procedures and Programs

Table 3-2 provides a summary of the existing safety procedures and programs that will be used for this task. Copies of applicable procedures and programs are included in the *Basewide HASP*, as indicated.

Table 3-2. Written Safety Procedures and Programs

Reference Procedure or Program	Applicable Section(s)
Hazard Communication Program	All (Refer to Basewide HASP)
Respiratory Protection Program	All (Refer to Basewide HASP)
Hearing Conservation Program	All (Refer to Basewide HASP)
Incident Reporting and Investigation Program	All (Refer to Basewide HASP)
General Work and Safety Rules	All (Refer to Basewide HASP)
Site Health and Safety Inspections	All (Refer to Basewide HASP)
Environmental Monitoring	All (Refer to Basewide HASP)
Personal Protective Equipment Program	All (Refer to Basewide HASP)
Thermal Stressors Program	All (Refer to Basewide HASP)
Materials Handling Program	All (Refer to Basewide HASP)
Housekeeping Program	All (Refer to Basewide HASP)
Fire Prevention/Protection/Response Plans Program	All (Refer to Basewide HASP)
Utilities Program	All (Refer to Basewide HASP)
Electrical Safety Program	All (Refer to Basewide HASP)
Emergency Procedures Program	All (Refer to Basewide HASP)
Hand and Power Tools Program	All (Refer to Basewide HASP)

3.4 Permits

Before site activities can begin, there are several pre-investigation documents and approval requirements to be met, including Air Force Form (AF Fm) 332 approval, Base dig permit with utility clearances, site security measures, and facility manager notification of the intended operations. NationView will coordinate project requests for Base installation support services through the 49th Civil Engineering Squadron/Engineering Asset Management (CES/CEA). Pertinent to the start of activities, a pre-construction meeting and site walk-through will be conducted with the U.S. Army Corps of Engineers (USACE) Resident Engineer, Holloman Air Force Base (HAFB) personnel, and NationView Site Manager, to inspect site conditions for site/equipment access, equipment staging, and decontamination area(s), potential site hazards and emergency evacuation routes. Also reviewed at this time will be project procedures in accordance with the schedule and planned activities.

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4 PERSONAL PROTECTIVE EQUIPMENT

4.1 Purpose

The purpose of this program is to ensure that personal protective equipment (PPE) is selected in accordance with 29 Code of Federal Regulations (CFR) §1910.132, properly used and maintained, and that NationView personnel are properly trained in the inspection, use, and maintenance of PPE.

4.2 Scope

This program applies to all NationView operations including the sub-contractors on NationView managed projects. The following PPE as presented in Table 4-1 will be used for the identified activities based on the best available information about the work requirements and anticipated hazards.

Table 4-1. Personal Protective Equipment by Activity

Activity	Head/Face	Foot	Hands	Respiratory	Clothing
Mobilization / Demobilization	Hard Hat (for overhead hazards), Safety Glasses[1] with rigid side shields	Steel toed boots	Leather gloves as needed	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve
General Site Labor	Hard Hat (for overhead hazards), Safety Glasses[1] with rigid side shields Goggles if windy or dusty conditions exist	Steel toed boots	Leather gloves as needed	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve High visibility vests around vehicular traffic Hearing protection in areas > 85 decibels A-weighted (dBA)
Equipment Decontamination	Hard Hat[2] (for overhead hazards), Safety Glasses[1] with rigid side shields Goggles if windy or dusty conditions exist	Steel toed boots Boot covers	Chemical resistant gloves (nitrile inner and outer)	None[3, 4] Full face Air Purifying Respirator with organic vapor (OV)/Chlorine and P100 combination cartridges or powered air purifying respirator (PAPR) with P100/OV/Chlorine cartridges based on monitoring results	Minimum of long pants and shirts with a minimum 4-inch sleeve Tyvek coveralls may be worn where splashing is possible and as recommended by the Site Safety and Health Officer (SSHO) High visibility vests around vehicular traffic Hearing protection in areas > 85 dBA

Activity	Head/Face	Foot	Hands	Respiratory	Clothing
Soil, surface water and groundwater sampling/ screening Handling IDW	Hard Hat[2] (for overhead hazards), Safety Glasses[1] with rigid side shields Goggles if windy or dusty conditions exist	Steel toed boots Boot covers as needed	Chemical resistant gloves (nitrile inner and outer)	None[3, 4] Full Face Air Purifying Respirator with OV/Chlorine and P100 combination cartridges or PAPR with P100/OV/Chlorine cartridges based on monitoring results	Minimum of long pants and shirts with a minimum 4-inch sleeve Tyvek coveralls may be worn where splashing is possible and as recommended by the SSHO High visibility vests around vehicular traffic Hearing protection in areas > 85 dBA Life jackets may be worn while sampling surface water bodies
Supervision of work	Hard Hat (for overhead hazards), Safety Glasses[1] with rigid side shields Goggles if windy or dusty conditions exist	Steel toed boots Boot covers as needed	Leather gloves as needed Chemical resistant gloves (nitrile) if contact with contaminants is possible	None[3, 4] Full Face Air Purifying Respirator with OV/Chlorine and P100 combination cartridges or PAPR with P100/OV/Chlorine cartridges based on monitoring results	Minimum of long pants and shirts with a minimum 4-inch sleeve Tyvek coveralls may be worn where splashing is possible and as recommended by the SSHO High visibility vests around vehicular traffic Hearing protection in areas > 85 dBA

Notes:

[1] Safety Glasses with rigid side shields approved by American National Standards Institute (ANSI) Z-87 required at all times.
[2] Hard hats are not required inside fully enclosed equipment cabs.
[3] Voluntary use of respirators is authorized for comfort from nuisance dusts and odors, provided they are issued and used in accordance with established respiratory protection program procedures.
[4] Cartridge change out will occur at the following conditions:

- Damage to cartridge
- Cartridge is wet, restriction in breathing, unusual odors
- Cartridge is visibly clogged with dust, restriction in breathing
- After each day of use with no continuous exposures over the established Permissible Exposure Limits (PELs) per 29 CFR §1910.1028(g)(3)(i) (benzene standard) and the cartridge manufacturer's change out calculations based on anticipated concentrations.
- Changes that may be otherwise identified in 29 CFR §1910.120.

The following qualified person certifies that the selection of PPE is based on best available information about the work requirements and anticipated hazards.

Printed name:	Signature:	Date:
Sally S. Smith, MHS, CIH, CSP, CHMM, CPEA Health and Safety Manager	Sally S. Smith	7-17-09

5 SITE MONITORING

5.1 Exposure Monitoring

Site monitoring will be conducted using direct-reading instruments primarily in the workers' breathing zone. To the extent feasible, site operations will be conducted and modified as needed to ensure that personnel are situated upwind of the hand auger and groundwater sampling point installation activities. Initial upwind background and work-zone readings will be obtained before the initiation of activities. Readings of breathing zones (unless location is otherwise specified) will be taken periodically during all activities. The SSHO has the authority to modify the level of protection required for work at this site as well as halt operations as deemed necessary to control personal exposures. Monitoring results will be recorded on an Atmospheric Monitoring Log Field Health and Safety form maintained by the SSHO. Monitoring, calibrating, and maintaining instruments are the responsibility of the SSHO. Table 5-1 summarizes the site monitoring parameters and action levels applicable for direct reading exposure monitoring.

Table 5-1. Direct Reading Exposure Monitoring

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Soil boring and groundwater sampling point installation (all intrusive soil activities) Handling IDW	Total VOCs / Photoionization Detector (PID)	0 - 5 parts per million (ppm) Every 15 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		> 5 ppm to < 10 ppm (Sustained for more than 5 minutes)	Ensure personnel are upwind, notify the Project Manager (PM). SSHO will upgrade PPE to Level C respiratory protection with OV and High Efficiency Particulate Air (HEPA) cartridge, as necessary. Implement appropriate controls such as ventilation. Monitor for benzene and implement actions listed below.
		> 10 ppm (Sustained for more than 5 minutes)	Stop work, ensure employees are upwind. Notify PM and Health and Safety Manager (HSM) for additional control measures.
	Benzene / By colorimetric tube or similar (where indicted by PID readings)	No detection up to 0.2 ppm	Continue work activities in required protective equipment. Perform integrated personal exposure monitoring using OV badge or charcoal tubes with calibrated pump per National Institute for Occupational Safety and Health (NIOSH) or Occupational Safety and Health (OSHA) method (consult HSM as needed).
		> 0.2 ppm	Cease work, exit the area to upwind location and notify the Site Manager.

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Intrusive Soil Activities	Dust Particulates / Personal DataRam or SKC HAZ Dust IV Real Time Particulate Air Monitor	0 – 1 milligrams per cubic meter (mg/m^3) Every 5 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		>1 mg/m^3 - < 30 mg/m^3 (Sustained for more than 5 minutes)	Cease work and ensure personnel are upwind, notify the Site Manager. Use wet methods for dust suppression. SSHO shall upgrade PPE to full face air purifying respiratory protection with HEPA/OV/Chlorine cartridges. Perform personnel exposure monitoring using integrated time weighted average (TWA) monitoring for dust and metals: lead, arsenic, and chromium.
		>30 - < 50 mg/m^3 (Sustained for more than 5 minutes)	Cease work and ensure personnel are upwind, notify the Site Manager. Use wet methods for dust suppression. SSHO shall upgrade PPE to full face powered air purifying respiratory protection with HEPA/OV/Chlorine cartridges. Perform personnel exposure monitoring using integrated TWA monitoring for dust and metals: lead, arsenic, and chromium.
		> 50 mg/m^3 (Sustained for more than 5 minutes)	Stop work, ensure employees are upwind. Notify PM and HSM for additional control measures.
All site activities	Noise	< 85 dBA	Continue work in required PPE and continue monitoring.
		> 85 dBA to < 110 dBA	Ear plugs or ear muffs must be worn with a Noise Reduction Rating (NRR) of at least 26 dBA.
		> 110 dBA to < 130 dBA	Ear plugs and ear muffs must be worn together each with a NRR of at least 26 dBA each
		> 130 dBA	Cease work and ensure personnel leave work area. Notify the PM.

5.2 Heat Stress Monitoring and Protocols

Due to the large site area and the limitation to foot access only for the AOC-U RFI sampling activities, each employee will be monitored closely for heat stress. Furthermore, each employee will be required to carry fluids in a back pack hydration system (CamelBak® or similar) equipped with a 3 Liter (L) reservoir. (Care should be taken to avoid bringing fluids, including the back pack hydration reservoir into the work/exclusion zone. Hydration reservoirs and other fluid containers must be stored and fluids consumed in the support/clean zone. These Site Control Procedures, including zone delineation, are outlined below in Section 6.1. Ambient temperature and physiological monitoring will begin when the ambient temperature is above 70 degrees Fahrenheit (°F), which exceeds the American Conference of Governmental Industrial Hygienists (ACGIH, 2007) Threshold Limit Value (TLV). When the body temperature rises, the body seeks to dissipate the excess heat. The major disorders due to heat stress are heat cramps, heat exhaustion, and heat stroke. The symptoms and recommended prevention for each are listed below:

- Heat cramps are painful spasms, which may occur in the muscles of workers who have perspired profusely in the heat. If this occurs, work should be stopped and the worker supplied with fluids.
- Heat exhaustion is characterized by extreme weakness or fatigue, dizziness, nausea, and headache. In serious cases, a worker may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and the body temperature can be normal or slightly higher than normal. Treatment consists of rest in a cool place and replacement of body water lost by perspiration. Mild cases may recover quickly with this treatment. Severe cases may require care for several days. There are no permanent effects.
- Heat stroke is caused by the breakdown of the body's heat regulating mechanism. The skin is very dry and hot with a red or bluish appearance. Unconsciousness, mental confusion, or convulsions may occur. Without quick and adequate treatment, the result can be permanent brain damage or death. Medical assistance should be given quickly. The person should be moved to a cool place. Body heat should be reduced artificially by soaking the person's clothes with water.

The following steps can be taken to reduce the potential for heat stress:

- Drinking plenty of fluids with balanced salts (to reduce loss through sweating) (e.g., Gatorade®, mineral water, or Powerade®). Additionally, each employee will personally carry their own water and gear in a CamelBak® hydration pack system.
- Wear cotton undergarments to act as a wick to absorb moisture.
- Specifically train workers to recognize the early signs and symptoms of heat stress and heat stroke.
- Specifically train workers on procedures to follow if they detect symptoms of heat stress/stroke.
- Make adequate shelter available for taking rest breaks to cool off.

For extremely warm weather, follow these additional recommendations:

- Shift working hours to early morning and early evening, avoiding the hottest time of the day.
- Rotate crews wearing protective clothing.
- Work with the "Buddy System".
- Allow crews to become acclimated.

- The work/rest cycle will be established on an individual basis depending on physiological monitoring results (e.g., heart rate and temperature).

Additional considerations will be made depending on the specific activities being performed.

6 SITE CONTROL

6.1 Site Activities

Site-specific site control measures will be used to control access to the AOC-U work area. Tables 6-1 and 6-2 summarize the site control requirements applicable for both general work areas and work areas with potentially contaminated soils, respectively.

Table 6-1. Site Control for General Work Area(s)

Location	Site Control Procedure (discuss important elements such as signs, barricades, fencing, briefings, sign-in/out logs, etc.)
General Work Area	Due to the location of the project site, access will be coordinated with the Site Manager and HAFB Operations. Access will be made via a specified route. The SSHO will be responsible for the accountability for all onsite personnel using appropriate sign in / sign out procedures as needed. The SSHO shall be responsible for maintaining adequate site control in order to limit hazards to site workers and site visitors. To the extent feasible, immediate work areas shall be cordoned off through the use of devices such as traffic cones, caution tape, or construction fencing along with appropriate signage such as “Danger – Construction Area, Authorized Personnel Only” and “Hard Hat, Safety Glasses, and Safety Boots Required in this Area”. All site workers shall be aware of surroundings and prevent unauthorized personnel as well as vehicle traffic from entering the work area. AOC-U, Lost River Basin is undeveloped and no roads traverse the area. Therefore, traffic control will not be required. In the unlikely event of traffic control use, all traffic control devices and methodologies will comply with the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD, http://mutcd.fhwa.dot.gov) including the use of appropriate roadway markings, highly visible safety vests, and flagmen as needed.

Table 6-2. Site Control for Potentially Contaminated Area(s)

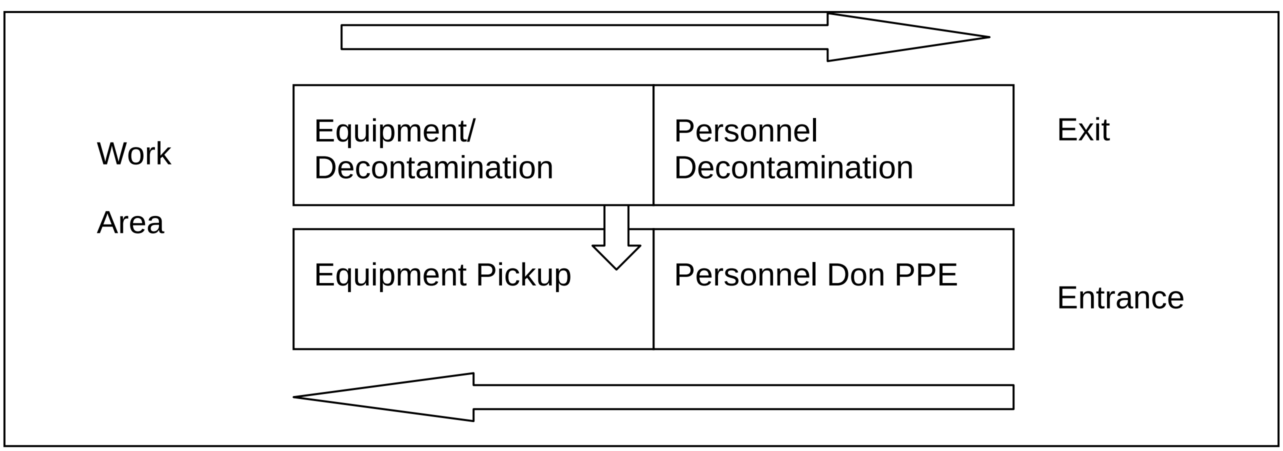
Location	Site Control Procedure (discuss important elements such as signs, barricades, briefings, qualifications, required supplies and equipment, sign-in/out logs, etc.)
Support Zone (SZ)	Located outside of contaminated areas, access will be from clean areas or from the Exclusion Zone through the Contamination Reduction Zone.
Contamination Reduction Zone (CRZ)	The Contamination Reduction Zone will be demarcated with caution tape or temporary construction fencing. Decontamination stations will be located here.
Exclusion Zone (EZ)	Exclusion Zone work areas will be clearly demarcated with caution tape or temporary construction fencing. All access to this area will require the use of a sign-in/out log.

6.2 Decontamination

Required decontamination procedures are described below in Table 6-3.

Table 6-3. Decontamination Procedures by Location

Type of Decontamination	Decontamination Methods
Personnel decontamination	Personal hygiene will be the responsibility of each individual worker. Eating, drinking, chewing tobacco or gum, smoking, and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the work area. Personnel will be required to thoroughly wash hands and face prior to eating, drinking, or smoking. Any disposable PPE used will be collected following use in the work area for proper disposal. All disposable PPE will be removed and disposed of in a labeled, pre-designated receptacle prior to leaving the work area to prevent the spread of contaminants. Upon return, new and/or cleaned PPE will be provided for use. In the case of excessive soiling or splattering, the PPE shall be changed out more frequently to reduce the spread of contamination and reduce the potential for contaminant breakthrough. Reusable PPE shall be cleaned with soap and water after each use. Respirator filter cartridges (if used) shall be changed out on a daily basis. The decontamination area will be divided into two general areas (equipment area and personnel decontamination area). When exiting the work area, workers will leave all equipment in the equipment area. Workers will then remove PPE. Gloves will be turned inside out so as to not come into contact with potentially contaminated material. Respirators if used will then be removed and set aside for cleaning. Workers will then proceed to the personnel decontamination area and don clean gloves for use with soap and water to wash respirators, any other reusable PPE and tools. A small wash area will be provided so workers can then wash their face and hands. Clean paper towels and/or rags will be used to dry hands and face. Spent PPE and towels/rags will then be placed in a 55-gallon drum for proper disposal at the end of the project. The drawing below this table depicts a typical decontamination sequence.
Equipment decontamination	Work efforts will be made to minimize equipment contact with contaminated materials. Prior to leaving the work area following sampling, equipment (vehicle tires and hand tools) will be dry decontaminated. Soils from the dry decontamination process will be disposed with the excess soil sampling wastes. Decontamination tools may include brooms and shovels.



7 COMMUNICATIONS

Cellular telephones will be available to summon emergency services as required. Refer to Sections 10, 11, and 12 of this Site-Specific Addendum (SSA) to the HASP for site specific guidance on emergency situations and appropriate actions. Site communication amongst workers shall be a combination of verbal and line of sight hand communications. Visual signals include:

1. Hand gripping throat = Can’t breathe,
2. Grip partner’s wrist or both hands at waist = Leave area immediately,
3. Hands on top of head = Need assistance,
4. Thumbs up = OK, I’m all right, I understand,
5. Thumbs down = No, Negative

Cellular telephone use is not permitted while operating equipment. However, in the event of an emergency, the support zone may contact other onsite personnel with hand held radios or cellular phones.

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8 MEDICAL SURVEILLANCE AND TRAINING

The medical surveillance and training requirements for NationView's on-site personnel working on the soil boring, soil sampling, groundwater sampling point installation, and groundwater sampling activities will follow the requirements outlined in the Basewide HASP Sections 7.4 and 5, respectively.

All personnel performing on-site work activities, wherein they may be exposed to hazards resulting from field activities, will have completed applicable training in compliance with 29 CFR Part 1910/29 CFR Part 1926 and Engineering Manual (EM) 385-1-1. Table 8-1 provides a summary of the minimum training requirements for site project personnel.

Table 8-1. Required Worker Training and Site-Specific Training

Required worker training	Site-specific training requirements
√ 40-hour Hazwoper General Site Worker (All) √ 8-hour Hazwoper Supervisor (SSHO) √ 8-hour Hazwoper Refresher (as applicable) √ 30-hour for Construction (SSHO) No retraining requirements are anticipated during the project	All personnel working on site shall attend site-specific orientation/training prior to starting onsite project work. This training will be facilitated by the SSHO.

Additionally, at a minimum the SSHO or the designated representative and one other person will be certified in First Aid and Cardiopulmonary Resuscitation (CPR), and will be continuously present during site operations.

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9 HAZARDOUS CHEMICALS

Hazardous chemicals (as defined in 29 CFR §1910.1200) to be brought or used on-site are identified below. This chemical inventory and associated Material Safety Data Sheet (MSDSs) will be maintained by the SSHO.

Table 9-1. Hazardous Chemicals Brought On-Site

Chemical Name	Amount	Location	Purpose
Assorted fuels, lubricants, coolants, etc. necessary for vehicular operation	No storage planned. Quantities limited to immediate use requirements of on-site equipment.	No storage planned. Materials to be brought on-site by vendor's maintenance vehicle.	Vehicle Servicing and Operation
Calibration gases for air monitoring equipment, if required for instruments in use	One small aluminum cylinder of each required gas. (Each contains approximately 35 L of gas mixture).	Storage with monitoring equipment in the onsite field office	Calibration of monitoring equipment
Groundwater sample preservative (hydrochloric acid)	2 milliliter (mL)/vial	Minimal quantities will be required for groundwater sampling	Groundwater Sampling

Hazardous materials anticipated to be brought on site include preservatives for groundwater samples, calibration gases for air monitoring equipment, and possible fuel, lubricants, or coolants for accessory vehicles. No other hazardous materials are anticipated to be brought on site by NationView or any potential subcontractor for use on site under this scope of work.

A copy of the NationView Hazard Communication Program is included in the Basewide HASP. A MSDS must be maintained on site for any hazardous materials stored or used. A MSDS must be submitted to the HSM and approvals obtained prior to bringing any hazardous materials on the job site. The MSDSs for all hazardous materials will be reviewed with all onsite personnel by the SSHO as a part of chemical specific hazard communication training.

Additionally, all personnel onsite will have appropriate general hazard communication training per 29 CFR §1910.1200 and 29 CFR §1910.120. All containers used to store hazardous materials or IDW will be properly labeled with the identity and hazards associated with the contents. All IDW water will be contained in 55-gallon U.S. DOT approved drums. An inventory of the number of drums will be maintained by the SSHO. The labeling will be weatherproof and fade proof for a minimum of 1 year. An IDW holding area will be designated at or near the subject site. Groundwater sampling results will be used to characterize the IDW.

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10 EMERGENCY ACTION AND RESPONSE

Personnel responsible for coordinating emergency response actions during the AOC-U soil boring, groundwater sampling point installation, and soil and groundwater sampling activities are identified below in Table 10-1. A map showing directions to the authorized medical facility is included in Section 12.

Table 10-1. Emergency Coordinator and Alternate

Responsibility	Name	Phone Number(s)
Task Emergency Coordinator	Mr. John Hymer	Office (575) 201-4261 Cell (575) 491-9171
Alternate Emergency Coordinator	Mr. Dave Rizzuto	Office (575) 674-2012 Cell (575) 430-3965

If an emergency situation develops which requires evacuation of the work area, the evacuation procedures in Table 10-2 shall be followed.

Table 10-2. Evacuation Procedures

Evacuation Step	Methods and comments:
Notify affected workers	Use of site communication methods as applicable
Evacuate to safe location	Assemble at the primary evacuation site (support area outside of the exclusion zone)
Assemble and account for workers	Emergency Coordinator shall account for personnel using site Sign in/Sign out sheet
Notify Fire and Emergency Services	Notification as needed
Complete incident report	Follow the Incident Reporting and Investigation Procedure

Table 10-3 summarizes potential emergency situations and response actions that are applicable for the AOC-U work site.

Table 10-3. Potential Emergency Situations

In case of	Response actions
Injury or illness	Treat injury with applicable First Aid. All work related injuries beyond first aid will result in notification of Emergency Services and notification of the employee supervisor. Any employee requiring advanced medical treatment will be accompanied by a knowledgeable company employee that can answer potential questions on job duties and hazards. Make notifications in accordance with the Incident Reporting and Investigation Procedure (found in Section 10.2.2 of the *Basewide Health and Safety Plan*, Bhate, December 2003).
Chemical exposure	First Aid shall be provided such as but not limited to: move victim to fresh air, remove contaminated clothing, flush affected skin with water, and seek medical attention.
Fire or explosion	Notify emergency services immediately. All personnel shall evacuate the immediate area of the fire and move to an upwind location. Personnel shall not engage in fire fighting activities, such as the use of fire extinguishers, unless trained to do so and only in the incipient stages of fire.
Adverse weather	Tornados, lightning, or other threatening weather conditions will result in an immediate shut down of operations and evacuation of personnel. Lightning proximity will be determined by measuring the time interval between the visually observed lightning flash and the subsequent sound of thunder. An interval less than 30 seconds will prompt the shut down. Operations will be shut down for the period of the storm passing plus an additional 20 minutes.
Material spill or release	Vehicles and equipment will be maintained and inspected so as to prevent fluid leaks. Should any vehicle fluid leaks occur, the equipment will be taken out of service to make necessary repairs and any contaminated material will be cleaned-up and disposed of properly. Spill kits will be available to facilitate prompt containment and clean-up of spills. Notification will be made in accordance with the Incident Reporting and Investigation Procedure. Storage areas will be designed to have secondary containment as required, and work plans will be executed to accommodate stormwater runoff and minimize the potential for contamination spread.

11 EMERGENCY CONTACTS

In the event of an emergency, the following contacts should be made, as appropriate:

HAFB Emergency Number (using HAFB phone system) 9-911
Operators will assist with Medical, Fire, and Police emergencies
HAFB Security Force.. (575) 572-5037
HAFB Fire Protection .... (575) 572-1117
HAFB Hospital – 49th Medical Group (Main switchboard) .... (575) 572-2778
Civilian Hospital (Alamogordo)
Gerald Champion Regional Medical Center .... (575) 439-6100

After initial contacts have been made and the situation has stabilized, notify the Site Manager SSHO, Senior Project Manager, and/or HSM, as appropriate.

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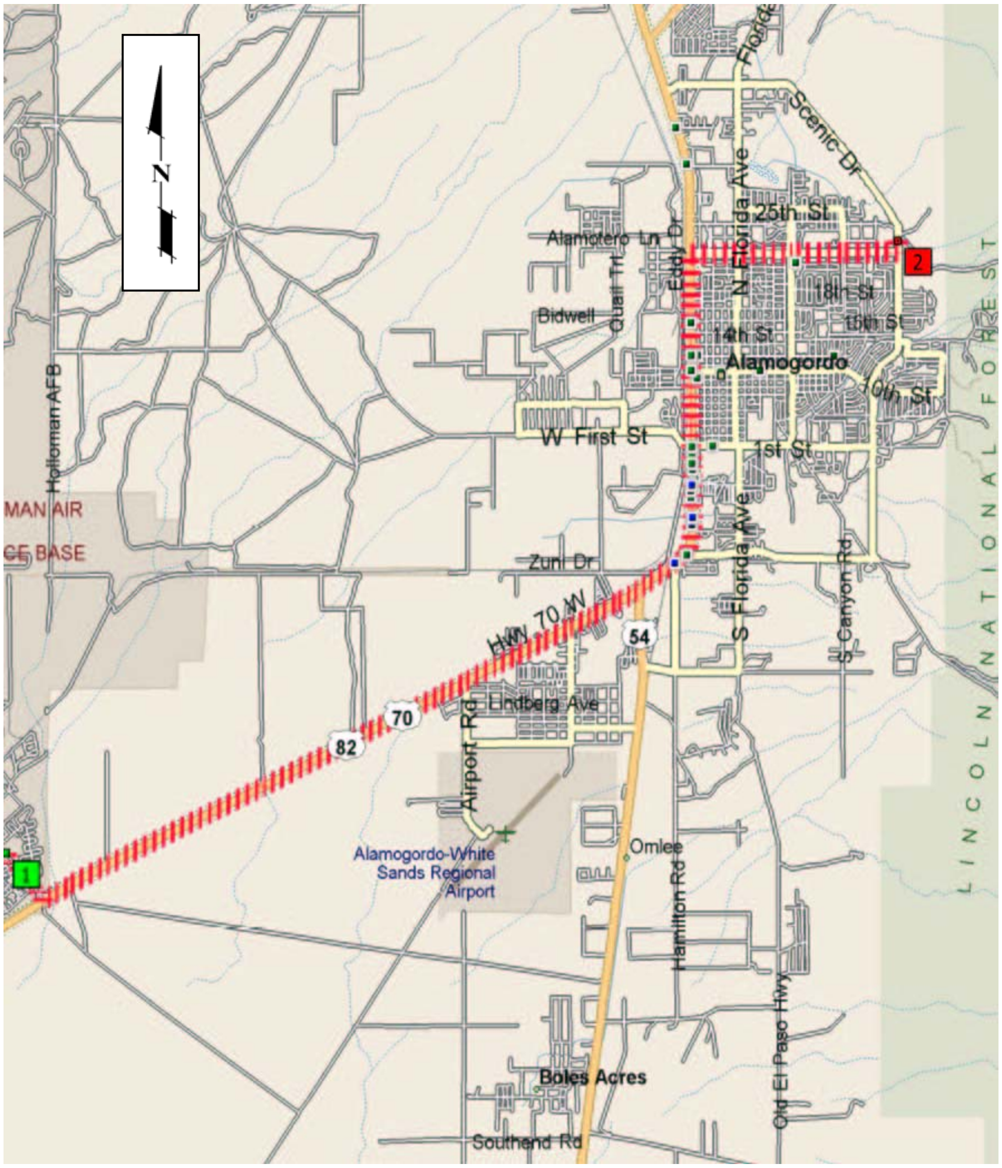
12 HOSPITAL DIRECTIONS

In the event of a true medical emergency ("life or limb"), HAFB Emergency Services should be used. Notification of any injury must be made to HAFB Emergency Services. NationView personnel and subcontractors should not transport injured personnel to the HAFB Hospital without prior authorization from HAFB Emergency Services.

Other injuries should be treated as necessary at Gerald Champion Regional Medical Center at 2669 Scenic Drive, Alamogordo, NM 88330. From HAFB, exit the Main Gate and proceed east on US-70 onto US-54, continue north on US-54 to Indian Wells Road, turn right heading east to Scenic Drive, and turn left on Scenic proceed to the medical center. A map to this hospital is presented as Figure 12-1.



NATIONVIEW

HOSPITAL ROUTE MAP
Holloman Air Force Base to
Gerald Champion Regional Hospital

Source: Microsoft Expedia Street Maps

Not to Scale

Date
July 2009

AOC-U RFI Work Plan
Holloman Air Force Base
SSA to the HASP

Figure 12-1

Figure 12-1. Hospital Route Map

ATTACHMENT A

ACTIVITY HAZARD ANALYSES (AHAS)

Activity Hazard Analysis (AHA) – 01

Task: AOC-U RCRA Facility Investigation	NationView Project Number: 8090006	
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat in the event of overhead hazards, leather work gloves, and hearing protection, as required)	Location: Holloman Air Force Base, New Mexico Analysis Approved by: Sally S. Smith	Date: July 2009

Activity	Potential Hazards	Recommended Controls
General Site Activities including Mobilization / Demobilization and Site Preparation Note: Each workday shall begin with a mandatory daily safety meeting for all on-site workers	Slips, trips, or falls on uneven and rough walking and working surfaces	• Determine the best access route prior to transporting equipment and tools • Continuously inspect the work area for slip, trip, and fall hazards (uneven terrain) • Pay attention; ensure safe and secure footing • Maintain clean work areas by following good housekeeping procedures • Be alert for uneven and variable terrain • Wear slip resistant footwear when walking/working on slippery surfaces or slopes
	Site Traffic	• Be aware of potential vehicle traffic while on site • Follow posted warnings and rules for travel around site • All personnel to wear highly visible safety vests
	Eye injury	• Use approved safety glasses with rigid side shields • Use safety goggles if dusty conditions exist
	Overhead hazards	• Personnel will be required to have hard hats available that meet ANSI Standard Z89.1 for potential work in areas with overhead hazards.
	Cuts, punctures, and abrasions	• Wear leather work gloves when handling materials or using tools (i.e., hand auger tooling)
	Dropped objects	• Steel toe boots meeting ANSI Standard Z41 will be worn
	Thermal Stressors (i.e. heat stress, cold stress)	• Employees will have appropriate clothing for variable weather • Use of long sleeves or application of sunscreen with a high sun protection factor (SPF) on exposed skin encouraged • Employees will take breaks and drink plenty of fluids to prevent heat stress. Each employee will carry drinking water, contained and transported in CamelBak® hydration systems, which must be stored and consumed outside the exclusion zone. • Warming breaks will be permitted as necessary to prevent cold stress
	Back Injury from Materials Handling	• Use proper lifting techniques • Mechanical equipment for assistance with loads greater than 50 pounds will NOT be available. Therefore, care should be taken to avoid loads greater than 50 pounds and or use of a wheel barrel for transporting these loads. • Prior to lifting, check the load for jagged or sharp edges • Avoid torso twisting motions while handling or moving loads

AHA – 01 (Continued)

Activity	Potential Hazards	Recommended Controls
Mobilization/Demobilization and Site Preparation (continued)	Inclement weather (Thunderstorms and tornadoes)	• Halt activities immediately and take cover during thunderstorm or tornado warnings, shelter in a building if possible, stay away from windows • If outdoors, stay close to the ground • Listen to radio or television announcements for pending weather information • Do not try to outrun a tornado on foot or in a vehicle
	Biological hazards (spiders, snakes, etc.)	• Workers will inspect the work area carefully and avoid placing hands and feet into concealed areas • Look in direction of travel for biological hazards to avoid
	Chemicals (i.e. fuels, lubricants, coolants, sample preservatives, etc)	• Always practice good personal hygiene by washing hands and face frequently during the day and especially before eating, drinking, smoking, applying cosmetics, or any other activity that would increase the chances for hand to mouth exposure. • Wear appropriate PPE while handling any chemicals; refer to the MSDS for specific requirements; minimum PPE must include safety glasses, safety boots, hard hats (for overhead hazards), and chemical resistant gloves.
Safety Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE First Aid Kit Fire Extinguisher Eyewash	Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits. Portable eye wash will be inspected weekly. Informal daily work area inspections to be conducted by the SSHO. Formal weekly inspections to be conducted by the SSHO using the Site Safety and Health Inspection Form.	Site personnel have read and understand the SSA Site personnel possess all of the required training as specified in the SSA Site personnel received site specific safety indoctrination Site personnel have reviewed all applicable MSDSs At least two individuals on-site will have current CPR and First Aid training

Activity Hazard Analysis (AHA) – 02

Task: AOC-U RCRA Facility Investigation	NationView Project Number: 8090006	
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat in the event of overhead hazards, leather work gloves, chemical gloves (nitrile inner and neoprene outer), and hearing protection, as required)	Location: Holloman Air Force Base, New Mexico	
	Analysis Approved by: Sally S. Smith	Date: July 2009

Activity	Potential Hazards	Recommended Controls
Soil Boring, Soil, Surface Water, and Groundwater Sampling, Handling IDW Hazards and recommended controls from AHA – 01 apply	Hand Auger Sampling Hazards Including but not limited to: Intensive labor, pinch points, uneven rough terrain, heavy sampling equipment transportation with the aide of mechanical machinery, etc.	• Hand Auger equipment and tooling is to be inspected, operated, and maintained properly • To the extent possible, site ingress and egress should be limited to level terrain • Work areas should be inspected, and to the extent possible level terrain should be selected for work, prior to initiating hand auger soil boring sampling or well point installations activities • Wear required PPE (hard hat, safety glasses, work gloves, ear muffs or plugs, steel toe work boots), ensure loose clothing, jewelry, and/or hair is secured • Maintain good housekeeping on and around each sampling site
	Water sampling in and around open water bodies (if encountered) less than two feet deep; drowning	• Wear a U.S. Coast Guard approved life jacket or buoyant work vest • Prior to each use the life jackets/buoyant work vests will be inspected for defects • A lifesaving skiff will be immediately available to provide emergency aide over surface water
	Overhead/buried utilities	• Conduct a utility locate to identify the location of underground utilities in boring locations and complete any required dig permits • Overhead utilities should be considered live until determined otherwise • Maintain a minimum distance of 15 feet from overhead utilities • All underground utilities must be clearly marked before beginning work • No soil borings shall be made within a 4 foot "Buffer Zone" of any utility marking
	Exposure to soil contaminants	• To the extent feasible, limit contact with subsurface materials • Wear required PPE when conducting intrusive activities • SSHO shall conduct breathing zone monitoring for VOCs with a PID and particulates in accordance with requirements for site monitoring • SSHO may require an upgrade in PPE or modification to work based on monitoring results • Wear appropriate PPE including chemical resistant gloves (nitrile inner and outer), boot covers, and Tyvek coveralls to minimize potential contact with soil, as appropriate • Use appropriate decontamination methods • All IDW will be containerized in 55 gallon drums and properly labeled and stored

AHA – 02 (Continued)

Activity	Potential Hazards	Recommended Controls
Groundwater Sampling Point Installation	Pinch points	• Utilize appropriate PPE (leather gloves) when handling well casings and tools
	Dust	• Use care when installing well materials (sand, bentonite, Portland cement) into sampling point to prevent dust generation • Position body in and upwind location • Suppress dust generation using wet methods and careful handling
Well Point Purging / Groundwater depth measurement / Groundwater sampling	Exposure to groundwater contaminants	• Position body upwind from the well points prior to opening cap • Wear appropriate PPE including chemical resistant gloves (nitrile inner and neoprene outer), boot covers, and Tyvek coveralls to minimize potential contact with groundwater, as appropriate • Conduct work activities in a manner that minimizes potential contact with groundwater • Collect all PPE and disposable sampling equipment and dispose of properly • Wash hands and face prior to eating, drinking, or smoking
Safety Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE First Aid Kit Fire Extinguisher Eyewash	Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits. Portable eye wash will be inspected weekly. Informal daily work area inspections to be conducted by the SSHO. Formal weekly inspections to be conducted by the SSHO using the Site Safety and Health Inspection Form.	Site personnel have read and understand the SSA Site personnel possess all of the required training as specified in the SSA Site personnel received site specific safety indoctrination Site personnel have reviewed all applicable MSDSs At least two individuals on-site will have current CPR and First Aid training

ATTACHMENT B

PRIMARY CONTAMINANTS OF CONCERN

Properties of the Primary Contaminants of Concern

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
1,1-Dichloroethene	None	5 ppm	Inhalation, skin absorption, ingestion, dermal and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the kidneys liver.	Eyes, skin, respiratory system, central nervous system, liver, kidneys	10	1.21	500	-2.0	6.5	15.5
Trichloroethene	100 ppm (TWA) 200 ppm (Ceiling)	10 ppm (TWA) 25 ppm (STEL)	Inhalation, Ingestion, dermal and/or eye contact	Irritation of respiratory system, CNS depression, mental confusion, headache, nausea, liver and kidney disturbance	CNS depression, liver and kidney disturbances, Cancer, adverse reproductive effects (female fertility, birth defects)	Respiratory System, central nervous system, liver, kidneys, heart	NA	1.47	57.8	NA	8.0	12.5
Arsenic	0.01 mg/m^3	0.01 mg/m^3 (TWA)	Inhalation, Ingestion, dermal and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea	Cancer, adverse reproductive effects (female fertility, birth defects)	Kidneys, lungs, central nervous system, mucous membranes	NA	5.72	NA	NA	NA	NA
Chromium	1 mg/m^3	0.5 mg/m^3	Inhalation, Ingestion, Contact, Absorption	Caustic to skin and mucous membranes	Cancer	Lung, kidney, and liver	NA	2.7	NA	NA	NA	NA
Lead	0.05 mg/m^3	0.05 mg/m^3	Inhalation, Ingestion, Contact	Eye irritation	Weakness, anorexia, tremors, neuropathy, Hypo-tension	GI tract, CNS, kidneys, blood, gingival tissue	N/A	11.34	0	N/A	N/A	N/A
Benzene	1 ppm 5 ppm = STEL	0.5 ppm	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, skin, nose, and throat, headache, dizziness, nausea, staggered gait, fatigue	Cancer (leukemia), adverse reproductive effects (female fertility, birth defects)	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	9.24	0.88	75	12	1.2	7.8
Toluene	200 ppm (750 mg/m^3) Ceiling 300 ppm	20 ppm	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, skin, nose, drowsiness, fatigue, weakness, confusion, headache, nausea, dilated pupils	Liver and kidney damage	Eyes, skin, respiratory system, CNS, liver, kidneys	8.82	0.87	21	40	1.1	7.1
Ethylbenzene	100 ppm (435 mg/m^3)	100 ppm (434 mg/m^3)	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, and skin, may also cause conjunctivis (eyes)	CNS depression, pulmonary aspiration	CNS, eyes, skin, respiratory system	8.76	0.87	7	55	0.8	6.7

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
Xylenes (o-, m-, p- isomers)	100 ppm	100 ppm	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, skin, nose	CNS, permanent brain and nervous system damage	CNS, liver, and urinary system/kidneys	21	0.864	8	76	1.0	7.0
Perchlorate	15 mg/ m^3 (total dust)	10 mg/ m^3 (total dust)	Inhalation, Ingestion, dermal and/or eye contact	Irritation of the respiratory system, nausea, vomiting, fever, rashes, shortness of breath	Kidney damage, bone marrow (aplastic anemia)	Red Blood Cells, liver, kidneys	NA	2.52	NA	NA	NA	NA

Notes:

PEL	=	Permissible Exposure Limit	UEL	=	Upper Explosive Limit
TLV	=	Threshold Limit Value	%	=	Percent
IP	=	Ionization Potential	ppm	=	Parts per million
eV	=	Electron volt	mg/m^3	=	Milligrams per cubic meter of air
VP	=	Vapor Pressure	CNS	=	Central Nervous System
mm Hg	=	Millimeters of mercury	GI	=	Gastrointestinal
°F	=	Degrees Fahrenheit	STEL	=	Short term exposure limit
TWA	=	Time Weighted Average			
LEL	=	Lower Explosive Limit			