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RESPONSIVENESS • INTEGRITY • TEAMWORK

August 29, 2005

New Mexico Environment Department
Hazardous Waste Bureau
5500 San Antonio, NE
Alburquerque, NM 87109

Attention: Mr. Cornelius Amindyas
HAFB Project Leader

Subject: Additional Investigation Requirements Work Plan
ERP Site SD-08 (SWMU 82 – Building 131 Washrack)
Holloman Air Force Base, New Mexico
Contract DACA45-02-D-0023, Task Order Nos: 2 & 7
Bhate Project Numbers 9040002.01.04 and 9050043.01.04

Dear Mr. Amindyas:

Bhate Environmental Associates, Inc. (Bhate), is pleased to submit the enclosed Work Plan which includes the Site Specific Addendum to the Basewide Health and Safety Plan and the Quality Assurance Project Plan Addendum for the Additional Investigation to be performed at Holloman Air Force Base, New Mexico. Please review the document and submit any comments as needed to Holloman AFB.

If you have any questions, please feel free to call me at 970-216-7819.

Sincerely,
Bhate Environmental Associates, Inc.

Frank Gardner, PG
Program Manager

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ADDITIONAL INVESTIGATION REQUIREMENTS WORK PLAN
ERP SITE SD-08
(SWMU 82 – BUILDING 131 WASHRACK)
HOLLOMAN AFB, NEW MEXICO

Prepared For

U.S. Army Corp of Engineers

Omaha, Nebraska

CONTRACT NO. DACA45-03-D-0023
TASK ORDER NOs. 2 & 7

Received
AUG 2 1 2005
District 1

Prepared By

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Birmingham, Alabama

Bhate Project Numbers: 9040002.01.04 & 9050043.01.04

August 2005

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ADDITIONAL INVESTIGATION REQUIREMENTS WORK PLAN
ERP SITE SD-08
(SWMU 82 – BUILDING 131 WASHRACK)
HOLLOMAN AFB, NEW MEXICO

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Appendix A Summary of Previous Investigations at SD-08: Section 4.1 of Table 1 Phase II RFI (Foster Wheeler/Radian, June 1995)

Appendix B Lithologic Logs and Well Construction Records from Previous Investigations at SD-08

Appendix C Site-Specific Addendum to the Basewide Health and Safety Plan

Appendix D Quality Assurance Project Plan Addendum for ERP Site SD-08

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ACRONYMS AND ABBREVIATIONS

AAF	Army Air Field
AF	Air Force
ANSI	American National Standards Institute
Bhate	Bhate Environmental Associates, Inc.
BSOP	Bhate Standard Operating Procedures
CoC	Chain-of Custody
CRZ	Contaminant reduction zone
CZ	Construction zone
DPT	Direct push technology
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
EZ	Exclusion zone
°F	Degrees Fahrenheit
FS/CMS	Feasibility Study/Corrective Measures Study
ft bgs	Feet below ground surface
ft^2	Square feet
GPS	Global Positioning System
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HAS	Hollow stem auger
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
LTM	Long term monitoring
mg/L	Milligrams per liter
MS	Matrix spike
MSD	Matrix spike duplicate
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
OSHA	Occupational Safety and Health Administration
OVA	Organic vapor analyzer
O/WS	Oil/water separator
POL	Petroleum, Oil, and Lubricant
PPE	Personal protective equipment
PVC	Poly vinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SOPs	Standard Operating Procedures

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SSL	Soil screening level
SVOC	Semi-Volatile Organic Compounds
SWMU	Sold Waste Management Unit
TDS	Total dissolved solids
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WRCC	Western Regional Climate Center
WSMR	White Sands Missile Range

1 INTRODUCTION

Bhate Environmental Associates, Inc., (Bhate) has been retained by the U.S. Army Corps of Engineers (USACE), under contract DACA45-03-D-0023, Task Orders No. 2 and 7, to prepare an Additional Investigation Work Plan for Environmental Restoration Program (ERP) Site SD-08 (Solid Waste Management Unit [SWMU] 82 - Building 131 Washrack) at Holloman Air Force Base (HAFB), New Mexico. The objectives of this Work Plan are outlined in correspondence dated February 9, 2005, and July 27, 2005, from the New Mexico Environment Department (NMED) to Holloman AFB (see Attachment A) and are summarized as follows:

1. The location of the SWMU 82 drain field must be positively identified and additional characterization must be performed.

2. Monitoring wells must be installed in the former drain field and at or down gradient of the wash rack.

3. Groundwater shall be sampled for Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), metals, and organochlorine pesticides

4. Samples from these new wells should be collected on a quarterly or semi-annual basis over a two-year period.

This document is to provide a Work Plan that will serve as the primary working document for the site assessment and investigation activities at site SD-08, Holloman AFB and provides the relevant site specific information as it pertains to the requirements as outlined in aforementioned correspondence. The primary objective of this Work Plan is to review available information and to collect soil and groundwater data to fulfill the requirements identified by NMED. The ultimate objective is to achieve approval for site closure from NMED.

This document has been prepared to provide relevant information on the geologic, hydrologic, and other environmental conditions for HAFB and at the site. Information is provided for the entire Base and its surrounding environ as well as SD-08, specifically. Likewise, the procedures encompassing the assessment/investigation, sampling, and waste management are presented.

1.1 Base and Site Description

1.1.1 HAFB

HAFB is located in southeastern New Mexico in Otero County, New Mexico, approximately 100 miles north-northeast of El Paso, Texas and six miles west of Alamogordo, New Mexico (Figure 1-1). HAFB was first established in 1942 as Alamogordo Army Air Field (AAF). From 1942

through 1945, Alamogordo AAF served as the training grounds 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. Today, HAFB also serves as the training center for the German Air Force's Tactical Training Center.

1.1.2 Site SD-08 Description

Site SD-08 is located in the southeastern corner of the refuse collection yard near Building 131. The refuse collection yard is located southwest of the Petroleum, Oil, and Lubricant (POL) Storage Area and east of the Main Base area. The original yard occupied approximately one-half acre and was surrounded by a chain-link fence. The yard was unpaved with sparse vegetation only along the fence. In 1995 the entire yard area was covered with an asphalt cap as part of the remedial measures performed at the site. The topography of the site is generally flat. Figure 1-2 shows the location of SD-08 at Holloman AFB.

The washrack was installed in 1942 and consisted of a rectangular concrete pad (approximately 1,000 square feet [ft^2]). Refuse collection trucks were washed with soap and water at the washrack. Base records indicate that pesticides were routinely sprayed inside the trucks during the 1970s for fly control; however, this practice ceased in 1982. Drains located at the north end of the washrack connected to a sewer line that carried wastewater to an oil/water separator (O/WS) near the northwest corner of the washrack. According to site personnel, it was common for the sewer line to clog, causing the sump and O/WS to overflow onto the surrounding soil. The washrack contained cracks in the concrete and was replaced in 1992 with a new washrack in the same location. The OW/S was abandoned in place.

1.1.3 Site SD-08 Summary of Previous Investigations

The site was identified in the Installation Restoration Program (IRP) Phase I Records Search (CH2M Hill, 1983). As a result, the site was investigated under Phase I of the IRP as Site SD-08 in 1991. The ensuing *Remedial Investigation Report, Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992) revealed organochlorine pesticides and metals in the shallow soils at SD-08 and organochlorine pesticides in the groundwater. The associated risk evaluation concluded that pesticide concentrations in soil pose an occupational health risk. To mitigate this risk, the site entered into the Feasibility Study/Corrective Measures Study (FS/CMS) process, which established health based cleanup criteria, estimated an area exceeding these cleanup criteria, and recommended the emplacement of an impermeable cap. The Phase II RFI (Foster Wheeler/Radian, 1995) delineated the extent of organochlorine pesticide contamination in groundwater. In 1996, SD-08 was recommended for long-term groundwater monitoring to ensure that the remedial action was preventing further degradation of groundwater. For

reference purposes, Section 4.1 of the *Draft Final Phase II RCRA Facility Investigation Report, Table 1 Solid Waste Management Units* (Foster Wheeler/Radian, 1995) is presented in Appendix A.

1.2 Physiography

HAFB is located within the Sacramento Mountains Physiographic Province on the western edge of the Sacramento Mountains (Figure 1-3). 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. HAFB is approximately 59,600 acres in area, and is located at a mean elevation of 4,093 feet above sea level. The Base is located in the Tularosa Sub-basin which is part of the Central Closed Basins. The San Andreas Mountains bound the basin to the west (about 30 miles) with the Sacramento Mountains approximately 10 miles to the east. At its widest, the basin is about 60 miles east to west and stretches approximately 150 miles north to south.

Site SD-08 is primarily comprised of gently crowned asphalt cap that covers the entire site. The site is located northeast of the main Base area on Arkansas Avenue.

1.3 Surface Water

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 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 Rita's 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.

Ancient lakes and streams deposited water bearing deposits over the older bedrock basement material. Fractures, cracks, and fissures in the Permian and Pennsylvanian bedrock yield small quantities of relatively good quality water in the deeper peripheral. Potable water is only found from a handful of wells near the edges of the basin with more saline water towards the center. Two of the principal sources of potable water are a long narrow area on the upslope sides of Tularosa and Alamogordo with the other in the far southwestern part of the basin. Alamogordo's water, as well as the Base's, is supplied from Lake Bonito (which is in the Pecos River Basin).

Within the boundaries of SD-08 and the surrounding area, surface flow is to the southeast towards Dillard Draw.

1.4 Groundwater

The predominance 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, groundwater ranges from 5 to 50 feet. Flow for the Base is generally towards the southwest with localized influences from the variations in the topography of the Base. Near the arroyos, groundwater flows directly toward the surface drainage feature.

Previous investigations at SD-08 (presented in Appendix A) concluded groundwater flow was east and northeast. However, recent survey and water level data from SD-08 and other sites in the vicinity (LF-10) would suggest a southeastern flow direction toward Dillard Draw (Figure 1-4). The difference in groundwater flow directions is attributed to errors in the original physical survey of the initial monitoring wells that were compounded as surveyors used incorrect well casing elevations as monuments.

Previous analyses indicate total dissolved solids (TDS) of greater than 10,000 milligrams per liter (mg/L) in groundwater beneath Holloman. This exceeds the New Mexico Water Quality Control Commission (NMWQCC) limit for potable water and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, United States Environmental Protection Agency (USEPA) guidelines have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L. Long term monitoring (LTM) data for SD-08 suggest a TDS concentration that ranges from 1,900 to 59,200 mg/L (Tetra Tech FW, January 2004).

1.5 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, usually less than 10 inches (Foster Wheeler/Radian, 1995). 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 to 30 – 40% of the annual total rainfall.

1.6 Geology

The sedimentary rocks which make up the adjacent mountain ranges are between 500 and 250 million years old (White Sands Missile Range [WSMR], 2003). 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, gravel, and other matter continues to flow into the basin.

As the Tularosa Basin is a bolson, which is a basin with no surface drainage outlet, sediments carried by surface water into a closed basin are bolson deposits. The overlying alluvium generally consists of unconsolidated gravels, sands, and clays. Soils in the basin are derived from the adjacent ranges as erosional deposits of limestone, dolomite, and gypsum. A fining sequence from the 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 clay containing gypsum and are contiguous with the alluvial fan and eolian deposits throughout HAFB. There has been the identification of stiff caliche layers, varying in thickness, at different areas of the Base. At the site, soils are predominantly silty sands and interbedded clays.

Based on drilling logs from previous investigations, the site geology is comprised primarily of silty and clayey sands. A discontinuous layer of poorly graded sand interbedded with thin layers of caliche and clayey sand was observed in borings near the washrack. A complete description of site lithology is presented in the drilling logs from previous investigations which are included in Appendix B.

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2 INVESTIGATION ACTIVITIES

The objective of the investigation activities at the site is to fill data gaps identified by NMED (Attachment A presents NMED correspondence dated February 9, 2005). Specifically, these are to: 1) establish upgradient water quality with a new well, 2) locate and characterize the drainage pits associated with the washrack), 3) assess groundwater quality under the drainage pits, 4) install a new well downgradient of the drainage pits, and 5) collect groundwater samples from selected wells every 6 months for a 2-year period. The investigation for SD-08 will be conducted in accordance with the State of New Mexico requirements. Upon conclusion of the investigative activities; a report will be developed in accordance with Section 3 of this Work Plan.

2.1 Investigation Activities

Prior to the initiation of any sampling activities, Air Force (AF) Form 322 and utility clearance permitting will need to be completed. To meet the investigation objectives, the following activities will be performed:

- Install upgradient monitoring well
- Advance two soil borings to characterize soil conditions under the drainage pits
- Install one monitoring well downgradient of drainage pits
- Analyze the soil and groundwater samples for organochlorine pesticides, VOCs, SVOCs, Resource Conservation and Recovery Act (RCRA) metals, and TDS (water only)
- Perform physical survey of soil borings and monitoring wells with survey grade Global Positioning System (GPS)

2.1.1 AF Form 332

AF Form 332, included in Attachment B, authorizes construction work at HAFB and is required for the initiation of any construction work. This work request form describes what activities will take place at the location. The AF Form 332 also is the mechanism by which the utility clearance/dig permit is authorized. AF Form 332 will be initiated by Bhate. Both the AF Form 332 and dig permit will be reviewed by required Base personnel for their approvals to begin work in their area or that which may affect a utility under their authority. Prior to the submittal of AF Form 332, the sampling locations will be clearly indicated with marker flags or stakes.

2.1.2 Dig Permit/Utility Clearances

As noted above, utility clearance approvals will be completed by Base personnel. Upon receipt of the approved dig permit with the utility clearances, the site supervisor or other authorized project personnel will complete a site walk-down confirming the dig permit authorizations and will make any required changes.

The following subsections provide detailed descriptions for completing each activity.

2.1.3 DPT Soil Assessment

The field work for the investigation will be conducted in accordance with HAFB Standard Operating Procedures (SOPs) provided in the Basewide Quality Assurance Project Plan (QAPP) (Bhate, 2003a). These SOPs outline methodologies for soil boring advancement, soil sampling, soil sample description, field screening, sample management, equipment decontamination, and chain-of-custody procedures.

Location of the drainage pits will be determined from site drawings (Appendix A). Confirmation of the drainage pits will be performed using direct push technology (DPT) borings.

Two DPT soil borings (Figure 2-1) will be advanced at the site to an anticipated depth of 15 feet below ground surface (ft bgs) using DPT methodology in accordance with HAFB SOP No. 4. Continuous soil samples will be collected from these borings with lithologic descriptions per HAFB SOP No. 7. A total of five soil samples, including one field duplicate sample, will be submitted to the laboratory for analysis. The samples will be placed on ice and shipped under strict chain-of-custody to Accutest Laboratories in Orlando, Florida.

Soils will be field screened in accordance with HAFB SOP No. 6 using an organic vapor analyzer (OVA) utilizing soil-headspace screening techniques. Notation will also be made of any visual (discoloration) and/or aromatic indicative of potential contamination.

Based on headspace screening results, two soil samples from each soil boring with the highest OVA readings will be selected for laboratory analyses. Should the screening not identify one or more intervals in which to select, then the lower most interval at the soil-water interface and uppermost, or single OVA detection shall be retained for laboratory analysis.

2.1.4 Monitoring Well Installation

Two monitoring wells will be installed as part of this investigation. The wells will be advanced and installed using hollow stem auger (HSA) drilling technology. The monitoring wells will be constructed of schedule 40 poly vinyl chloride (PVC) casing and screen with a slot opening of 0.10 inch. The portion of Bhate Standard Operating Procedure (BSOP) No. 10, *Subsurface Water Investigation*, regarding well construction and development is provided in Attachment C

of this Work Plan. The first well will be installed upgradient of the site to establish background water quality. A second well will be installed immediately downgradient of the drainage pits to evaluate groundwater quality at the suspected source of organochlorine pesticides. Continuous soil samples will be collected from these borings with lithologic descriptions per HAFB SOP No. 7. A total of two soil samples, from the downgradient well will be submitted to the laboratory for analysis. The samples will be placed on ice and shipped under strict chain-of-custody to Accutest Laboratories in Orlando, Florida.

2.1.5 Groundwater Sampling

The two new wells will be sampled along with three existing wells (MW08-01, MW08-05, and S10-MW01) illustrated in Figure 2-1. These wells will be sampled two times per year for a period of 2 years. Well MW08-02 was gauged in February 2005 and found to be dry and, therefore, will not be included in the sampling program. Wells MW08-04 and MW08-06 are cross gradient to the suspected source and, thus, not included in the sampling program. Because well MW08-03 is in close proximity to the new upgradient well, it will not be sampled either. A total of seven groundwater samples, including one field duplicate sample, a matrix spike (MS) / matrix spike duplicate (MSD) will be submitted to the laboratory for analysis from each sampling event. All samples for 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.

2.1.6 Laboratory Analysis

Each soil and groundwater sample (including the field duplicates) will be analyzed for their respective analytes in accordance with Table 2-1. Soil and groundwater samples will be analyzed for organochlorine pesticides by Method 8081A, VOCs by Method 8260B, SVOCs by Method 8270C, and RCRA metals (arsenic, barium, chromium, cadmium, lead, mercury, selenium, and silver) by Method 6010B with the exception of mercury, which will be analyzed by Method 7470A/7471A. Groundwater samples will additionally be analyzed for total dissolved solids by Method 160.1. Field filtration will be performed for the fraction of groundwater samples submitted for metals analysis.

Table 2-1. Sample Analytes and Methodologies

Analysis	Water	Soil
Organochlorine Pesticides	EPA Method 8081A	EPA Method 8081A
VOC	EPA Method 8260B	EPA Method 8260B
SVOC	EPA Method 8270C	EPA Method 8270C
RCRA Metals	EPA Methods 6010B/7470A	EPA Methods 6010B/7471A
Total Dissolved Solids	EPA Method 160.1	Not Applicable

Appendix D details the method detection limits by method for chemical constituents indicated for SD-08. Table 2-2 is a matrix indicating the analytical requirements for SD-08.

Table 2-2. Summary of Analytical Parameters for SD-08

Analytical Constituents	Soil Samples	Water Samples
Organochlorine Pesticides Method 8081A	7 samples (including 1 duplicate)	6 samples (including 1 duplicate)
Volatile Organic Compounds Method 8260B	7 samples (including 1 duplicate)	7 samples (including 1 duplicate and 1 trip blank)
Semi-Volatile Organic Compounds Method 8270C	7 samples (including 1 duplicate)	6 samples (including 1 duplicate)
RCRA Metals Methods 6010B and 7470A/7471A (mercury)	7 samples (including 1 duplicate)	6 samples (including 1 duplicate)
Total Dissolved Solids Method 160.1	Not Applicable	6 samples (including 1 duplicate)

2.1.7 Site Restoration

Upon completion of the site investigation activities, the site will be restored to the original condition. Sampling locations will be backfilled or grouted to the surface. The site will be canvassed for trash, debris, etc.

3 INVESTIGATION REPORT

The summary report will evaluate the newly collected data as well as the historical information so that decisions regarding the need for further action can be made.

3.1 Evaluation of Soil Contaminants

For any pesticides, VOCs, SVOCs, or metals that are detected in the soil, the concentration will be evaluated against the screening levels provided in the NMED guidance document *Technical Background Document for Development of Soil Screening Levels* (NMED, 2004). Tables containing the soil screening levels (SSLs) from this guidance document are provided in Appendix A of the NMED SSLs document. Laboratory data from each of the collected soil samples will be compared to these SSLs. If the completed evaluation indicates an acceptable risk, then no further excavation will be required and the site can be considered for closure with no further action.

3.2 Evaluation of Groundwater Contaminants

Groundwater shall meet the standards of Subsection A and B of Section 20.6.2.3103 Standards for Groundwater of 10,000 mg/L TDS concentration or less of the New Mexico Administrative Code (NMAC). If one or more water contaminants affecting human health are present, the toxic pollutant criteria as set forth in the definition of toxic pollutant in Section 20.6.2.7.VV NMAC for the combination of contaminants shall apply, which ever is more stringent. Non-aqueous phase liquid shall not be present floating atop of or immersed within groundwater, as can be reasonably measured.

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4 HEALTH AND SAFETY REQUIREMENTS

Health and Safety practices during the investigation activities as SD-08 will adhere to the *Basewide Health and Safety Plan* (HASP) (Bhate, 2003b), and the project Site-Specific Addendum to the Basewide Health and Safety Plan which is included in Appendix C of this Work Plan. It is anticipated that no greater than modified level D personal protective equipment (PPE) will be required to complete the investigation and 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 during the investigation is part of safety at the site. Items of concern include the proper designation and demarcation of the investigation boundaries (i.e. exclusion zone [EZ], contaminant reduction zone [CRZ], and construction zone [CZ]), 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 at length in the *Basewide Health and Safety Plan* (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 CZ. This is essential in the utility clearance process and it serves as the demarcation of the site for both project and non-project persons. Presently, there exists a fence surrounding the immediate presumed boundaries of the site. This shall be used as the CZ. Because there is little information regarding the possible hazardous substances at the site at this time, a CRZ and/or EZ will be established during field work as guided by the HASP and site prevailing conditions.

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5 IDW MANAGEMENT AND DECONTAMINATION

Investigation Derived Waste (IDW) generated by the activities of this investigation (Table 5-1) will be managed and characterized according to the following guidelines. All removed soils will be returned to their respective boring as backfill. Liquid wastes, such as decontamination rinses, are anticipated to be non-hazardous and as such, can be disposed of through the Base water treatment facility. PPE and other site non-hazardous debris/waste shall be disposed in standard trash receptacles.

Table 5-1. Proposed Waste Streams for SD-08

Activity	Waste Stream		
	PPE	Soil	Water
Equipment Decontamination	X		X
Soil Sampling	X	X	
Groundwater Sampling	X		X

5.1 General Decontamination Procedures

All equipment, inclusive of small hand and sampling tools and down hole tooling will require decontamination. Small items can be decontaminated in five-gallon buckets and the like at the site (Bhate, 2003a). The larger equipment will be decontaminated at the subcontractor staging area using high temperature – high pressure water cleaner and scrub brushes.

5.1.1 Personal Protective Equipment

Prior to disposal, used PPE, disposable items, and the decontamination pad liner will be rinsed clean with tap water and diluted detergent solution. Cleaned PPE and presumed clean, based upon non-contact with contaminated soils, water or equipment, and other disposable clean items will be contained in trash bags and disposed of at the applicable receptacle.

5.1.2 Hazardous and Special Waste

There is not expected to be any hazardous or special waste generated during the completion of this project.

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6 QAPP ADDENDUM

The laboratory performing the chemical sample analysis will follow the Final Quality Assurance Project Plan Addendum provided as Appendix D to this Work Plan.

6.1 Sample Identification

Each environmental sample will be identified on the sample label and chain-of-custody (CoC) records for each sample collected, regardless of type. USACE duplicates will be paired with another random sample and will be blind samples. The duplicate samples will appear in sequence with the regular samples. The identifier nomenclature will adhere to the procedures and guidelines established in the Basewide QAPP.

6.2 Standard Operating Procedures

Applicable SOPs for completing this excavation are located in Appendix A of the Basewide QAPP.

6.3 Sample Documentation

Sample documentation, identification, and tracking will adhere to the prescribed methods found in the Basewide QAPP and/or its respective project specific addendum. All sampling activities will include documentation of significant activities and sample identification information. At a minimum, field log books will be utilized to record dates and times, sampling protocols, project numbers, and sampler's name. Other pertinent information will include CoC numbers and air-bill tracking numbers. Chain-of-custody forms will be completed and included with each sample shipment; one CoC per cooler.

6.4 Data Reporting

Data obtained during the investigation will be reported according to the Basewide QAPP and/or its respective project specific addendum. Risk evaluation and sampling results will be tabulated and summarized in the closure report for the site. An Environmental Restoration Program Information Management System (ERPIMS) submittal is not required for this project.

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7 ORGANIZATION

During the investigation activities at Site SD-08, Mr. John Hymer will serve as the Bhate Site Manager overseeing and directing all investigation sampling activities. Mr. Hymer will also provide on-site management of any sub-contractor for the project. Mr. Frank Gardner is the Bhate Program Manager 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 7-1.

Table 7-1. Key Personnel and Responsibilities

Name	Project Title/Assigned Role	Phone Numbers
Mr. John Hymer	Field Team Leader/Site Health and Safety Officer	Work: (505) 491-9171
Mr. Jerry Pelfrey & Mr. Kevin Germann	Field Samplers	Work: (505) 491-8261
Mr. John Hymer	First Aid Personnel (Note-all onsite personnel are required to be trained in cardiopulmonary resuscitation and first aid)	Work: (505) 491-9171
Other Project Personnel		
Mr. Frank Gardner	Bhate Program Manager	Work: (970) 216-7819
Mr. Eric Lehnertz	Health and Safety Specialist	Work: (205) 918-4000
Mr. Mike D'Auben	QA/QC Specialist/Chemist	Work: (205) 918-4000
QA/QC = Quality Assurance/Quality Control		

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8 REFERENCES

CH2M Hill, 1983. Installation Restoration Program Phase I Records Search, Holloman Air Force Base, New Mexico.

Bhate Environmental Associates, April 2002. *Bhate Standard Operating Procedures* [BSOP] *for Federal Programs, BSOP No. 10, Subsurface Water Investigation.*

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

Bhate Environmental Associates, December 2003b. *Final Basewide Health and Safety Plan,* Holloman Air Force Base, New Mexico.

Foster Wheeler/Radian, June 1995. *Draft Final Phase II RCRA Facility Investigation Report, Table 1 Solid Waste Management Units*, Holloman Air Force Base, New Mexico, Volume I.

New Mexico Environment Department, Hazardous Waste Bureau and Ground water Quality Bureau Voluntary Remediation Program, *Technical Background Document for the Development of Soil Screening Levels*, Revision 2, February 2004 (Updated August 2004).

Radian, June 1992. *Remedial Investigation Report, Investigation, Study and Recommendation for 29 Waste Sites,* Holloman Air Force Base, New Mexico, Volume I.

Tetra Tech FW, January 2004. *Letter Report for the Evaluation of Groundwater Quality, 2002 Long-Term Groundwater Monitoring Program*, Holloman Air Force Base, New Mexico.

Western Regional Climate Center (WRCC), 2003. Desert Research Institute State Narrative Web Page, http://www.wrcc.dri.edu/narratives/NEWMEXICO.htm.

White Sands Missile Range (WSMR), 2003. Public Affairs Office, Site Informational Web Page, http://www.wsmr.army.mil/paopage/Pages/WU%2360.htm.

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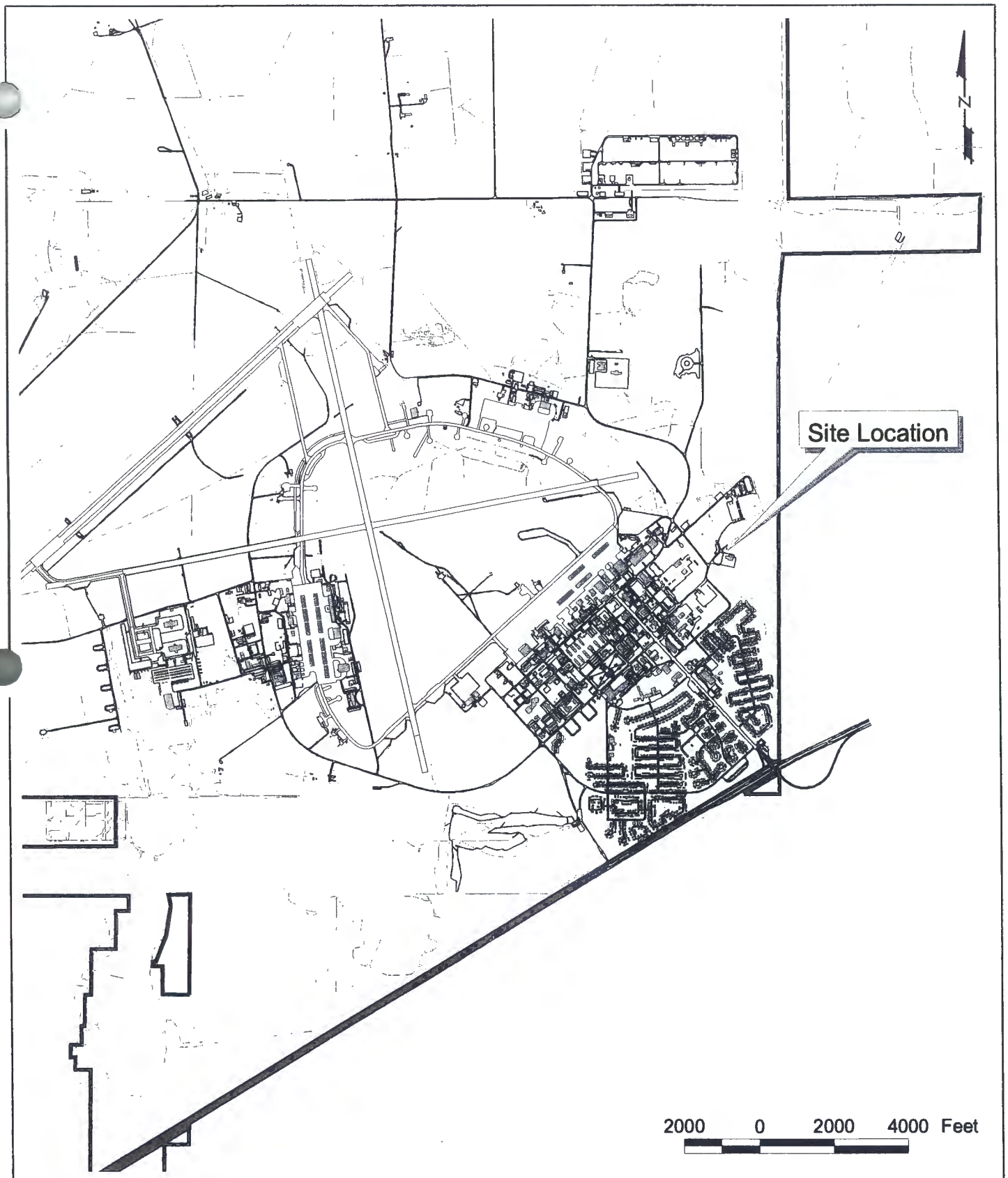
FIGURES

bhate associates
ENGINEERING, SCIENCE AND CONSTRUCTION

Location Map				Site SD-08
PROJECT NO.	SCALE	DATE	DRAWN BY: cm	Figure 1-1
9040002	Shown	4/25/05	DRAWING NO: fig1-1	



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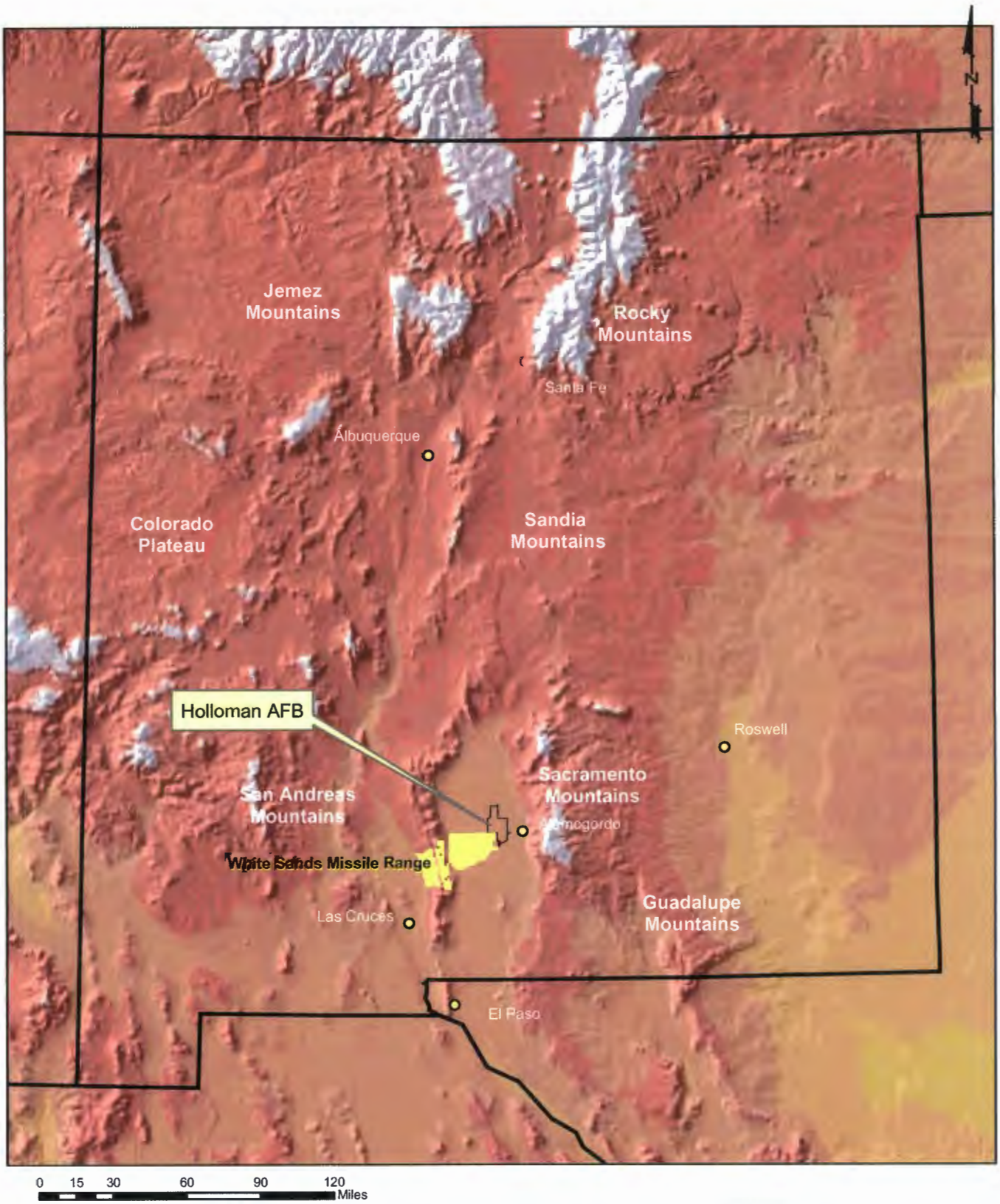
ENGINEERING, SCIENCE AND CONSTRUCTION

SD-08 Location Map

PROJECT NO.	SCALE	DATE	DRAWN BY:
9040002	Shown	4/13/05	cm
			DRAWING NO: gis_1-2

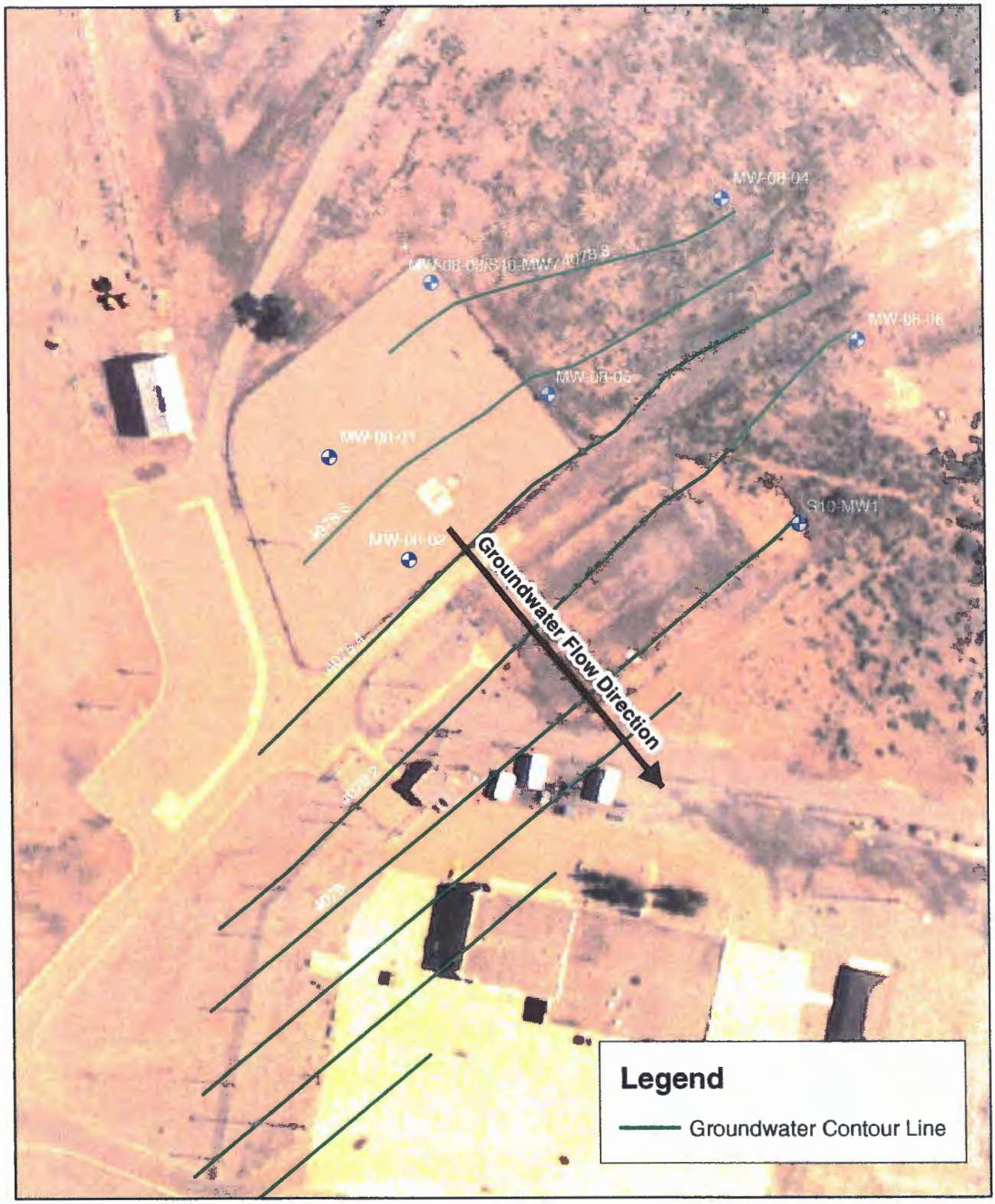
Site SD-08

Figure 1-2



bhate associates
ENGINEERING SCIENCE AND CONSTRUCTION

Physiographic Map				Site SD-08
PROJECT NO.	SCALE	DATE	DRAWN BY: cm	Figure 1-3
9040002	Shown	4/13/05	DRAWING NO: gis_1-3	



0 40 80 160 240 320 Feet

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Groundwater Contour Map

PROJECT NO	SCALE	DATE	DRAWN BY
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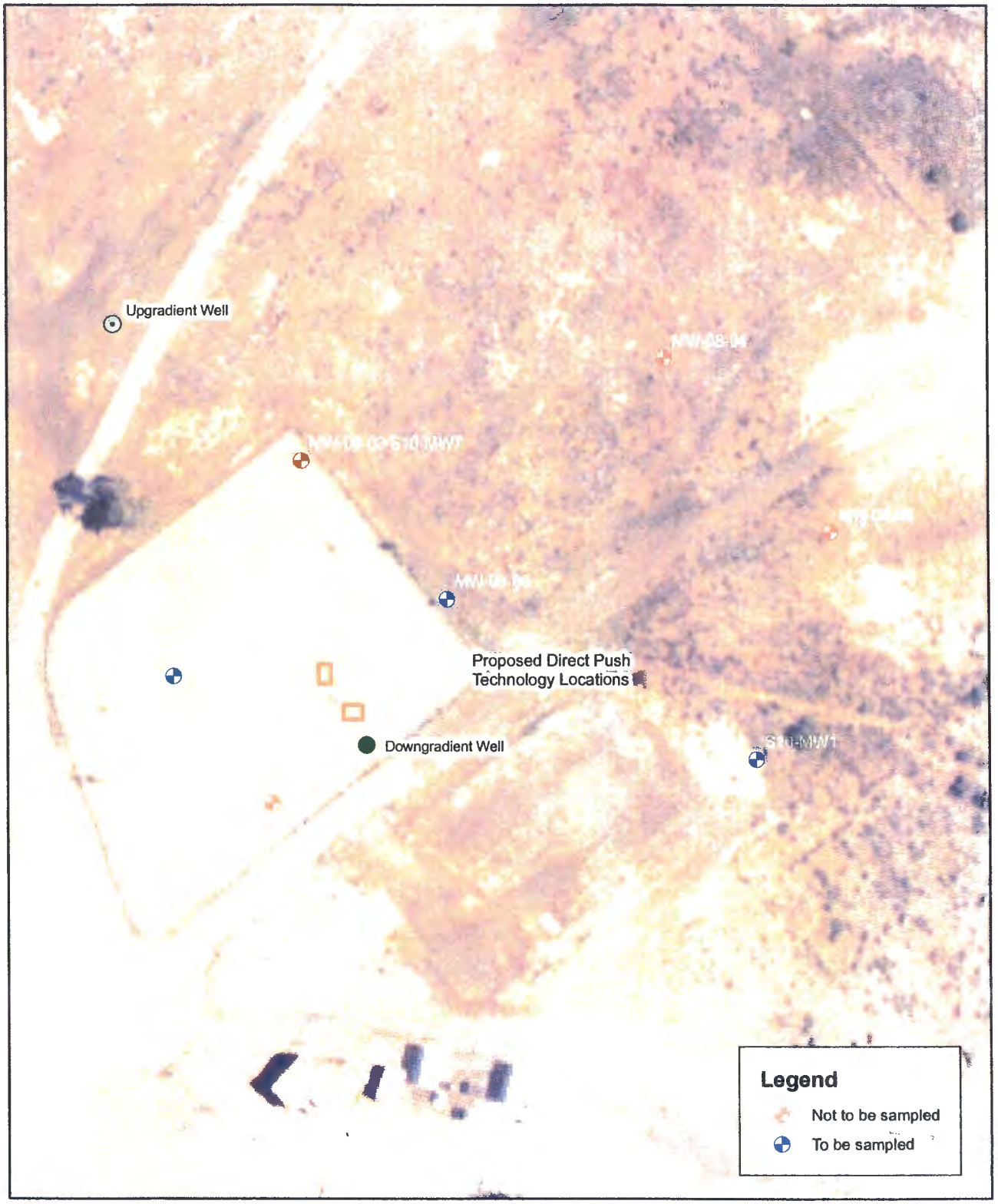
			DRAWING NO gis_1-4

Site SD-08

Figure 1-4



0 30 60 120 180 240 Feet

bhate associate
ENGINEERING, SCIENCE AND CONSTRUCTION

Sampling Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:
9040002	Shown	4/13/05	cm
			DRAWING NO: gis_2-1

Site SD-08

Figure 2-1

ATTACHMENT A

NEW MEXICO ENVIRONMENT DEPARTMENT CORRESPONDENCE DATED FEBRUARY 9, 2005, AND JULY 27, 2005

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

February 9, 2005

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

RE: ADDITIONAL INVESTIGATION REQUIREMENTS AT SITES - SS-02&05, SD-08, SS-39
HOLLOMAN AIR FORCE BASE
EPA ID# NM6572124422
HWB-HAFB-04-009

Dear Ms. Hartell:

The New Mexico Environment Department (NMED) has reviewed the 2003 Long-Term Groundwater Monitoring Report and older investigation reports for the above referenced sites. Based on this review the NMED has additional concerns and will require additional ground water investigations at these sites. The NMED's current policy (May 15, 1995) regarding the treatment of ground water contamination at Holloman AFB states, in part, that soil and ground water contaminant plumes must be adequately characterized and monitoring wells defining the plumes must be sampled at least annually. NMED interprets "monitoring wells defining the plumes" to include wells located within the plume, particularly in the area of highest contamination, not just the wells defining outside the perimeter of the plume. NMED does not believe the ground water monitoring at the referenced sites conforms to this policy.

The following provides a brief reasoning for requiring the additional work at each site.

Site SS-02/05 (SWMU AOC-T)

This site is currently undergoing a voluntary corrective measures to remove contaminated soils a part of the final remedy and site closure. As part of site closure a final risk assessment must be

performed. The risk assessment will need to look at the ground water exposure pathway in relation to potential vapors impacts under current and future land use scenarios. Currently only one cross-gradient well, MW-02&5-05, within the contaminant plume is being sampled.

NMED believes additional ground water sampling from throughout the contaminant plume is required to support the risk assessment and eventual site closure. Therefore, the following actions must be implemented:

1. A two-year groundwater-sampling program should be initiated. Samples should be collected on a quarterly or semi-annual basis for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

2. Ground water samples should be collected from MW-02&5-02. This well is located in the source area with historically the highest concentrations and would provide information on the affects of the soil excavation had on the ground water plume.

3. At least one additional well should be installed approximately 100 feet east of the excavation to better define the ground water plume. The only true down gradient well, MW-02&5-06, is located over 400 feet from the source area. As most petroleum plume are < 400 feet in length, especially at sites with flat gradients, this well is not real useful for monitoring plume characteristics but is better suited as a sentinel well to monitor plume migration. A second well should also be considered to the southeast of MW-02&5-02 based on the historic ground water flow direction.

4. Sampling and review of historical data from other site wells that have not been part of the LTM monitoring program should be performed to ensure that ground water conditions have not changed since the original investigations were performed. Wells such as MW-02&5-01, MW-02&5-07, and S1-MW3 should be included in inital sampling event.

<u>Site SD-08 (SWMU 4 and SWMU 82)</u>

The review of the current and historic ground water potentiometric surface maps presented in the LTM reports indicates a south/southwest ground water flow direction. Based on the location of SWMU 82 (source area) presented in the recently submitted no further action statement of basis (NFA SOB, November 2004), all of the monitoring wells sampled as part of the LTM program are either up gradient or cross-gradient from the known source area. Therefore, site ground water conditions cannot be adequately assessed. In addition, based on the information presented in the NFA SOB the drain field was not adequately characterized.

The following actions must be implemented:

1. As stated in NMED review of the NFA SOB (February 2005), the location of the SWMU 4 drain field must be positively identified and additional characterization must be performed.

2. Monitoring wells must be installed in the former drain field and at or down gradient of the wash rack. Ground water shall be sampled for VOCs, SVOCs, metals, and organochlorine pesticides.

3. Samples from these new wells should be collected on a quarterly or semi-annual basis over a two-year period.

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

As part of the LTM review, the NMED also looked at the original site investigation material presented in the *Phase I RCRA Facility Investigation Report, Table 2 Solid Waste Management Units*, September 1997 report. Based on the review of the original characterization data, it appears that all monitoring wells are installed up gradient of the TCE plume as determined by Geoprobe sampling locations. Ground water samples collected from several Geoprobe locations showed TCE concentrations between 324 *ug*/L and 2730 *ug*/L in locations down gradient of the LTM sampling locations. Additional ground water characterization work was performed in 1998 that defined the ground water plume but no permanent monitoring wells were installed. See the attached map. Also, according to the site summary presented in the HAFB's September 1995 Decision Document, tetrachloroethene (PCE) concentration of 95 mg/kg was detected in the soils around the drainage sumps at Building 1176. This is above the NMED's residential risk based soil screening levels of 9.83 mg/kg.

Therefore, the following actions are required:

1. An in-depth review of previous investigations should be performed and summarized in the work plan. An investigation of the current soil and ground water conditions shall be performed based on the analysis of the historical data.

2. Ground water monitoring wells shall be installed in area of highest contaminant concentrations and at down gradient locations. The distance between well(s) shall be no more than 200 feet, unless approved by NMED. The down gradient extent of the plume shall be defined where the concentration of TCE in the ground water is less than 5 mg/L. The wells shall be installed at the shallowest depth possible to yield representative ground water samples.

3. A vertical extent well shall be installed in the area of highest contaminant concentrations.

4. Initially, samples shall be analyzed for VOCs, SVOCs, RCRA metals, and perchlorate.

5. Samples from these new wells should be collected on a quarterly or semi-annual basis over a two-year period.

Additional requirements for these sites may be required based on the historical information provided in the work plans.

Work plans for the above requirements must be reviewed and approved by the NMED before the work is performed. The work plans shall include detailed summaries of the operational history and investigational history of each site, potential contaminants of concern, proposed monitoring well locations and construction details, analytical parameters and methods, quality controls and any other details as determined by the NMED as necessary to properly investigate each site. The work plans shall be submitted within 90 days from receipt of this letter.

If you have any questions, please contact me at (505) 845-5932.

Sincerely,

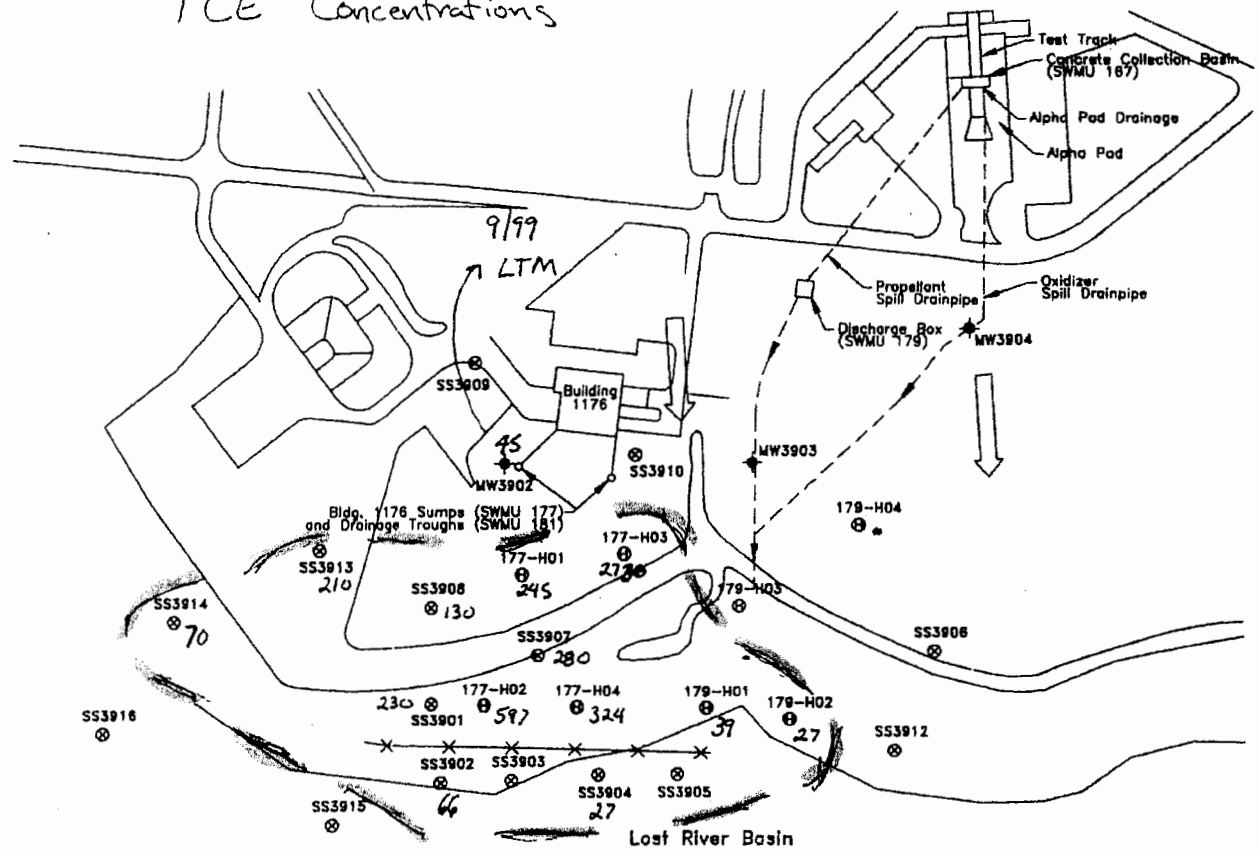
Steve Jetter
Permits Management Program

cc: James Bearzi, NMED HWB
John Kieling, NMED HWB
Cornelius Amindyas, NMED HWB
James Harris, EPA-Region 6
Dan Holmquist, HAFB
File: Reading and HAFB-HSWA 2005

SS-3, SWMU 177 & 179

TCE Concentrations

Look in
- Phase II, Table 2 RFI Report
  Radian 1994
  or
- Phase I, Table 2, RFI Report
  Sept 97



SS3911

N

0 Feet 200
Scale

LEGEND

- Monitoring Well
- Previous Groundwater Sampl Location (1993)
- DPT Groundwater Sample Location 5/98
- Fence
- Groundwater Flow Direction (November, 1991)

0307SS59.DWG (1:200) 08-06-98

Figure 1. SS-39 SITE MAP WITH DPT GROUNDWATER SAMPLING LOCATIC

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
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www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

July 27, 2005

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

SUBJECT: REQUEST FOR SUPPLEMENTAL INFORMATION: ADDITIONAL INVESTIGATION REQUIREMENTS WORK PLAN, ERP SITE SD-08 (SWMU 82 – BUILDING 131 WASHRACK), MAY 2005
HOLLOMAN AIR FORCE BASE
EPA ID# NM6572124422
HWB-HAFB-05-003

Dear Ms. Hartell:

The New Mexico Environment Department (**NMED**) Hazardous Waste Bureau (**HWB**) has reviewed the subject document for technical completeness. Based on that review, NMED has determined that this Work Plan can not be approved at this time as revisions to this Work Plan are necessary. Enclosed is a list of requested revisions, which Holloman Air Force Base (**HAFB**) must address. Please respond to this Request for Supplemental Information (**RSI**) within thirty (30) calendar days of the date of this letter. Failure to respond within this time period may result in the issuance of a Notice of Deficiency. NMED may consider a petition for an extension of the deadline for submittal of the additional information, provided that written justification and the expected submittal date are provided by HAFB.

If you have any questions regarding this matter or if you would like to discuss the comments prior to your response, please contact David Strasser at (505) 222-9526.

Sincerely,

Cornelius Amindyas
HAFB Project Leader
Permits Management Program

CA/ds

cc: James Bearzi, Chief, NMED, HWB
William Moats, NMED, HWB
David Strasser, NMED, HWB
Debra Tellez, EPA, Region 6 (6PD-F)
Dan Holmquist, HAFB
File: Reading and HAFB-HSWA

ATTACHMENT
REQUEST FOR SUPPLEMENTAL INFORMATION
ADDITIONAL INVESTIGATION REQUIREMENTS WORK PLAN,
ERP SITE SD-08 (SWMU 82 – BUILDING 131 WASHRACK), MAY 2005
HOLLOMAN AIR FORCE BASE (HAFB)
EPA ID# NM6572124422

TASK # HWB-HAFB-05-003

The following are NMED's requested revisions to HAFB's Additional Investigation Work Plan for ERP Site SD-08 (SWMU 82), dated May 2005. The quotations in **bold print** are taken directly from the subject document. Please address the comments and submit the revised information as directed in the cover letter.

COMMENTS

1. Page 2-2, Section 2.1.4, "**Monitoring Well Installation**"

a) NMED requests that during the installation of the new "downgradient well", two soil samples be collected and analyzed as specified in Section 2.1.3, DPT Soil Assessment. Soils at the "upgradient well" will not require analysis.

b) In correspondence from the NMED dated February 9, 2005, which outlined the requirements for this additional investigation, the Work Plan was to include monitoring well construction details. These details were not included. NMED requests that HAFB submit information regarding well construction details.

2. Page 2-3, Section 2.3, "**Groundwater Sampling**", 1st Sentence

This sentence indicates that three existing wells will be sampled (MW08-03, MW08-05 and S10-MW01). NMED requests that HAFB collect a groundwater sample from well MW08-01 instead of from well MW08-03. NMED understands that well MW08-01 is cross gradient to the suspected source. However, MW08-01 has a history of VOC detections that should be monitored. In addition, the groundwater from well MW08-03 has been relatively uncontaminated and the proposed "upgradient well" is in close proximity to well MW08-03.

3. Page 3-1, Section 3.2, "**Evaluation of Groundwater Contamination**", 2nd Sentence

NMED requests that HAFB revise this sentence to read as follows (additions underlined; deletions struck through): "If ~~more than~~ one or more water contaminants affecting human health ~~is~~ are present, the toxic pollutant criteria as set forth in the definition of toxic pollutant in Section ~~20.6.2.1101~~ 20.6.2.7.VV NMAC … ".

ATTACHMENT B

BASE CIVIL ENGINEER WORK REQUEST AIR FORCE FORM 332 (JAN 92)

BASE CIVIL ENGINEER WORK REQUEST

(See Back of This Form Set for Instructions)

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average .3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to the Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project 0704-0188, Washington DC 20503. Please DO NOT RETURN your form to any of these addresses. Send your completed form to HQ AFESC/DEMG.

SECTION I - TO BE COMPLETED BY REQUESTER

1. FROM *(Organization)*	2. OFFICE SYMBOL	3. DATE OF REQUEST	4. WORK REQUEST NO. *(For BCE Use)*

5. NAME AND PHONE NO. OF REQUESTER	6. REQUIRED COMPLETION DATE	7. BUILDING, FACILITY OR STREET ADDRESS WHERE WORK IS TO BE ACCOMPLISHED

8. DESCRIPTION OF WORK TO BE ACCOMPLISHED *(Include Sketch or Plan, when appropriate)*

9. BRIEF JUSTIFICATION FOR WORK TO BE ACCOMPLISHED *(Not required for maintenance and repair)*

10. DONATED RESOURCES

☐ FUNDS	☐ LABOR	☐ MATERIAL	☐ CONTRACT BY REQUESTER	☐ NONE

11. NAME OF REQUESTER	12. GRADE OF REQUESTER	13. SIGNATURE OF REQUESTER *(See Instructions on back)*

14. COORDINATION

SECTION II - FOR BASE CIVIL ENGINEER USE

15. WORK ORDER *(Place an "X" in the appropriate box.)*

☐ IN- SERVICE	☐ SELF-HELP	☐ CONTRACT	☐ SABER

16. DIRECT SCHEDULED WORK *(Place an "X" in the appropriate box.)*

☐ EMERGENCY	☐ URGENT	☐ ROUTINE	☐ SELF-HELP	☐ M/C

17. SELF-HELP *(Place an "X" in the appropriate box.)*

☐ BRIEFING REQUIRED	☐ ADEQUATE COORDINATION	☐ INSPECTION REQUIRED

SECTION III - COMPLETE ONLY IF WORK IS TO BE ACCOMPLISHED BY WORK ORDER

18. WORK CLASS	19. PRIORITY	20. ESTIMATED HOURS	21. ESTIMATED FUNDED COST	22. ESTIMATED TOTAL COST

☐ 23 THERE IS NO NEED FOR AN ENVIRONMENTAL ASSESSMENT (AFR 19-2)	☐ 24. A WRITTEN ASSESSMENT IS BEING/HAS BEEN PROCESSED	☐ 25. APPROVED	☐ 26. DISAPPROVED

27. REMARKS

SECTION IV - APPROVING AUTHORITY

28. NAME AND GRADE *(Please Type or Print)*	29. SIGNATURE	30. DATE

CONTINUATION SHEET FOR AF FORM 332

(COMPUTER GENERATED)

1. FROM *(Organization)*	2. OFFICE SYMBOL	3. DATE OF REQUEST	4. WORK REQUEST NO. *(For BCE Use)*

5. NAME AND PHONE NO. OF REQUESTER	6. REQUIRED COMPLETION DATE	7. BUILDING, FACILITY OR STREET ADDRESS WHERE WORK IS TO BE ACCOMPLISHED

8. DESCRIPTION OF WORK TO BE ACCOMPLISHED *(Include Sketch or Plan, when appropriate)*

ATTACHMENT C

PORTIONS OF BHATE STANDARD OPERATING PROCEDURE No. 10; SUBSURFACE WATER INVESTIGATION

1 MONITORING WELL INVESTIGATION

1.1 Objective

It is the policy of Bhate to design, install, and construct monitoring wells in a manner that ensures that all wells installed meet the criteria of being 1) adequately sealed to prevent surface contamination or cross contamination between aquifers; 2) capable of yielding high quality groundwater samples representative of true water quality within the target unit; 3) adequately protected; and 4) in compliance with all applicable State and federal regulations. The procedures set forth in the section apply to all Bhate and contract personnel who are responsible, both directly and indirectly, for the design of monitoring well systems, for oversight of drilling and construction operations, and for evaluation of the suitability and reliability of monitoring wells and data and measurements obtained from monitoring wells.

1.2 Procedure

Monitoring wells are installed primarily to provide information on the hydrogeology of a site and to determine the extent of migration of contaminants, if any. Well permits will be obtained prior to initiating construction, repair, or abandonment of any monitoring well. The drilling subcontractor, who must be certified in the appropriate state, will obtain the permits. The certified well driller or his representative must be present at the site during all drilling operations. All drilling personnel must meet all applicable OSHA requirements. The supervising hydrogeologist must be fully knowledgeable and experienced with federal and state requirements/regulations for groundwater monitoring programs.

Site-specific work plans will specify drilling methods to be used, and will present proposed well design and construction details. The drilling methods, well design, and well construction will adhere to the criteria and methodologies presented in this document. The proposed well design will be based on existing subsurface and groundwater fluctuation data. The design will present these data with the grain size of the filter pack and a discussion of the procedure to be used in the field for determining screen placement. All equipment, well materials and tools that will enter the borehole must be steam cleaned with a high temperature pressure washer (water at 200°F and 1,500 psi) prior to installation. The cleaned materials will be wrapped in clean Visqueen plastic and protected from possible contaminants. If needed, they will be steam cleaned again immediately before installation. The specifications presented herein are to be adhered to unless a site-specific variance has been granted by the appropriate authorities.

1.2.1 Well Design Specifications

Well Screen

In general, the standard monitoring well screen installed at a site will consist of a 2-inch inside diameter Schedule 40 PVC screen with 0.010 inch slots. If site specific conditions warrant, well

screen materials will be designed based on site specific data or selected depending upon the known or suspected chemical contaminants at the site, and so that the completed monitoring well provides data, which meet the project data quality objectives. Monitoring well screens will be sized to retain over 90% of the filter pack. Well screen materials will be of the same size and strength material as the well riser, and will be a non-contaminating, continuous wrap design. Factory-slotted screens will be acceptable for USACE projects as long as the suspected contaminants do not include those that have an affinity for sorbing onto soil particles (e.g., PCBs and PAHs) or metals. In such cases, continuous-wrapped screen will be required. No glues, adhesives, lead shot, or lead wool will be used to connect the riser sections or screen. No field-slotted screen will be permitted.

Filter Pack

The filter pack material will be clean, washed, well-rounded silica sand sized to perform as a filter between the formation material and the well screen. Proper documentation will be furnished concerning the composition, grain-size distribution, cleaning procedure, and chemical analysis. The filter pack gradation shall have a uniformity coefficient (C_u) of not more than 2.5, and shall be sized so that the slotted screen will retain 90 percent of the material.

The standard filter pack material used for monitoring wells will typically conform to the size appropriate for slot screen. The following table provides the appropriate sized filter pack material in accordance with ASTM D 5092-90 (ASTM, 1990).

Table 1-1. Grain Size Distribution Chart

Size of Screen Opening, mm (in.)	Slot No.	Sand Pack Mesh Size Names(s)	1% Passing Size (D-1), mm	Effective Size (D-10), mm	30% Passing Size (D-30), mm
0.125 (0.005)	5	100	0.09 to 0.12	0.14 to 0.17	0.17 to 0.21
0.25 (0.010)	10	20 to 40	0.25 to 0.35	0.4 to 0.5	0.5 to 0.6
0.50 (0.020)	20	10 to 20	0.7 to 0.9	1.0 to 1.2	1.2 to 1.5
0.75 (0.030)	30	10 to 20	0.7 to 0.9	1.0 to 1.2	1.2 to 1.5
1.0 (0.040)	40	8 to 12	1.2 to 1.4	1.6 to 1.8	1.7 to 2.0
1.5 (0.060)	60	6 to 9	1.5 to 1.8	2.3 to 2.8	2.5 to 3.0
2.0 (0.080)	80	4 to 8	2.0 to 2.4	2.4 to 3.0	2.6 to 3.1

In addition to the primary filter pack installed along the screened interval of the monitoring well, a secondary filter pack consisting of finer material will be installed to prevent bentonite pellets from commingling with the primary filter pack.

Well Riser

Well riser (casing) will consist of polyvinyl chloride (PVC) or stainless steel. PVC pipe will be new, threaded, flush-jointed, and as a minimum, conform to the requirements of ASTM F480-81/SDR 13.5 (Schedule 40). PVC pipe will bear markings identifying the material as that specified, and will carry the seal of the National Sanitation Foundation. Stainless steel pipe will consist of new, flush-jointed, and threaded, Type 304, corrosion-resistant steel. Unless noted in the site-specific work plans, monitoring wells will be 2-inch inside diameter (ID).

Bentonite Seal

The bentonite seal will be composed of commercially manufactured sodium bentonite pellets, which do not exceed 0.25-inch diameter. Clean, potable water will be used to hydrate the bentonite.

Annular Seal

The cement grout will consist of a mixture of Portland Cement (ASTM C 150-00) and water in the proportion of approximately 6 to 7 gallons of approved water per bag of cement (94 pounds). In addition, 3 to 5 percent by weight of sodium bentonite powder will be added. The minimum acceptable grout weight will be 14 pounds per gallon (lbs/gal). The cement grout weight will be determined using a mud balance. Water may be added to the mix in small amounts, at the discretion of the field geologist, to achieve pumpability.

1.2.2 Borehole Completion

Procedures for the drilling and advancement of soil borings are presented in BSOP No. 1, Section 4. Drilling techniques employed must minimize disturbance of subsurface samples and must not introduce contamination to the subsurface or allow contaminants, if any, in shallow hydrogeologic units to migrate to deeper units. A Monitoring Well Installation Detail Form (Attachment 1-1) will be completed for each monitoring well. This form includes a comprehensive list of pertinent drilling hydrogeologic and monitoring well construction information.

1.2.3 Well Construction

At all times during the progress of the work, precautions will be taken to prevent tampering with the well or the entrance of foreign material into it. Run-off will be prevented from entering the well during construction.

Depending on site conditions, consideration should be given to overdrill the borehole so that soils that have not been removed or that have fallen into the borehole during auguring or drill stem retrieval will fall to the bottom of the borehole below the depth of the filter pack and the screen. Normally 3 to 5 feet are sufficient for overdrilling. Once the desired depth of the borehole has been attained, the borehole will be prepared for installation of the well casing and

screen. If drilling fluid was used, it must be flushed from the borehole with clean potable water to the extent possible without causing borehole collapse. The well casing/screen assembly will then be inserted into the borehole. For wells that are being installed beneath a confining or semi-confining unit, or are intended to monitor deep members or portions of an aquifer, the well casing/screen assembly will be installed within pre-set surface casing, to prevent cross-connections between different aquifer zones. If a well cannot be properly completed to prevent such an interchange of water between water-bearing zones or to prevent a loss of artesian pressure, the well will be abandoned and plugged.

The casing/screen assembly will be installed as follows:

1. Prior to installation of the casing and screen, the lengths and diameters of all components (including the bottom plug or cap) will be measured and recorded on the Casing/Well Screen Tally Form (Attachment 1-2). The casing riser and screen assembly will be installed round, plumb, and true to line.

2. A bottom plug will be attached to the bottom of the screened section.

3. The well screen will be connected to the riser sections of the casing assembly. For wells intended to monitor the upper surficial aquifer near the water table, the well screen will be installed so as to straddle the free water surface, extending both above and below the water table to accommodate seasonal or other variations in its elevation. In all cases, the top of the screen will be located at least 2 feet below the base of the down-hole seal. Screen slot size will be 0.10 inches, or the appropriate size based on grain-size distribution analyses and filter back design, as discussed above.

4. For wells installed to depths exceeding 50 feet, centralizers will be placed at locations just below the screen, just above the location of the bentonite seal, and at 50-foot intervals along the riser casing. Stabilizers will not be used if their installation prevents the placement of the annular materials.

5. Well risers will extend at least 2.5 feet above the ground surface, unless well casings must be completed at ground surface level as specified by the client or mandated by site conditions and planned use of the well. If a flush finish completion is conducted, the placement of annular materials will be done in such a way that the inside of the well casing is protected, i.e., the protective vault will be waterproof and strong enough to support anticipated loads.

6. The primary filter pack will be placed in the annulus between the well material and borehole using a tremie pipe, starting with the tremie at the bottom of the borehole and working the tremie upward as the filter pack is placed. When using hollow stem augers (HSAs), the augers will be raised incrementally during the installation of the filter pack. Attempts will be made to keep the bottom of the augers below the top of the filter pack during installation. The level of the top of the filter pack in the annulus will be continually verified by tag-line measurement during placement. The filter pack will extend at least 2 feet above the top of the screen. The volume of the installed filter pack will be compared with the annular volume

to verify proper placement of the filter pack. This material accounting will be recorded in the field book.

7. A secondary filter pack, at least 2 feet thick and consisting of material finer than the primary filter pack, but of similar composition, will be placed in the annulus between the primary filter pack and the overlaying bentonite seal. This secondary filter is intended to prevent movement of the seal or grout (or both) into the underlying primary filter pack.

8. A bentonite seal at least 2 feet thick will be placed in increments of four 6-inch lifts immediately above the filter pack. Pouring of the pellets is acceptable for boreholes less than 50 feet where the annular space is large enough to limit the potential for bridging and to allow measurements to ensure that the pellets have been placed at proper intervals. For depths greater than 50 feet, the bentonite pellets will be installed through a tremie pipe. The bentonite pellet seal will be hydrated either by pouring water or utilizing the tremie pipe with an approximately equal volume of clean, potable water, and allowed to hydrate a minimum of 30 minutes between lifts before proceeding. If water is used, its source and the volume used should be documented in the field book. After the placement of the final lift, the bentonite seal will be allowed to hydrate another 2 hours before grouting the remaining annulus. The level of the top of the bentonite seal will be verified by tag-line measurement prior to grouting. When using HSAs, the bottom of the augers will be left in the borehole as close as possible above the bentonite seal.

9. To grout the remaining annular space, a side-discharging tremie pipe will then be maintained 3 feet above the bentonite seal and will be used to slowly place the cement/bentonite grout mixture. When using HSAs, the augers will be pulled incrementally during the grouting procedures to limit borehole collapse. Grout will be pumped into the annulus through the tremie pipe until undiluted grout flows from the borehole at the ground surface. The grout will be allowed to cure for at least 24 hours prior to development.

1.2.4 Double Cased Wells

Surface casing will be installed in the borehole when drilling a monitoring well that will be installed at depths below relatively impermeable (confining) layers or below depths of known contamination. The purpose of the surface casing is to prevent cross-contamination between two aquifer zones and to prevent dragging contamination down to a greater depth during the drilling procedure.

A pilot borehole should be drilled and the surface casing installed to slightly below the known depth of contamination or a minimum of 2 feet into the confining layer. The diameter of the surface casing will be sufficient to contain the inner casing and a 2-inch annular space. The size of the borehole should be sufficient to maintain a 2-inch annular space between the borehole walls and the surface casing. The material of the surface casing may vary, but it will be chemically inert and able to withstand potential chemical degradation and any forces exerted on the casing during its installation and monitoring well construction.

The outer casing should be grouted by the tremie method from the bottom to within 2 feet of the ground surface. The grout should be pumped into the annular space between the outer casing and the borehole wall. This will be accomplished by either placing the tremie tube in the annular space and pumping the grout from the bottom of the borehole to the surface, or placing a grout shoe or plug inside the casing at the bottom of the borehole and pumping the grout through the bottom grout plug and up the annular space on the outside of the casing. If the casing is set into very tight clay, both of the above methods may have to be used, because the clay usually forms a tight seal in the bottom and around the outside of the casing preventing grout from flowing freely during grout injection. A minimum of 24 hours will be allowed for the grout seal to cure before attempting to drill through it. The grout mixture used to seal the outer annular space will be a neat cement mixture of one 94-lb bag of Type I Portland Cement per approximately 7 gallons of water and 3 to 5 percent bentonite powder by weight.

When drilling through the seal, care will be taken to avoid cracking, shattering, and/or washing out the seal. If caving conditions exist such that the outer casing cannot be sufficiently sealed by grouting, the out casing should be driven into place and a grout seal placed in the bottom of the casing. Removal of outer casings, which are sometimes called temporary surface casings, after the well screens and casings have been installed and grouted, is not acceptable. Trying to remove outer surface casings after the inner casings have been grouted could jeopardize the structural integrity of the well. The boring will be advanced through the surface casing to the target depth for monitoring well installation. The borehole beneath the surface casing will be of sufficient diameter to maintain a 2-inch annular space between the monitoring well and the borehole well.

1.2.5 Well Head Completion

Upon completion of the well, a suitable vented cap will be installed on the top of the well riser. The well riser will be surrounded by a larger diameter protective steel or PVC casing rising approximately 3 feet above ground level and set a minimum of 2 feet below the ground surface into the cement grout backfill. A drain hole at least 0.25 inches in diameter will be drilled at the base of the protective casing. The protective casing will be provided with a locking cap and a brass padlock or the well casing will be secured with a plastic expansion cap locked with a hexagonal key. All locks used at a particular site will be keyed alike. If wells are required to be finished flush with the grout or pavement, these will be fitted with a watertight, flush-mounted, traffic-rated steel cover at least 6 inches larger in diameter than the well riser. The well casing will be secured with a plastic expansion cap locked with a hexagonal key.

A minimum 3-foot by 3-foot by 4-inch thick concrete pad, sloped away from the well, will be constructed around the monitoring well with the top outer edge at the final ground elevation. At locations where vehicular traffic is likely, the concrete pad will be reinforced with reinforcement wire or rebar. Three or four 3-inch diameter or larger concrete-filled steel or PVC posts will be equally spaced around the well and cemented in place around the concrete pad. The base of these posts shall extend 2 feet bls and be appropriately 3 feet tall. Metal rebar may be installed inside the posts for additional stabilization. The concrete pad surface immediately surrounding

the top of the well will be sloped away from the well. After the well is installed, the area will be cleaned and all discarded material will be properly disposed.

1.2.6 Documentation and Recording

In addition to providing standard field documentation procedures, a Monitoring Well Construction Form (Attachment 1-1) will be prepared to provide an accurate "as-built" diagram of each well and will include the following information:

- Project and site names, well number and the total depth of the completed well
- Depth of any grouting or sealing, and the amount of cement and/or bentonite used, and to the total borehole depth and elevation
- Depth, elevation, and type of well casing
- Installation date or dates, and name of the driller and the geologist installing the well
- All pertinent construction details of monitoring wells, such as depth to and description of all annular fill materials; gradation of filter packs; length, location (depth and elevation), diameter, slot size, material, and manufacturer of well casing and screen; position of centralizers; and location of any blank pipe or intermediate casing installed in the well
- Description of surface completion, including protective steel casing, protective pipes, and concrete surface seal
- Surveyed coordinates and elevation of top of ground and top of well riser. The accuracy of the survey points will be in accordance with BSOP No. 11.
- A brief stratigraphic log, showing depths to and descriptions of major lithologic changes encountered in the well borehole

A discussion of information to include in the boring logs is presented in BSOP No. 1. All original well record form, field report forms and geologist logs will be maintained in the project file.

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ATTACHMENT 1-1

MONITORING WELL INSTALLATION DETAIL FORM

Bhate Environmental Associates — **WELL CONSTRUCTION DIAGRAM (Flush Mount)**

Project/Phase: _____
Location: _____
Client: _____
Drilling Contractor: _____
Driller: _____
Geologist: _____

Well/Boring No.: _____
Drilling Method: _____
Date(s): _____
Northing (NAD 83): _____
Easting (NAD 83): _____
Bhate Project #: _____

NOT TO SCALE

Surface Elevation: _____

Top of Casing Elevation: _____

Borehole Diameter (in): _____

Well Casing Diameter (in): _____

Depth to Water (ft)
During Drilling: _____
Date _____
Pre Development: _____
Date _____
Post Development: _____
Date _____

Top of Bentonite Seal: _____

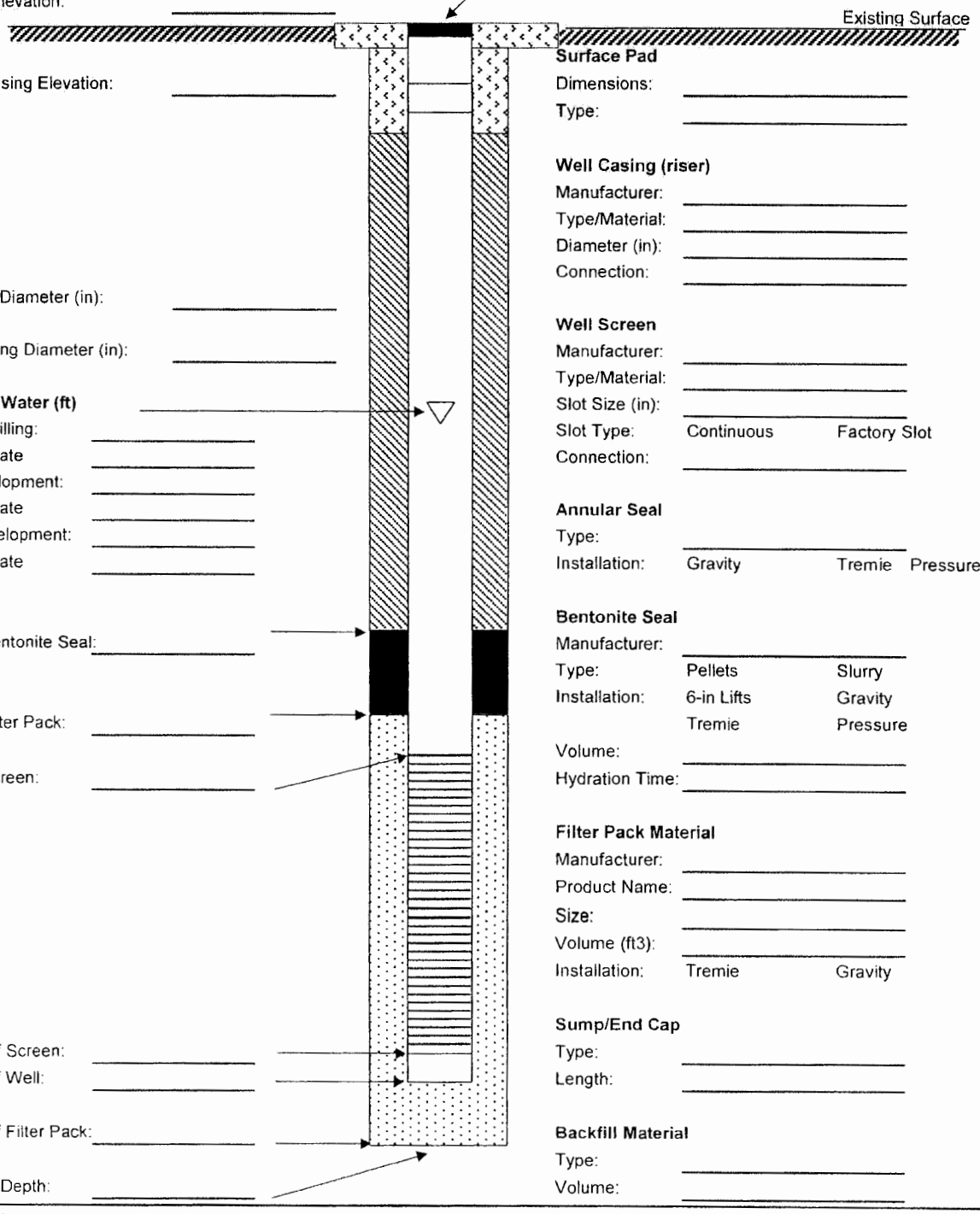
Top of Filter Pack: _____

Top of Screen: _____

Bottom of Screen: _____
Bottom of Well: _____

Bottom of Filter Pack: _____

Borehole Depth: _____



Protective Casing
Type: _____
Dimensions: _____
Length: _____

Surface Pad
Dimensions: _____
Type: _____

Well Casing (riser)
Manufacturer: _____
Type/Material: _____
Diameter (in): _____
Connection: _____

Well Screen
Manufacturer: _____
Type/Material: _____
Slot Size (in): _____
Slot Type: Continuous Factory Slot
Connection: _____

Annular Seal
Type: _____
Installation: Gravity Tremie Pressure

Bentonite Seal
Manufacturer: _____
Type: Pellets Slurry
Installation: 6-in Lifts Gravity
Tremie Pressure
Volume: _____
Hydration Time: _____

Filter Pack Material
Manufacturer: _____
Product Name: _____
Size: _____
Volume (ft3): _____
Installation: Tremie Gravity

Sump/End Cap
Type: _____
Length: _____

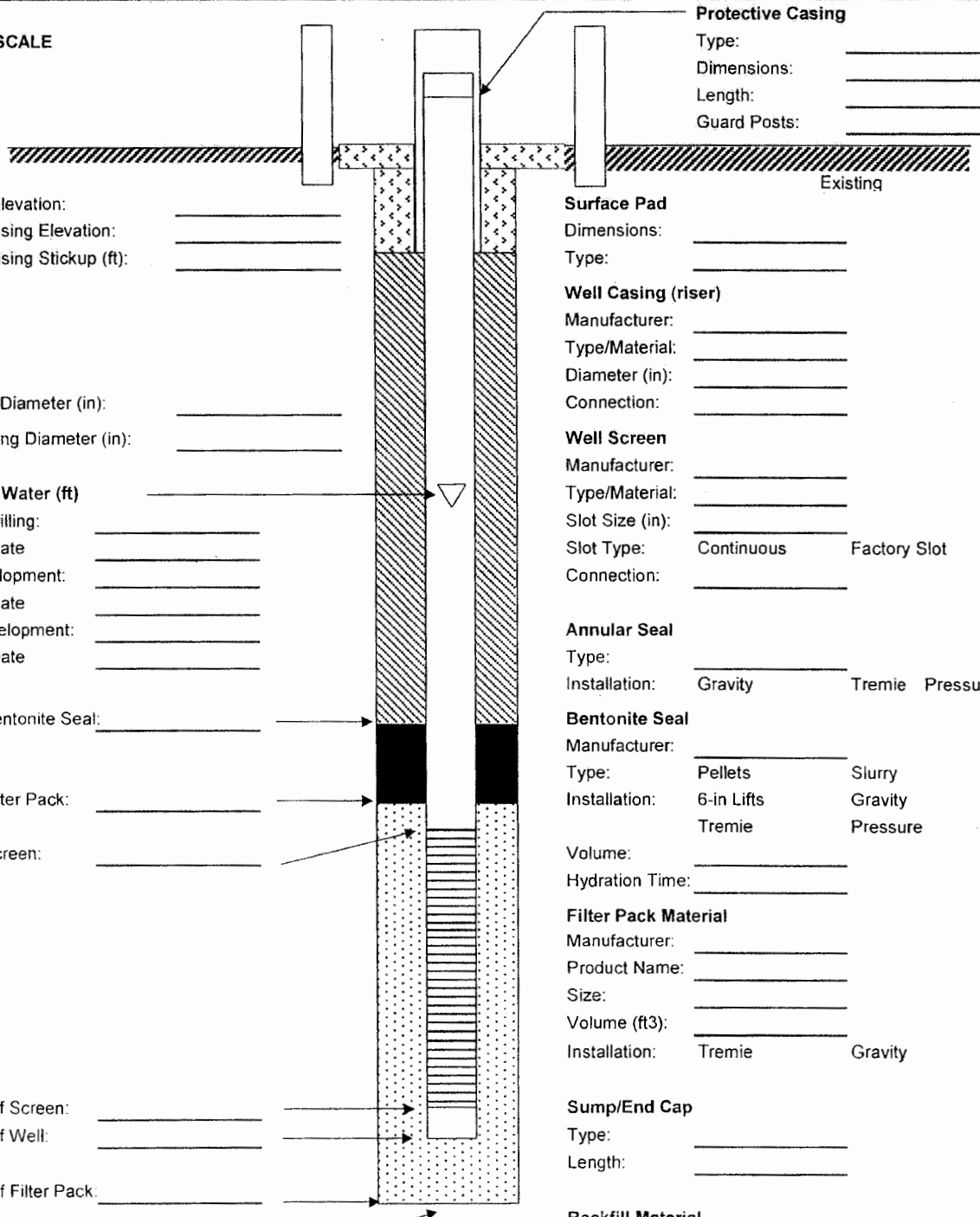
Backfill Material
Type: _____
Volume: _____

Comments:

Bhate Environmental Associates **WELL CONSTRUCTION DIAGRAM (Above Grade)**

Project/Phase: _____ Well/Boring No.: _____
Location: _____ Drilling Method: _____
Client: _____ Date(s): _____
Drilling Contractor: _____ Northing (NAD 83): _____
Driller: _____ Easting (NAD 83): _____
Geologist: _____ Bhate Project #: _____

NOT TO SCALE



Protective Casing
Type: _____
Dimensions: _____
Length: _____
Guard Posts: _____

Surface Elevation: _____
Top of Casing Elevation: _____
Top of Casing Stickup (ft): _____

Borehole Diameter (in): _____
Well Casing Diameter (in): _____

Depth to Water (ft)
During Drilling: _____
Date _____
Pre Development: _____
Date _____
Post Development: _____
Date _____

Top of Bentonite Seal: _____
Top of Filter Pack: _____
Top of Screen: _____

Bottom of Screen: _____
Bottom of Well: _____
Bottom of Filter Pack: _____
Borehole Depth: _____

Surface Pad
Dimensions: _____
Type: _____

Well Casing (riser)
Manufacturer: _____
Type/Material: _____
Diameter (in): _____
Connection: _____

Well Screen
Manufacturer: _____
Type/Material: _____
Slot Size (in): _____
Slot Type: Continuous Factory Slot
Connection: _____

Annular Seal
Type: _____
Installation: Gravity Tremie Pressure

Bentonite Seal
Manufacturer: _____
Type: Pellets Slurry
Installation: 6-in Lifts Gravity
Tremie Pressure
Volume: _____
Hydration Time: _____

Filter Pack Material
Manufacturer: _____
Product Name: _____
Size: _____
Volume (ft3): _____
Installation: Tremie Gravity

Sump/End Cap
Type: _____
Length: _____

Backfill Material
Type: _____
Volume: _____

Comments:

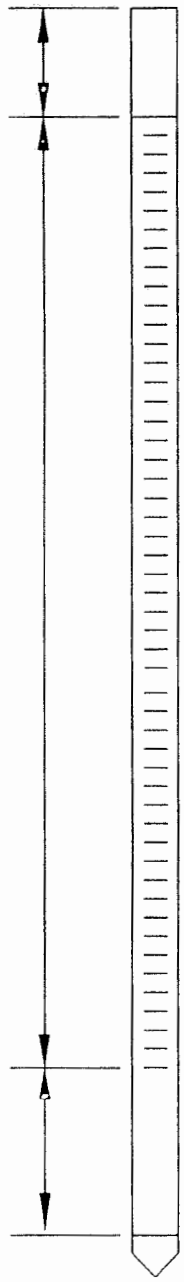
ATTACHMENT 1-2

CASING/WELL SCREEN TALLY FORM

BHATE
Environmental Engineers and Scientists

CASING TALLY

WELL NUMBER _____

ITEM NO.	DESCRIPTION	LENGTH (FEET)	SCREEN DIAGRAM
			

PROJECT NAME: _____ CLIENT: _____

PROJECT NUMBER/PHASE: _____ PROJECT LOCATION: _____

DRILLING MTHD: _____

DATE STARTED: _____ DATE FINISHED: _____ ENGINEER/GEOLOGIST: _____

ATTACHMENT 2-1

WATER LEVEL DATA SUMMARY FORM

WATER-LEVEL DATA SUMMARY

Project Name/Number	**Date**
	Field Personnel #1
Site Name	**Field Personnel #2**
Client	**Field Personnel #3**
Survey Datum (NGVD)	**Weather (previous 24 hours)**
Measuring Device	

Well Number	Time (hhmm)	Measuring Point		Depth to Water (ft, TOC)	Elevation of Water (ft, NGVD)
		Description	Elevation (ft, NGVD)		

Notes: NGVD = National Geodetic Vertical Datum
TOC = Top of Well Casing

Comments/Observations

ATTACHMENT 3-1

MONITORING WELL DEVELOPMENT LOG

Monitoring Well Development Log

Page ____ of ____

Date Started (yr/mo/day) _____ Data Completed (yr/mo/day) _____

Field Personnel _____

Project _____

Site Name _____

Job No. _____ Well ID _#_____

____Upgradient _____Downgradient _____Sidegradient

Weather Conditions _____

Air Temperature _____ °F

Total WellDepth (TWD)
From Top of Casing (TOC)= _____ 1/100 ft

Depth to Ground Water (DGW)
From Top of Casing (TOC)= _____ 1/100 ft

Length of Water Column (LWC) = TWD – DGW = _____ 1/100 ft

1 Casing Volume (OCV) – LWC x ____ = _____ gallons

5 Casing Volumes = _____ gallons

Method of Well Development _____

_____

Total Volume of Water Removed _____ gallons

Date/Time	Discharge Rate (gpm)	Cumulative Volume Purged (gallons)	Water Temperature (°C)	pH	Eh	Specific Conductivity (umhos/cm)	Turbidity/Color (NTUs)	Dissolved Oxygen (mg/L)	Sand Content (%)	Remarks

COMMENTS/OBSERVATIONS: _____

Monitoring Well Development Log (Continued)

Page ____ of ____

Project_____

Job No._____ Well ID No._____

Date/Time	Discharge Rate (gpm)	Cumulative Volume Purged (gallons)	Water Temperature (°C)	pH	Eh	Specific Conductivity (umhos/cm)	Turbidity/Color (NTUs)	Dissolved Oxygen (mg/L)	Sand Content (%)	Remarks

COMMENTS/OBSERVATIONS:_____

ATTACHMENT 4-1

FIELD DATA INFORMATION LOG FOR GROUNDWATER SAMPLING

Field Data Information Log for Groundwater Sampling

Page ____ of ____

Date Started (yr/mo/day) _____
Field Personnel _____
Site Name _____
Job No. _____
Well ID _#_____
____Upgradient _____Downgradient _____Sidegradient
Weather Conditions _____
Air Temperature _____°F
Total WellDepth (TWD) = _____1/100 ft
Depth to Ground Water (DGW) = _____1/100 ft
Length of Water Column (LWC) = TWD – DGW = _____1/100 ft
1 Casing Volume (OCV) – LWC x _____ = _____gallons
_____gal = Standard Evacuation Volume
Method of Well Evacuation _____
Method of Sample Collection _____
Total Volume of Water Removed _____gallons

Casing Diameter _____inches
Casing Material _____
Measuring Point Elevation _____1/100 ft
Height of Riser (above land surface) _____1/100 ft
Land Surface Elevation _____1/100 ft
Screened Interval _____1/100 ft
Dedictated Pump or Bailer YES___ NO____ Type _____
Steel Guard Pipe Around Casing YES___ NO____
Locking Cap YES___ NO____
Protective Post/Abutment YES___ NO____
Well Integrity Satisfactory YES___ NO____
Well Yield LOW_____ MODERATE_____ HIGH_____
Comments/Observations _____

FIELD ANALYSES

VOLUME PURGED (gallons)							
Pumping Rate (gpm)							
TIME (military)							
pH (S.U.)							
Specific Conductivity							
Water Temp (°C)							
Dissolved Oxygen (mg/L)							
Oxidation Reduction Potentail (ORP) (mV)							
Water Level (ft/TOC)							

COMMENTS/OBSERVATIONS: _____

Field Data Information Log for Groundwater Sampling (Continued)

Site Name_____

Job No._____ Well ID No._____

FIELD ANALYSES							
VOLUME PURGED (gallons)							
Pumping Rate (gpm)							
TIME (military)							
pH (S.U.)							
Specific Conductivity							
Water Temp (°C)							
Dissolved Oxygen (mg/L)							
Oxidation Reduction Potentail (ORP) (mV)							
Water Level (ft/TOC)							

COMMENTS/OBSERVATIONS:_____

FIELD ANALYSES							
VOLUME PURGED (gallons)							
Pumping Rate (gpm)							
TIME (military)							
pH (S.U.)							
Specific Conductivity							
Water Temp (°C)							
Dissolved Oxygen (mg/L)							
Oxidation Reduction Potentail (ORP) (mV)							
Water Level (ft/TOC)							

COMMENTS/OBSERVATIONS:_____

APPENDIX A

SUMMARY OF PREVIOUS INVESTIGATIONS AT SD-08: SECTION 4.1 OF TABLE 1 PHASE II RFI (FOSTER WHEELER/RADIAN, JUNE 1995)

4.1 SWMU 82—Building 131 Washrack (IRP Site SD-08)

Organochlorine pesticides and metals were detected in the shallow soils at SWMU 82 (the Building 131 Truck Washrack); organochlorine pesticides were also detected in the groundwater during the 29 Sites RI. The associated risk evaluation concluded that pesticide concentrations in soil pose an occupational health risk. To mitigate this risk, the site entered into the FS/CMS process, which established cleanup criteria for health-based RAOs, estimated an area exceeding these cleanup criteria, and recommended the emplacement of an impermeable cap. The cap will eliminate the occupational risk by eliminating the dermal and inhalation exposure pathway. The Phase II RFI delineated the extent of organochlorine pesticide contamination in the groundwater. SWMU 82 is recommended for long-term groundwater monitoring to ensure that the remedial action is preventing further degradation of groundwater.

4.1.1 SWMU Description

SWMU 82 is located in the southeastern corner of the refuse collection yard near Building 131. The refuse collection yard is located southwest of the Petroleum, Oil, and Lubricant (POL) Storage Area and east of the Main Base area. The yard occupies approximately one-half acre and is surrounded by a chain-link fence. The yard is unpaved and has sparse vegetation only along the fence. The topography of the site is generally flat. Figure 1-2 shows the location of SWMU 82 on Holloman AFB, and Figure 4.1-1 shows the site layout.

The washrack was installed in 1942 and consisted of a rectangular concrete pad (approximately 1000 ft^2). Refuse collection trucks were washed with soap and water at the washrack. Base records indicate that pesticides were routinely sprayed inside the trucks during the 1970s for fly control; however, this practice ceased in 1982. Drains located at the north end of the washrack connected to a sewer line that carried wastewater to an oil/water separator near the northwest corner of the washrack. According to site personnel, it was common for the sewer line to clog, causing the sump and oil/water separator to overflow onto the surrounding soil. The washrack contained cracks in the concrete and was replaced in 1992 with a new washrack in the same location.

Geology and Hydrogeology

Three monitor wells were installed during the Phase II RFI to a depth of 16.5 ft bgl. Drilling logs from these wells indicate that the stratigraphy at SWMU 82 consists primarily of silty and clayey sands. A layer of poorly-graded sand interbedded with thin layers of caliche and clayey sands was encountered in the boring closest to the washrack. Drilling logs from the *29 Sites RI* (Radian, 1992b) also indicated the presence of a sand layer within the silty sand unit. This sand layer was not encountered in borings for the two wells installed further downgradient of the washrack. Phase II RFI drilling logs, presented in Appendix B.1, provide a detailed description of the site lithology.

Groundwater was encountered at 9 to 10 ft bgl at SWMU 82. Water level data collected during groundwater sampling at the site confirmed that the groundwater flow is to the northeast, as shown in Figure 4.1-2.

4.1.2 Phase I Activities

The site was identified in the *IRP Phase I Records Search* (CH2M Hill, 1983). As a result, the site was investigated under Phase I of the IRP as Site SD-08 in 1991. During the 29 Sites RI, soil samples were collected from six soil borings drilled in areas of potential contamination. Metals and organochlorine pesticides were detected in the surface soils at the site. The highest concentrations were detected in soil borings SB-08-01 and SB-08-02 drilled near the southeastern corner of the washrack. Groundwater samples were collected from three monitor wells. Organochlorine pesticides and VOCs were detected in the groundwater. The highest concentrations of organochlorine

pesticides were detected in the downgradient monitor well MW-08-03. Sample locations are shown in Figure 4.1-1.

A preliminary risk-based screen was conducted for SWMU 82 as part of the 29 Sites RI. The screen indicated that organochlorine pesticide concentrations in the soil pose an unacceptable risk to human health and the environment (Radian, 1992b).

Because surface soils at SWMU 82 pose an unacceptable human health risk, remedial action was recommended. In addition, further investigation was recommended to define the extent of organochlorine pesticides and metals contamination in the soil and organochlorine pesticides in the groundwater at the site.

After reviewing the *29 Sites RI* (Radian, 1992b), EPA Region VI issued a letter, received by the Base on 3 November 1992, requesting:

- The installation of additional soil borings to define the extent of soil contamination around the northwestern perimeter of the washrack;
- The installation of additional monitor wells to delineate the full extent of pesticide contamination in the groundwater;
- The definition of the source and extent of VOCs present in monitor well MW-08-01; and
- The notification of a newly identified SWMU and associated releases.

The highest concentrations of VOCs were detected in the upgradient monitor well MW-08-01. On the basis of site history and investigation results, it was concluded that VOC concentrations detected in the groundwater were not due to site activities (Radian, 1992b). Holloman AFB identified a new AOC and is currently investigating the area.

4.1.3 Phase II Activities

The following additional investigations were conducted at SWMU 82 to address EPA Region VI concerns and implement the site recommendations:

- The corrective measures study in 1992;
- The feasibility study in 1993; and
- The Phase II RFI in 1994.

To select the appropriate remedial action, SWMU 82 was entered into the FS/CMS process. The *CMS Plan* (Radian, 1992a) established health-based RAOs for soil contamination at the site. The RAOs for the site are to prevent an unacceptable health risk posed to site workers by dermal contact and inhalation of contaminated soils. The cleanup criteria are presented in Table 4.1-1.

To determine the vertical and lateral extent of soil contamination exceeding the cleanup criteria, a predesign investigation was conducted in 1993. During the predesign investigation, 14 soil borings were installed to the groundwater table. Soil boring locations are shown in Figure 4.1-1.

To determine the extent of organochlorine pesticides in the groundwater, the Phase II RFI was conducted in 1994. During the investigation, groundwater samples were collected from seven temporary standpipes, installed using a direct push technology (DPT) rig, and located downgradient of SWMU 82. The samples were submitted to the laboratory for organochlorine pesticide analysis. The results of the DPT groundwater samples were used to place three new monitor wells downgradient of the SWMU. Groundwater samples were collected from the three new wells (MW-08-05, MW-08-06, and MW-08-07) and two existing wells (MW-08-03 and HSTE-10-MW-01). The monitor well locations are shown in Figure 4.1-2.

Table 4.1-1
Remedial Action Objectives for SWMU 82

Objective	Contaminant	Cleanup Criteria (mg/kg)	Site Condition
Prevent dermal contact with contaminated soil above the cleanup criteria.	4,4-DDD	4.0	Contaminated soil below the cleanup criteria does not present an occupational health risk.
	4,4-DDE	3.3	
Prevent inhalation of contaminated soil above the cleanup criteria.	4,4-DDT	1.1	
	Cadmium	0.29	
	Chlordane	0.14	
	Lead	12	
	Mercury	0.016	

Field Screening Results

The groundwater samples collected from the DPT locations were analyzed for organochlorine pesticides using EPA Method SW8080.

Concentrations of delta-BHC and alpha-BHC were detected at or below the detection limits. A concentration of 4,4'-DDD was detected below the detection limit in location HP-08-06. A concentration of gamma-BHC was measured at the detection limit in location HP-08-02. The results of the field screening were used to place one monitor well (MW-05) immediately downgradient, and two wells further downgradient of the SWMU. The field screening results are presented in Table B.6-1 of Appendix B.6.

Analytical Results

Soil samples collected at SWMU 82 were analyzed for cadmium, lead, mercury, and organochlorine pesticides using EPA Methods SW6010, SW7421, SW7471, and SW8080, respectively. The analytical results were presented in the *FS Report* (Radian, 1993b) and Table 4.1-2 was adapted from that report.

The area exceeding the cleanup criteria at SWMU 82 was estimated to be 20,800 sq. ft and encompasses the southern half of the refuse yard (Radian, 1993b). The estimated extent is shown in Figure 4.1-1. The depth of affected soils was estimated to extend to 2 ft bgl, except in the immediate vicinity of soil borings SB-08-04, SB-08-06, and SB-08-11, where contamination was detected to 4 ft bgl. The greatest number of analytes and the highest concentrations were detected in soil borings SB-08-01 and SB-08-02 near the northeastern edge of the washrack. A total volume of 1540 yd^3 was estimated to exceed the cleanup criteria at SWMU 82. The recommended remedial alternative for achieving the RAOs is source containment by constructing an impermeable cap over the affected soils.

All groundwater samples collected from monitor wells were analyzed for organochlorine pesticides using EPA Method SW8080. The analytical results are presented in Table 4.1-3. The greatest number and highest concentrations of organochlorine pesticides were detected in the monitor wells (MW-08-03 and MW-08-05) located immediately downgradient of the SWMU. Monitor wells located further downgradient contained concentrations below detection limits. Concentrations of 4,4'-DDD and delta-BHC were detected below the detection limits in the samples. Similar concentrations of delta-BHC were detected in the laboratory method blanks, making its presence in

the samples uncertain and likely due to low-level laboratory contamination. Concentrations of heptachlor epoxide were detected in monitor wells MW-08-03 (0.16 µg/L) and MW-08-05 (0.033 µg/L).

4.1.4 Conclusions

The lateral and vertical extent of organochlorine pesticide and metal concentrations in soil has been delineated. Contaminant concentrations were found to be highest in the southeastern corner of the refuse yard near and around the washrack. The concentrations pose an occupational health risk, and the selected corrective action to mitigate the risk is source containment by the emplacement of an impermeable cap over the affected soils. Once the remedial action has been implemented, the exposure pathways to soil will be eliminated. As a result, the occupational health risk will also be eliminated.

Elevated organochlorine pesticide concentrations were detected only in the two monitor wells nearest the site.

4.1.5 Recommendations

Voluntary corrective action (VCA) is recommended for SWMU 82. The recommended impermeable cap should be constructed over the soil with contaminants exceeding the health-based cleanup criteria. SWMU 82 is also recommended for long-term groundwater monitoring (using existing wells) to ensure that the remedial action prevents degradation of groundwater.

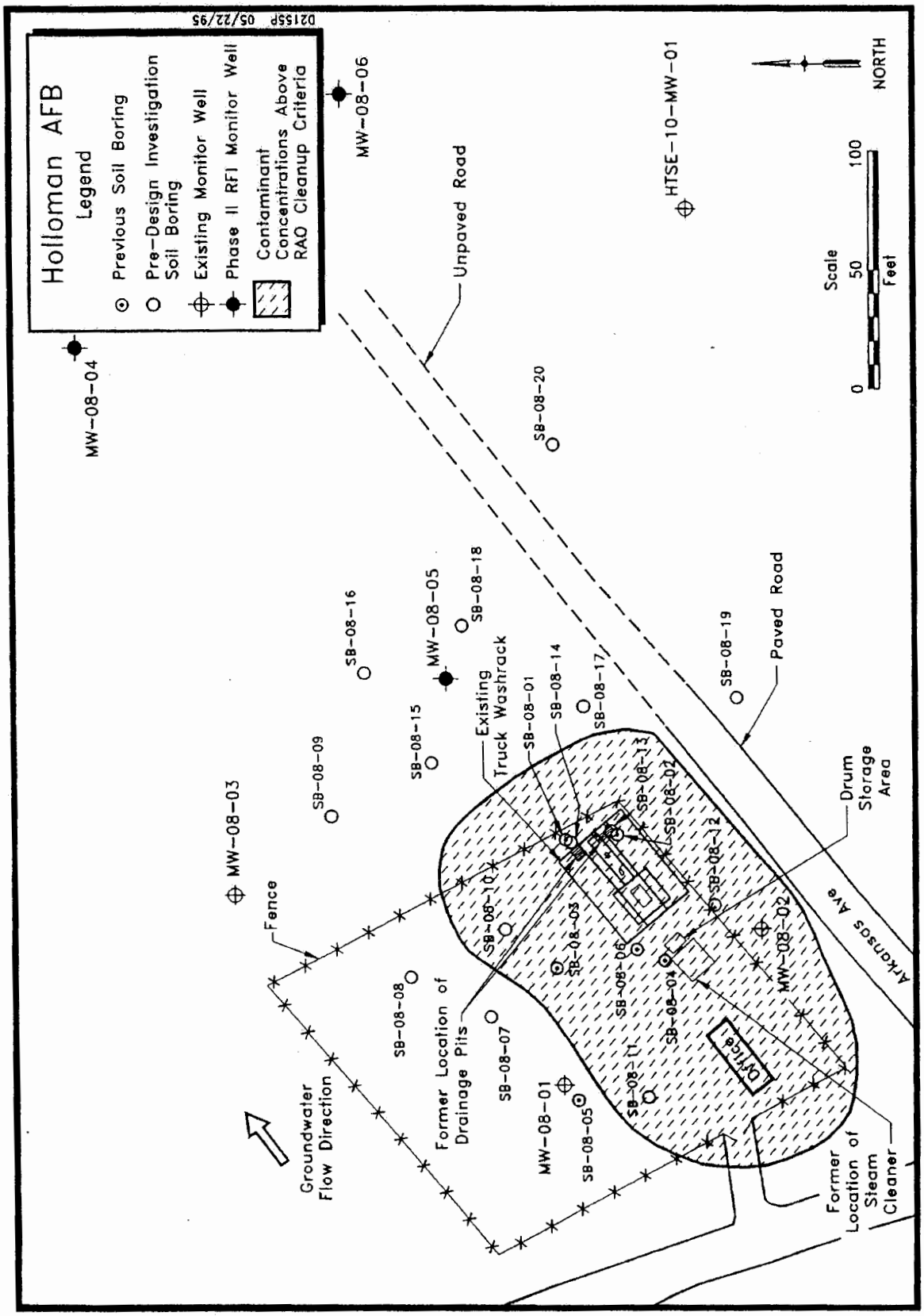


Figure 4.1-1. SWMU 82 - Soil Sample Locations

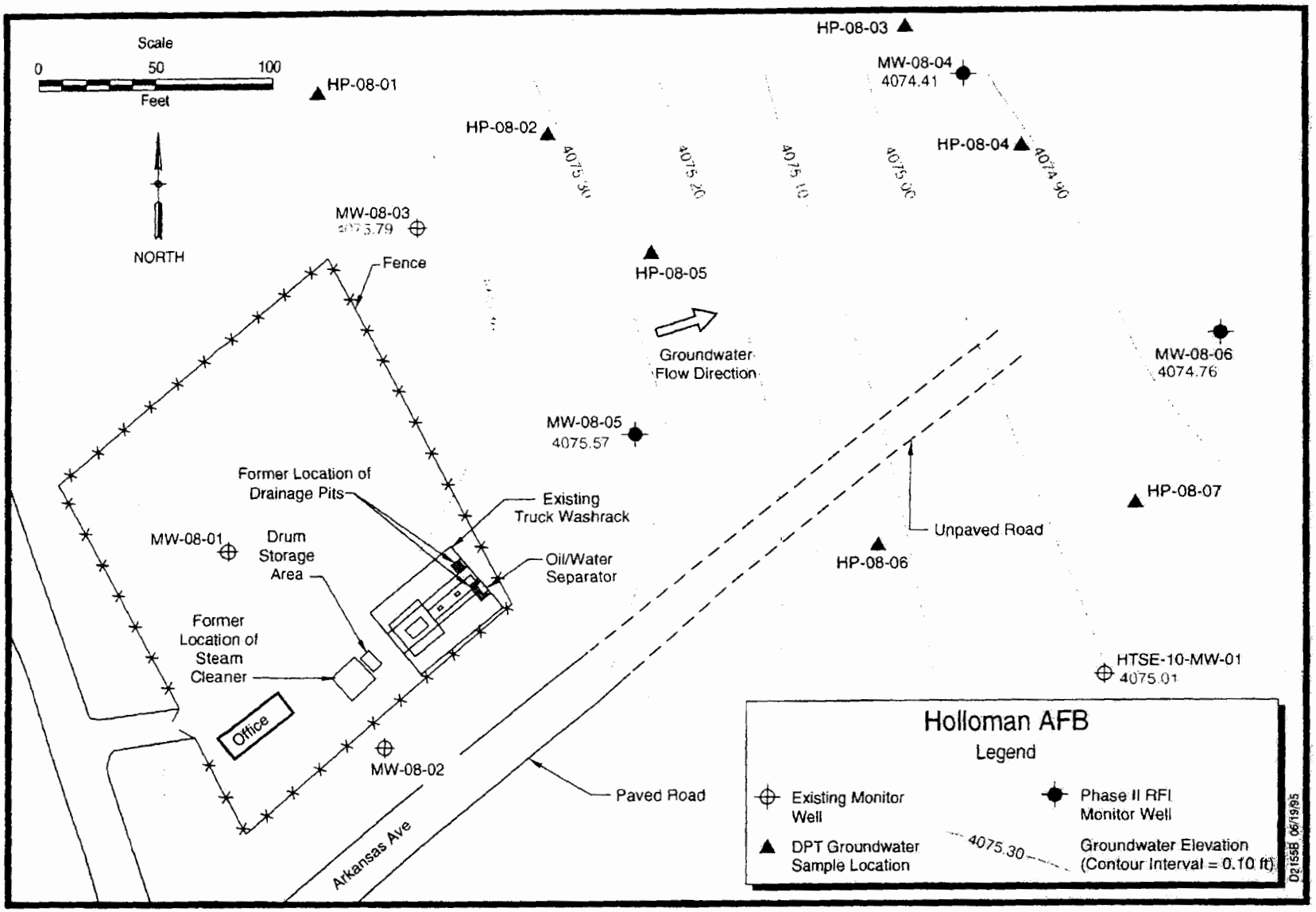


Figure 4.1-2. SWMU 82 - Groundwater Sample Locations

Table 4.1-2
Analytical Results for SWMU 82 Soil Samples

Location ID		SB-08-01	SB-08-01	SB-08-02	SB-08-02	SB-08-03	SB-08-03	SB-08-04	SB-08-04	SB-08-05
Total Depth (ft)		0 - 2	6 - 8	0 - 2	5 - 7	0 - 2	10 - 12	0 - 2	2 - 4	2 - 4
SW6010 (mg/kg)	Cadmium	0.92	ND	1.8	ND	ND	ND	ND	ND	ND
SW7421 (mg/kg)	Lead	50	1.1	370	2.3	19	0.3	8.1	18	2
SW7471 (mg/kg)	Mercury	0.49	ND	2.2	ND	0.11	ND	0.8	ND	ND
SW8080 (µg/kg)	4,4'-DDD	110	ND	4000	1.0X	28	ND	230	ND	ND
	4,4'-DDE	410	ND	5600	10	86	ND	530	3.3	1.0
	4,4'-DDT	400	ND	9300	12	26	ND	500	ND	ND
	Chlordane	950	ND	4000	20	230	ND	730	ND	ND
	Heptachlor	6.3	0.3	56	0.9	ND	0.9	12	0.3	0.4

Location ID		SB-08-05	SB-08-06	SB-08-06	SB-08-07	SB-08-08	SB-08-09	SB-08-10	SB-08-10	SB-08-11
Total Depth (ft)		6 - 8	2.5 - 4.5	7.5 - 9.5	0 - 2	0 - 2	0 - 2	0 - 2	2 - 4	0 - 2
SW6010 (mg/kg)	Cadmium	ND	0.92	ND	ND	NA	NA	3.71	NA	ND
SW7421 (mg/kg)	Lead	0.75	1	1.3	9.22	NA	NA	69.9	NA	10.6
SW7471 (mg/kg)	Mercury	ND	ND	ND	ND	NA	NA	0.297	NA	0.068
SW8080 (µg/kg)	4,4'-DDD	ND	3.2	4.0	56.4	9.4	3.4	116	1.5	21.0
	4,4'-DDE	ND	ND	.08X	52.1	8.1	9.0	88.4	1.4	23.3
	4,4'-DDT	ND	1.3	2.0	46.7	5.6	8.3	82.5	2.6	20.6
	Chlordane	ND	17	32	89.5B	85.9	3.6	263 B	2.9B	57.7B
	Heptachlor	ND	ND	ND	4.1	3.3	ND	8.9P	ND	493

Location ID		SB-08-11	SB-08-12	SB-08-12	SB-08-13	SB-08-13	SB-08-13	SB-08-14	SB-08-14	SB-08-15
Total Depth (ft)		2 - 4	0 - 2	2 - 4	0 - 2	2 - 4	4 - 6	2 - 4	4 - 6	0 - 2
SW6010 (mg/kg)	Cadmium	NA	NA	ND	NA	ND	NA	ND	NA	NA
SW7421 (mg/kg)	Lead	NA	NA	2.8	NA	9.11	NA	7.25	NA	NA
SW7471 (mg/kg)	Mercury	NA	NA	ND	NA	ND	NA	ND	NA	NA
SW8080 (µg/kg)	4,4'-DDD	ND	65P	ND	492	1.8P	4.9	ND	1.0	1.7
	4,4'-DDE	ND	1850	12.0	2500	1.8	12.1	2.9	5.9	6.1
	4,4'-DDT	ND	2740	7.9	4210	15.6	18.4	3.7	6.0	3.5
	Chlordane	238	51.1B	ND	386	23.4	1.8	1.2	2.9	3.4
	Heptachlor	343	ND	ND	7.8	2.5	ND	ND	ND	ND

Table 4.1-2
(Continued)

Location ID		SB-08-15	SB-08-16	SB-08-17	SB-08-17	SB-08-18	SB-08-19	SB-08-19	SB-08-20	SB-08-20
Depth (ft)		2-4	0-2	0-2	2-4	0-2	0-2	2-4	0-2	2-4
SW6010 (mg/kg)	Cadmium	NA	NA	ND	NA	NA	ND	NA	NA	NA
SW7421 (mg/kg)	Lead	NA	NA	7.44	NA	NA	0.726	NA	NA	NA
SW7471 (mg/kg)	Mercury	NA	NA	ND	NA	NA	ND	NA	NA	NA
SW8080 (µg/kg)	4,4'-DDD	1.9	1.5	ND	ND	91.2	1.3	ND	ND	ND
	4,4'-DDE	4.0	10.2	106	8.9	696	1.2	ND	7.8	ND
	4,4'-DDT	4.0	8.1	29.6	4.4	707	3.4	ND	10.0	ND
	Chlordane	2.2	ND	ND	ND	21.6B	2.8	ND	ND	ND
	Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND

Note: Adapted from the *FS* (Radian, 1993b).
Note: Samples from SB-08-01 through SB-08-06 were collected during the 29 Sites RI (Radian, 1992b). Soil samples from SB-08-07 through SB-08-20 were collected during the predesign investigation. Only those analytes included in the RAOs are listed.

ND = Not detected, detected below method detection limit, or detected below reporting limit.
B = Analyte detected in method blank.
P = Analyte not confirmed.
X = Presence of analyte confirmed by second-column analysis, but quantitation not confirmed.

Table 4.1-3
Analytical Results for SWMU 82 Groundwater Samples

Location ID		HSTE-10		MW-08-03		MW-08-04		MW-08-05		MW-08-06	
SW8080 (µg/L)	4,4'-DDD	0.014 J	(0.031)	0.046	(0.031)	ND	(0.031)	0.0042 J	(0.031)	ND	(0.031)
	4,4'-DDE	ND	(0.052)	0.099	(0.052)	ND	(0.052)	ND	(0.052)	ND	(0.052)
	Endosulfan I	ND	(0.021)	0.046	(0.021)	ND	(0.021)	ND	(0.021)	ND	(0.021)
	Endosulfan II	ND	(0.01)	0.035	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	Heptachlor epoxide	ND	(0.013)	0.16	(0.013)	ND	(0.013)	0.033	(0.013)	ND	(0.013)
	alpha-BHC	ND	(0.013)	ND	(0.013)	ND	(0.013)	ND	(0.013)	ND	(0.013)
	delta-BHC	0.0051 JB	(0.023)	ND	(0.023)	0.0065 JB	(0.023)	ND	(0.023)	0.003 JB	(0.023)
	gamma-BHC	ND	(0.013)	0.010 J	(0.013)	ND	(0.013)	ND	(0.013)	ND	(0.013)

B = Reported analyte concentration may be due to analytical background (or noise) from the laboratory.
J = Estimated concentration; analyte measured below the detection limit.
ND = Not detected. No instrument response for analyte or result less than zero.
( ) = Detection limit.

APPENDIX B

LITHOLOGIC LOGS AND WELL CONSTRUCTION RECORDS FROM PREVIOUS INVESTIGATIONS AT SD-08

DRILLING LOG

HOLE NO. SB-08-01

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 08
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 672303.42(Y), 554783.76(X)
	9. SURFACE ELEVATION 4085.81
	10. DATE STARTED 7 AUG 91 / 11. DATE COMPLETED 7 AUG 91
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED 12.3 ft
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE 15 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)	23. SIGNATURE OF INSPECTOR
			GROUT	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
	1	SILTY SAND: yellowish brown (10YR 5/4), very fine to fine, some gravel, moist, sub-rounded, roots, FILL. (SM)			91JULH008 -001, -001SS		3.0/5.0 ft -core barrel used
	2, 3, 4, 5	SANDY, CLAYEY SILT: brown (5YR 4/4), medium plasticity, low toughness, moist, some white gypsum spotting, homogeneous. (ML)	DH=2.0ppm BZ=0.0ppm				
	6, 7, 8	SILTY SAND: orange (10YR 8/2) to orange pink (5YR 8/4), caliche, interbedded sandy silt, firm, crumbly, moist, fine to very fine, poorly graded, very hard caliche layers. (SM)			91JULH008 -002, -002SS		5.0/5.0 ft
	9	SANDY SILT: light brown (5YR 6/4), mottled with tan zones, moist, crumbly, non-plastic. (ML)	HS=0.0ppm				

DRILLING LOG

HOLE NO. SB-08-01

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
	11	SILTY SAND: brown (5YR 6/4), interbedded caliche zones, fine to very fine, some mottling, similar to 6-9', subrounded. (SM)					4.0/5.0 ft
	12						
	13						water at 12.3 ft (loamy)
	14	SILTY SAND: light blueish-grey (5B 7/1), moist to wet, crumbly, poorly graded, very fine. (SM)	HS=0.0ppm				brown tint at 14' (petroleum?) clean at 15'
	15						TD= 15 ft
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

DRILLING LOG

HOLE NO.	SB-08-02
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	08
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	672281.88(Y), 554785.86(X)
9. SURFACE ELEVATION	4086.26
10. DATE STARTED	7 SEP 91
11. DATE COMPLETED	7 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	12 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	15 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
	1	SILTY SAND: brown (10YR 5/4), moist, organic, roots, small black stained zone, low plasticity, crumbly. (SM-SC)	BZ=1ppm		91JULH008 -003, -003SS		2.5/5.0 ft
	2, 3, 4, 5, 6	SANDY SILT: brown (5YR 3/4), moist, roots medium plasticity, low toughness, firm, white (gypsum?) spotting (ML) Same as 1.5-6 ft in SB008-001.	DH=3ppm; BZ=1ppm DH=3.3ppm		91JULH008 -004, -004SS		5.0/5.0 ft
	7, 8, 9	SILTY SAND: brown (10YR 5/4), fine to very fine (maybe a sandy silt ?), mottled with both darker and lighter areas, moist, crumbly, similar to 6-9 ft in SB-008-001 but no caliche, gypsum crystal layers, present (SM)	HS=1.0ppm				5.0/5.0 ft

DRILLING LOG

HOLE NO. SB-08-02

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
	11	grades to brown (6YR 5/6), gypsum crystal layers. coliche present at 11 ft.					
	12						water at 12 ft
	13		HS=0.0ppm				
	14	SAND: very pale brown (10YR 7/4), moist to wet, fine to very fine, some medium, clean. (SP)	OH=1.8ppm				
	15						TD= 15.0 ft
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

DRILLING LOG

HOLE NO. SB-08-03

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	08
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	672307.50(Y), 554729.28(X)
9. SURFACE ELEVATION	4086.32
10. DATE STARTED	7 AUG 91
11. DATE COMPLETED	7 AUG 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	12.7 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	14 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
	1	SANDY SILT: brown, low plasticity, moist, soft, crumbly. (ML)			91JULH008-005, -005SS		
	2	SANDY SILT: yellow orange (10YR 8/6), moist, crumbly. (ML)					3.5/4.0 ft
	3						
	4	SILTY SAND: as above, subrounded. (SM)	OH=2.7ppm BZ=1.8ppm				5.0/5.0 ft
	5	changes to (10YR 5/4).					
	6						
	7	Laminated, no caliche					
	8						
	9	changes to yellowish-brown (5YR 6/4)					

DRILLING LOG

HOLE NO. SB-08-03

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
	11	Caliche at 10", some large layers			91JULH008 -006, -006SS		5.0/5.0 ft
	12	SAND: yellowish brown (10YR 5/4), wet, fine to medium, some caliche. (SP)	HS=0.0ppm				
	13						water at 12.7 ft
							chemical odor
	14						TD= 14 ft
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

DRILLING LOG

HOLE NO. SB-08-04

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 1 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	08
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	672261.97(Y), 554732.56(X)
9. SURFACE ELEVATION	4086.02
10. DATE STARTED	8 AUG 91
11. DATE COMPLETED	8 AUG 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	8 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)	23. SIGNATURE OF INSPECTOR
			GROUT	TAC

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
		FILL: composed of SANDY SILT: greyish-black (N2), organic chemical staining, grading below 0.3 ft.	HS=0.0ppm		91JULH008-007	6,3,6,8	2.0/2.0 ft
	1	SILTY SAND: moderate brown (5YR 4/4), soft, dry, fine to very fine. (SM)					
	2	SILT: yellowish-grey (5YR 7/2), gypsum, low plasticity, moist, crumbly, soft. (ML)	HS=0.0ppm		91JULH008-008 -008SS	8,5,5,5	2.0/2.0 ft
	3						
	4	SILTY SAND: light brown (5YR 5/6), soft, moist. (SM)					
	5	SANDY SILT: light brown (5YR 6/4), soft, moist to wet, fine to very fine, non-plastic. (ML)	HS=0.0ppm			3,3,3,7	1.8/2.0 ft spill spoon wet when removed from hole
	6						
	7						
	8						TD= 8 ft
	9						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. SB-08-04

DRILLING LOG

HOLE NO. SB-08-05

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	08
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	672298.5 (Y), 554672.4 (X)
9. SURFACE ELEVATION	4085.88
10. DATE STARTED	9 AUG 91
11. DATE COMPLETED	9 AUG 91
12. OVERBURDEN THICKNESS	
13. DEPTH GROUNDWATER ENCOUNTERED	10.5 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	13 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)	23. SIGNATURE OF INSPECTOR
			GROUT	LEM

ELEV. 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
		FILL: angular gravel	HS=0.0ppm			28,42,14,8	1.6/2.0 ft
	1	SILTY SAND: moderate brown (5YR 4/4). (SM)					
	2	SILTY SAND: greyish-orange 10YR 7/4). (SM)	HS=0.0ppm		91JULH008 -009		2.0/2.0 ft
	3	SILTY SAND, as above: very pale orange (10YR 8/2). (SM)					
	4	SILTY SAND, as above: moist. (SM)				5,28,31,43	1.5/2.0 ft
	5						
	6	SILTY SAND, as above. (SM)			91JULH008 -010		2.0/2.0 ft
	7	SILTY SAND, as above: light brown (5YR 6/4). (SM)					
	8	SILTY SAND, as above: very pale orange (10YR 8/2). (SM)				18,18,10, 19	
	9	SILTY SAND, as above: moderate yellowish-brown (10YR 5/4), grading to moderate brown (5YR 4/4), caliche, moist. (SM)					

DRILLING LOG

HOLE NO. SB-08-05

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR LEM

SHEET 2 OF 2 SHEETS

ELEV. 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 SAND, as above: saturated. (SM)					
	11		C= 62.5ppm				
	12	SILTY SAND, as above. (SM)					1.0/2.0 ft chemical odor
	13						TD=13.0 ft
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

DRILLING LOG

HOLE NO. SB-08-06

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR LEM

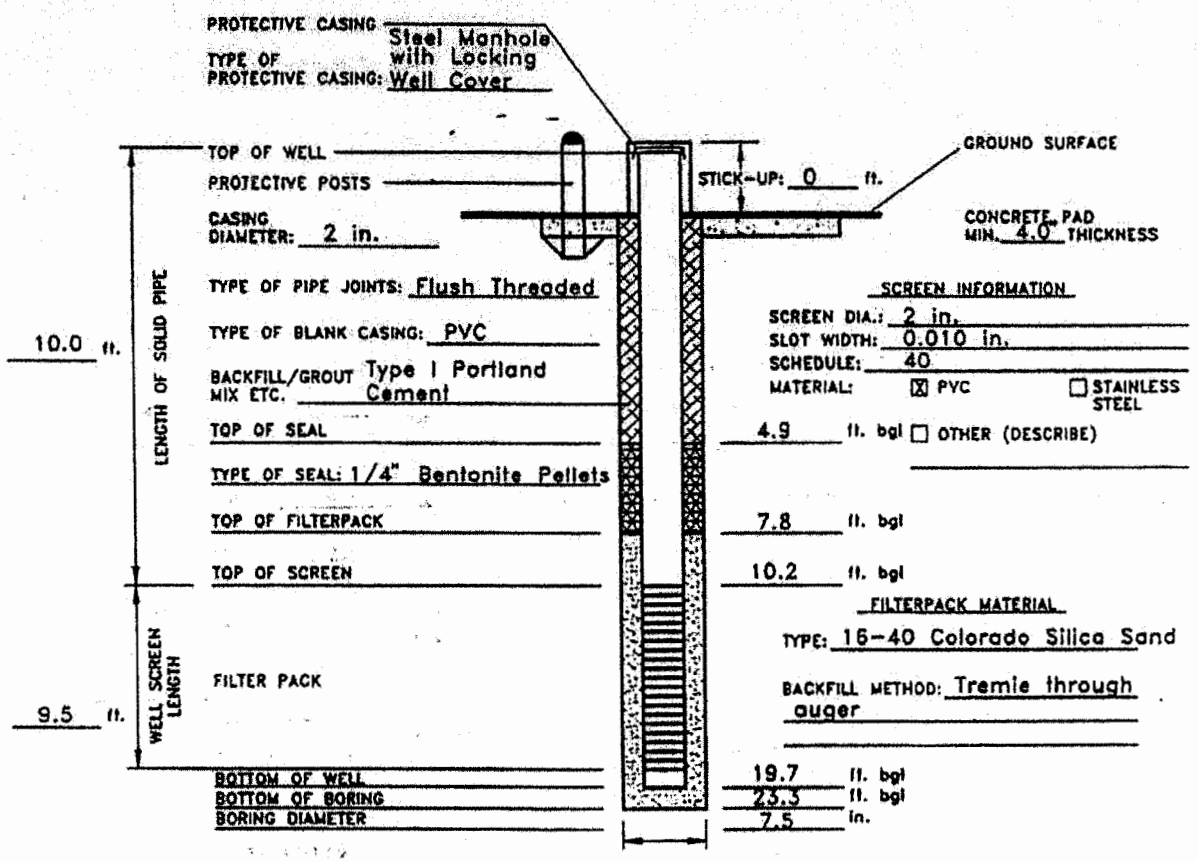
SHEET 2 OF 2 SHEETS

ELEV. 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 SAND: moderate yellowish-brown (10YR 5/4). (SM)	HS=0.2ppm				
	11	SILTY SAND, as above: greyish-orange (10YR 7/4). (SM)					
	12						
	13			SB-008-006			geotechnical sample 12.5 to 15.0 ft
	14	saturated					
	15						TD= 15.0 ft
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

ELEVATION GROUND WATER:	PROJECT: HOLLOMAN AFB RI/FS
DATE INSTALLED: 07 AUG 91 — STARTED: 1400 — COMPLETED: 1800	LOCATION (Coordinates or Station): 08
ELEVATION TOP OF CASING: 4085.87	SIGNATURE OF INSPECTOR/INSTALLER: LEM
DRILLING METHOD: HOLLOW STEM AUGER	WELL NO. (as shown on drawing: title and file number): MW-08-01

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



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 08 AUG 91/0930/8.8 ft bmp

4 NOV 91/ /8.96 ft. bmp

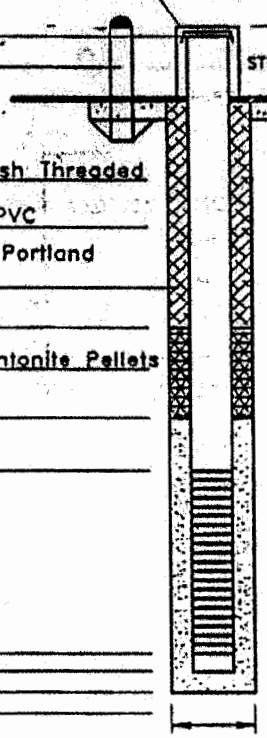
DEPTH FROM TOP CASING AFTER DEVELOPMENT:

F2329

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 08 AUG 91	STARTED 0800	COMPLETED 1200	LOCATION (Coordinates or Station) 08
ELEVATION TOP OF CASING 4088.16			SIGNATURE OF INSPECTOR/INSTALLER LEM
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-08-02

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.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

LENGTH OF SOLID PIPE: 9.0 ft.

WELL SCREEN LENGTH: 9.5 ft.

STICK-UP: 2.3 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0 THICKNESS

TOP OF SEAL: 1.6 ft. bgl

TOP OF FILTERPACK: 4.6 ft. bgl

TOP OF SCREEN: 6.7 ft. bgl

BOTTOM OF WELL: 16.7 ft. bgl

BOTTOM OF BORING: 18.9 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 11 AUG 91/0700/8.75 bmp

4 NOV 91/ /11.26 bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

F2330

DPT SOIL BORING LOG

HOLE NO.	04-08
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Target Environmental Services, Inc.
SHEET	1 OF 1 SHEETS
3. PROJECT	Table 3 RCRA Facility Investigation
4. LOCATION	SWMU 4, Holloman AFB, New Mexico
5. NAME OF DRILLER	Dave Starling
6. MANUFACTURERS DESIGNATION OF DRILL	Geoprobe (DPT)
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	"EW" drill rod; Control rod; 2'x1¼" Piston Sampler; 1¼" ID Acetate Liner
8. HOLE LOCATION	Easting=671841.9672; Northing=554067.2626
9. SURFACE ELEVATION	4081.9135 ft MSL
10. DATE STARTED/COMPLETED	10/19/94
11. RESAMPLE DATE*	NA
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	2.5 ft
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	4.00 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	No (DISTURBED / UNDISTURBED)
19. TOTAL NUMBER OF CORE BOXES	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	E418.1M	E418.1	SW8260	SW8270	RCRA Metals	21. TOTAL CORE REC.
Yes	1	0	0	0	0	NA

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Backfilled	Granular bentonite	No		Jonothan Mattes

ELEVATION a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	CORE SCREEN (ppm) e	HEAD-SPACE (ppm) f	PENETRATION RATE g	RECOVERY (ft) h	ANALYTICAL SAMPLE NO. i	TRPH RESULT (mg/kg)** 10 100 1000 10,000
			Silty SAND: poorly graded, rounded, brown (10YR5/3) and brownish yellow (10YR6/8), damp to saturated, soft, low plasticity, increasing sand with depth, water table at 2.5 ft. (SM)	2	1	easy	2		
4080.0	2			7	7	easy	1.25	94-04-S0-08-01 10/19/94 1430	
4078.0	4		Total Depth = 4 ft						
4076.0	6								
4074.0	8								
4072.0	10								

DPT SOIL BORING LOG

HOLE NO.	04-07
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Target Environmental Services, Inc.
SHEET	1 OF 1 SHEETS
3. PROJECT	Table 3 RCRA Facility Investigation
4. LOCATION	SWMU 4, Holloman AFB, New Mexico
5. NAME OF DRILLER	Dave Starling
6. MANUFACTURERS DESIGNATION OF DRILL	Geoprobe (DPT)
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	"EW" drill rod; Control rod; 2'x1¼" Piston Sampler; 1¼" ID Acetate Liner
8. HOLE LOCATION	Easting=671858.6804; Northing=554054.8589
9. SURFACE ELEVATION	4082.1292 ft MSL
10. DATE STARTED/COMPLETED	10/19/94
11. RESAMPLE DATE*	NA
12. OVERBURDEN THICKNESS	NA
13. DEPTH DRILLED INTO ROCK	NA
14. TOTAL DEPTH OF HOLE	4.00 ft
15. DEPTH GROUNDWATER ENCOUNTERED	3 ft
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	No (DISTURBED / UNDISTURBED)
19. TOTAL NUMBER OF CORE BOXES	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	E418.1M	E418.1	SW8260	SW8270	RCRA Metals	21. TOTAL CORE REC.
Yes	1	0	0	0	0	NA

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Backfilled	Granular bentonite	No		Andrew C. Steffe

ELEVATION a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	CORE SCREEN (ppm) e	HEAD-SPACE (ppm) f	PENETRATION RATE g	RECOVERY (ft) h	ANALYTICAL SAMPLE NO. i	TRPH RESULT (mg/kg)** 10 100 1000 10,000
			SAND with sand: poorly graded, brown (7.5YR4/4) and pink (7.5YR8/4), damp to saturated, soft, low plasticity, water table at 3.0 ft. (SP)	6.5	6.2	moderate	2	94-04-S0-07-01 10/19/94 1143	
4080.2	2			7	6	easy	1.5		
4078.2	4		Total Depth = 4 ft						
4076.2	6								
4074.2	8								
4072.2	10								

PROJECT: Table 3 RCRA Facility Investigation | LOCATION: SWMU 4 | HOLE NO.: 04-07

DPT SOIL BORING LOG

HOLE NO.	04-06
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Target Environmental Services, Inc.
SHEET 1 OF 1 SHEETS	
3. PROJECT	Table 3 RCRA Facility Investigation
4. LOCATION	SWMU 4, Holloman AFB, New Mexico
5. NAME OF DRILLER	Dave Starling
6. MANUFACTURERS DESIGNATION OF DRILL	Geoprobe (DPT)
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	"EW" drill rod; Control rod; 2'X1¼" Piston Sampler; 1¼" ID Acetate Liner
8. HOLE LOCATION	Easting=671876.51; Northing=554041.63
9. SURFACE ELEVATION	4082.3 ft MSL
10. DATE STARTED/COMPLETED	10/19/94
11. RESAMPLE DATE*	NA
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	2.5 ft
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	6.00 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	No
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	E418.1M	E418.1	SW8260	SW8270	RCRA Metals	21. TOTAL CORE REC.
Yes	1	1	0	0	0	NA

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Backfilled	Granular bentonite	No		Jonothan Mattes

ELEVATION a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	CORE SCREEN (ppm) e	HEADSPACE (ppm) f	PENETRATION RATE g	RECOVERY (ft) h	ANALYTICAL SAMPLE NO. i	TRPH RESULT (mg/kg)** 10 100 1000 10,000
			Silty SAND: poorly graded, fine-grained, rounded, dark yellowish brown (10YR4/6) and very pale brown (10YR7/4), damp to saturated, very soft, low plasticity, water table at 3.0 ft. (SM)	7	7	easy	2	94-04-S0-06-01 10/19/94 1040	
4080.2	2			7	7	easy	1.3		
4078.2	4			7	6	easy	2		
4076.2	6		Total Depth = 6 ft						
4074.2	8								
4072.2	10								

DPT SOIL BORING LOG

HOLE NO.	04-05
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Target Environmental Services, Inc.
SHEET	1 OF 1 SHEETS
3. PROJECT	Table 3 RCRA Facility Investigation
4. LOCATION	SWMU 4, Holloman AFB, New Mexico
5. NAME OF DRILLER	Dave Starling
6. MANUFACTURERS DESIGNATION OF DRILL	Geoprobe (DPT)
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	"EW" drill rod; Control rod; 2'x1¼" Piston Sampler; 1¼" IO Acetate Liner
8. HOLE LOCATION	Easting=671916.2893; Northing=553841.7856
9. SURFACE ELEVATION	4084.6567 ft MSL
10. DATE STARTED/COMPLETED	10/19/94
11. RESAMPLE DATE*	NA
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	2.4 ft
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	4.00 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	No; DISTURBED: ; UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	E418.1M	E418.1	SW8260	SW8270	RCRA Metals	21. TOTAL CORE REC.
Yes	1	0	0	0	0	NA

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Backfilled	Granular bentonite	No		Andrew C. Steffe

ELEVATION a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	CORE SCREEN (ppm) e	HEAD-SPACE (ppm) f	PENETRATION RATE g	RECOVERY (ft) h	ANALYTICAL SAMPLE NO. i	TRPH RESULT (mg/kg)** 10 100 1000 10,000
			Silty SAND with gravel: strong brown (7.5YR4/6) and pink (7.5YR7/4), damp, firm, low plasticity, water table at 2.5 ft. (SM)	7	7	moderate	2		
4082.6	2							94-04-S0-05-01 10/19/94 1532	
			Silty SAND: pink (7.5YR8/3) and reddish yellow (7.5YR7/6), saturated, soft. (SM)	6.1	6.2	easy	1.5		
4080.6	4		Total Depth = 4 ft						
4078.6	6								
4076.6	8								
4074.6	10								

DRILLING LOG

HOLE NO.	MW-08-04
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Geo-Test, Inc.
SHEET	1 OF 2 SHEETS
3. PROJECT	Holloman AFB Table I Phase II RFI
4. LOCATION	SWMU 82 / IRP Site 08
5. NAME OF DRILLER	John Maldonado
6. MANUFACTURERS DESIGNATION OF DRILL	CME - 55 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' x 2.6" ID Carbon Steel Continuous Sampler; 7.25" OD Hollow Stem Auger
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-7-94
11. DATE COMPLETED	11-7-94
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	9.5 ft
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	8.64 ft / 48 hrs
14. TOTAL DEPTH OF HOLE	17.5 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	None
18. RISK ASSESSMENT SAMPLES	No
SAMPLE ID (S)	
DEPTH	
19. TOTAL NUMBER OF CORE BOXES	NA

20. NUMBER OF SAMPLES FOR CHEMICAL ANALYSIS	SW8020	SW8080	SW8240	SW8270	SW8015ME	21. TOTAL CORE REC.
0	SW8015MP	Metals	EPA 418.1	SOP-426	SOP-427	NA

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Vertical		Yes		Tim Byers

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
	2, 4		SAND; Silty, poorly graded, fine-grained, very pale brown (10YR7/4), wet, loose, non-plastic, (SM) (SDFN).					
	6, 8		SAND; Clayey, poorly graded, fine-grained, dark red (2.5YR4/8), moist, medium density, low plasticity, with gypsum crystals, (SC) (SDCL). Auger was advanced 5.0 ft., then continuous sampler was installed.	0			100	
▼			SAND; Silty, poorly graded, fine-grained, very pale brown (10YR7/3), wet, medium density, non-plastic, water encountered at 9 ft, (SM) (SDFN).					

0 2 4 6 8 10

PROJECT: Holloman AFB Table I Phase II RFI | HOLE NO.: MW-08-04

DRILLING LOG

HOLE NO. MW-08-04

1. COMPANY NAME: Radian Corporation

2. INSPECTOR: Tim Byers

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			SAND: Silty, poorly graded, fine-grained, very pale brown (10YR7/3), wet, medium density, non-plastic, with gypsum crystals. (SM) (SDFN).					
	12			0			100	
	14							
	16							
			Total Depth = 17.5 ft.					
	18							
	20							
	22							
	24							
	26							
	28							

PROJECT: Holloman AFB Table I Phase II RFI

HOLE NO.: MW-08-04

DRILLING LOG

HOLE NO. MW-08-05

1. COMPANY NAME: Radian Corporation	2. DRILLING SUBCONTRACTOR: Geo-Test, Inc.
SHEET 1 OF 2 SHEETS	
3. PROJECT: Holloman AFB Table I Phase II RFI	4. LOCATION: SWMU 82 / IRP Site 08
5. NAME OF DRILLER: Victor Maldonado	6. MANUFACTURERS DESIGNATION OF DRILL: CME - 55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' x 2.6" ID Carbon Steel Continuous Sampler; 7.25" OD Hollow Stem Auger	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED: 11-8-94 / 11. DATE COMPLETED: 11-8-94
12. OVERBURDEN THICKNESS: NA	15. DEPTH GROUNDWATER ENCOUNTERED: 10.0 ft
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 8.88 ft / 24 hrs
14. TOTAL DEPTH OF HOLE: 17.8 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): None
18. RISK ASSESSMENT SAMPLES: No	SAMPLE ID (S) . / DEPTH / 19. TOTAL NUMBER OF CORE BOXES: NA

20. NUMBER OF SAMPLES FOR CHEMICAL ANALYSIS										21. TOTAL CORE REC.
0	SW8020		SW8080		SW8240		SW8270		SW8015ME	NA
	SW8015MP		Metals		EPA 418.1		SOP-426		SOP-427	

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Vertical		Yes		Carolyn Cooper

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			SAND; Silty, poorly graded, very fine-grained, reddish yellow (7.5YR6/6), moist, firm, (SM) (SDSL).	0			100	
			Very pale brown (10YR8/3), dry, very hard, caliche layer; cemented .					
	2		SAND; Poorly Graded, very fine-grained, reddish yellow (7.5YR7/6), moist, medium density, (SP) (SDVF).					
	4			0			100	
			SAND; Clayey, poorly graded, very fine-grained, strong brown (7.5YR5/6), moist, hard, with gypsum crystals, (SC) (SDCL).					
	6		Very pale brown (10YR8/3), moist, very loose, caliche layer, cemented.					
	8		SAND; Poorly Graded, very fine-grained, very pale brown (10YR7/4), moist to wet, medium density, (SP) (SDVF).				100	

PROJECT: Holloman AFB Table I Phase II RFI | HOLE NO.: MW-08-05

DRILLING LOG

1. COMPANY NAME	2. INSPECTOR	HOLE NO.	SHEET
Radian Corporation	Carolyn Cooper	MW-08-05	2 OF 2 SHEETS

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			~~Water at 10 ft.~~					
	12						100	
			SAND: Poorly Graded, very fine-grained, gray (10YR5/1), moist to wet, medium density, with gypsum crystals, (SP) (SDVF).					
			SAND: Poorly Graded, very fine-grained, very pale brown (10YR7/4), moist to wet, medium density, with gypsum crystals, (SP) (SDVF).					
	14		SAND: Poorly Graded, very fine-grained, light brown (7.5YR6/4), wet, dense, cemented, breaks along bedding planes, (SP) (SDVF).				100	
			SAND: Clayey, poorly graded, very fine-grained, yellowish red (5YR5/6), wet, hard, with gypsum crystals, (SC) (SDCL).					
	16		SAND: Poorly Graded, fine-grained, reddish yellow (7.5YR6/8), wet, medium density, (SP) (SDFN).					
	18		Total Depth = 17.6 ft.					
	20							
	22							
	24							
	26							
	28							

PROJECT: Holloman AFB Table I Phase II RFI

HOLE NO.: MW-08-05

DRILLING LOG

HOLE NO.	MW-08-06
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Geo-Test, Inc.
SHEET	1 OF 2 SHEETS
3. PROJECT	Holloman AFB Table I Phase II RFI
4. LOCATION	SWMU 82 / IRP Site 08
5. NAME OF DRILLER	John Maldonado
6. MANUFACTURERS DESIGNATION OF DRILL	CME - 55 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' x 2.6" ID Carbon Steel Continuous Sampler; 7.25" OD Hollow Stem Auger
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-8-94
11. DATE COMPLETED	11-8-94
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	9.0 ft
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	8.54 ft / 48 hrs
14. TOTAL DEPTH OF HOLE	17.5 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	None
18. RISK ASSESSMENT SAMPLES	No
SAMPLE ID (S)	
DEPTH	
19. TOTAL NUMBER OF CORE BOXES	NA
20. NUMBER OF SAMPLES FOR CHEMICAL ANALYSIS	0
SW8020	
SW8080	
SW8240	
SW8270	
SW8015ME	
SW8015MP	
Metals	
EPA 418.1	
SOP-426	
SOP-427	
21. TOTAL CORE REC.	NA
22. DISPOSITION OF HOLE	Vertical
BACKFILL	
MONITORING WELL	Yes
OTHER (SPECIFY)	
23. SIGNATURE OF INSPECTOR	Tim Byers

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			SAND; Silty, poorly graded, fine-grained, very pale brown (10YR7/4), wet, loose, non-plastic, (SM) (SDFN).					
	2							
	4		SAND; Clayey, poorly graded, fine-grained, yellowish red (5YR5/6), moist, medium density, low plasticity, with trace gypsum, (SC) (SDCL).					
			Auger was advanced 5.0 ft., then continuous sampler was installed.					
	6							
				0			100	
	8		SAND; Silty, poorly graded, fine-grained, very pale brown (10YR7/3), wet, medium density, non-plastic, (SM) (SDFN).					
▼			water at 9 ft.					

0 2 4 6 8 10

PROJECT: Holloman AFB Table I Phase II RFI | HOLE NO.: MW-08-06

DRILLING LOG

HOLE NO. MW-08-08

1. COMPANY NAME: Radian Corporation

2. INSPECTOR: Tim Byers

SHEET 2 OF 2 SHEETS

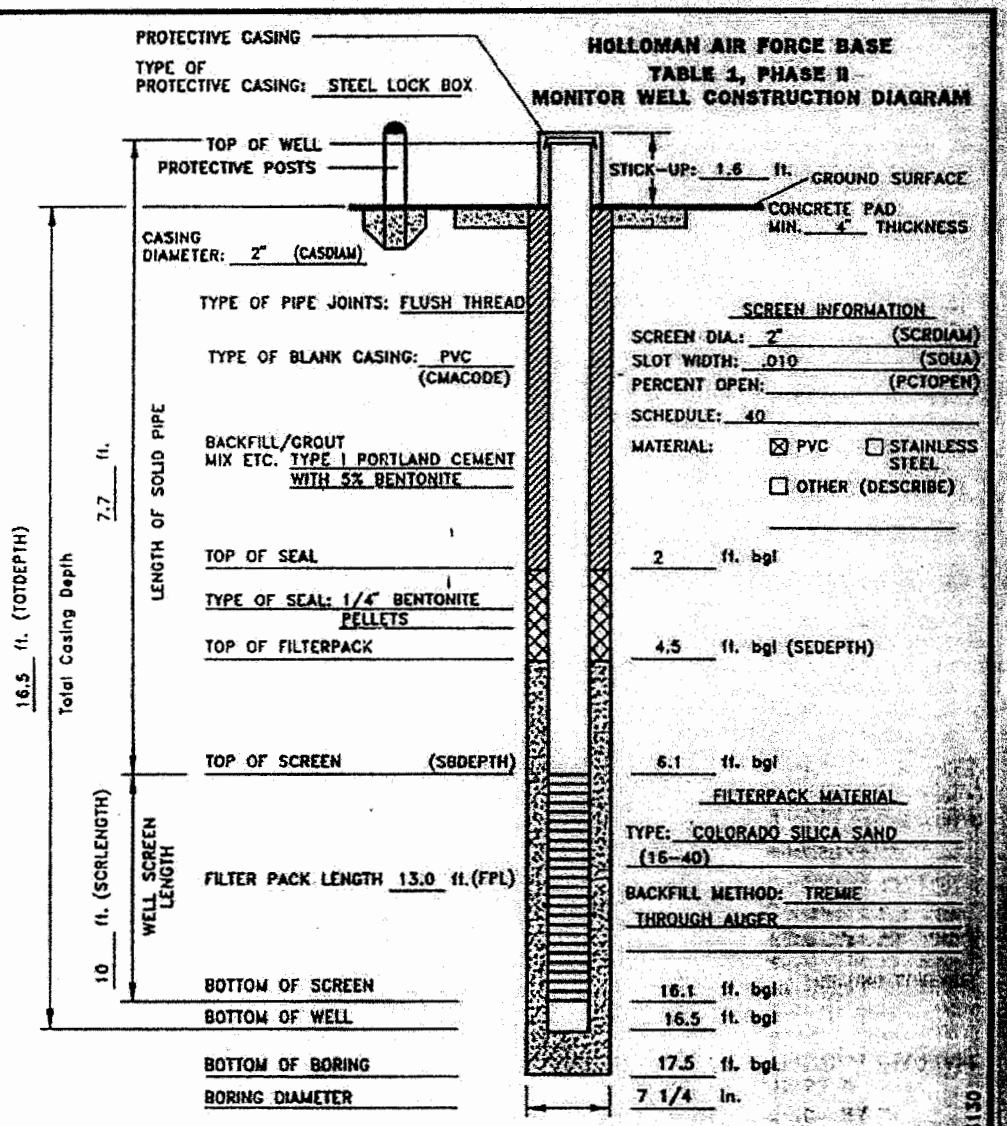
ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
	10							
	12			0			80	
	14							
	16			0			100	
	18		Total Depth = 17.5 ft.					
	20							
	22							
	24							
	26							
	28							

PROJECT: Holloman AFB Table I Phase II RFI

HOLE NO.: MW-08-08

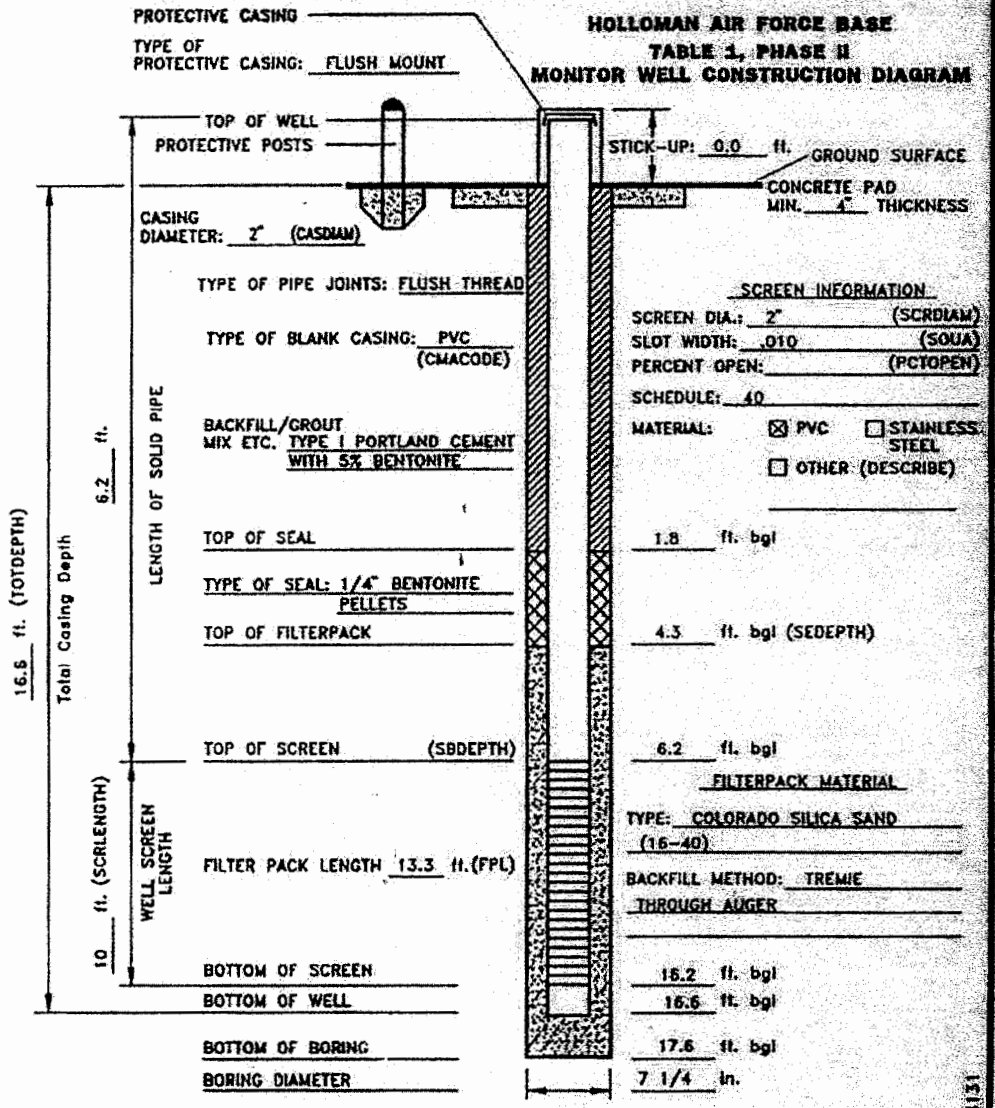
Project (PROJID)	Well I.D. (LOCID)	
HOLMN	MW-08-04	
Well Owner (VVL WELCODE)	Well Type (WL WTCODE)	
USAF	MNW	
Installer	Date Started (INSDATE)	Date Completed
GTI	11/7/94	11/7/94
Location Coordinates: (NCORD) (North) 672478.08	(ECORD) (East) 555017.95	
Elevation Top of Casing (MPELV)	Completion Method (VVL WCMCODE)	
4084.22	GS	
Sole Source Aquifer Code (VVL SAQCODE)		
NA		
Drilling Method	Completion Zone (VVL GZCODE)	
HS	W	
Remarks (REMARKS)		

HOLLOMAN AIR FORCE BASE
TABLE 1, PHASE II
MONITOR WELL CONSTRUCTION DIAGRAM



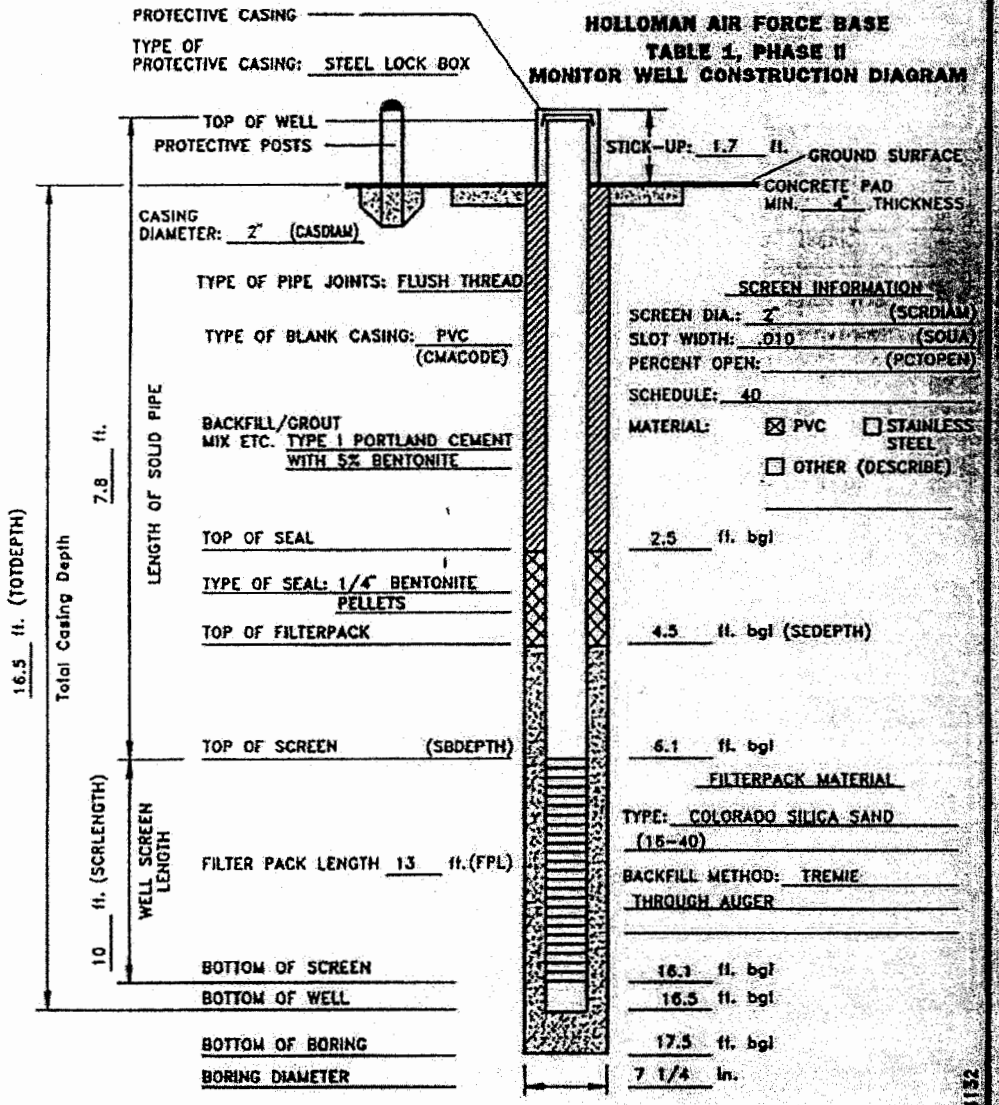
Project (PROJID)	Well I.D. (LOCID)	
HOLMN	MW-08-05	
Well Owner (VVL WELCODE)	Well Type (WL WTCODE)	
USAF	MNW	
Installer	Date Started (INSDATE)	Date Completed
GTI	11/8/94	11/8/94
Location Coordinates: (NCORD) (North) 672353.69	(ECORD) (East) 554853.41	
Elevation Top of Casing (MPELV)	Completion Method (VVL WCMCODE)	
4084.45	GS	
Sole Source Aquifer Code (VVL SAQCODE)		
NA		
Drilling Method	Completion Zone (VVL GZCODE)	
HS	W	
Remarks (REMARKS)		

HOLLOMAN AIR FORCE BASE
TABLE 1, PHASE II
MONITOR WELL CONSTRUCTION DIAGRAM



Project (PROJID)	Well I.D. (LOCID)	
HOLMN	MW-08-06	
Well Owner (VVL WELCODE)	Well Type (WL WTCODE)	
USAF	MNW	
Installer	Date Started (INSDATE)	Date Completed
GTI	11/7/94	11/7/94
Location Coordinates: (NCORD) (North) 672396.65	(ECORD) (East) 555099.61	
Elevation Top of Casing (MPELV)	Completion Method (VVL WCMCODE)	
4084.58	GS	
Sole Source Aquifer Code (VVL SAQCODE)		
NA		
Drilling Method	Completion Zone (VVL GZCODE)	
HS	W	
Remarks (REMARKS)		

HOLLOMAN AIR FORCE BASE
TABLE 1, PHASE II
MONITOR WELL CONSTRUCTION DIAGRAM



APPENDIX C

SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

ADDITIONAL INVESTIGATION REQUIREMENTS ERP SITE SD-08 HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

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

CONTRACT NO. DACA45-03-D-0023
TASK ORDER NOs. 2 & 7
Bhate Project Numbers: 9040002.01.04 & 9050043.01.04

Prepared by

Bhate Environmental Associates, Inc.
1608 13th Avenue South
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May 2005

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SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

ADDITIONAL INVESTIGATION REQUIREMENTS ERP SITE SD-08

HOLLOMAN AIR FORCE BASE, NEW MEXICO

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A - Activity Hazards Analysis and Primary Contaminants of Concern

ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
Bhate	Bhate Environmental Associates, Inc.
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
EPA	Environmental Protection Agency
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HSM	Health and Safety Manager
LTM	Long-term monitoring
MSDS	Material Safety Data Sheet
mg/m^3	Milligrams per cubic meter of air
NIOSH	National Institute for Occupational Safety and Health
PEL	Permissible exposure limit
PID	Photoionization Detector
PPE	Personal protective equipment
ppm	Parts per million
SPF	Sun protection factor
SSHO	Site Safety and Health Officer
USACE	US Army Corps of Engineers
VOC	Volatile organic compound

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1 PROJECT SAFETY COORDINATION

The Bhate personnel who are responsible for safety and health issues at the 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 Bhate Environmental Associates, Inc., (Bhate) for implementation on this scope of work prior to the start of field operations. The requirements of this site-specific addendum are applicable to Bhate employees, their subcontractors, and site visitors.

Table 1-1. Project Team Members with Project Health and Safety Responsibilities

Title	Name	Office Telephone
Site Manager	Mr. John Hymer	(505) 679-2100
Program Manager	Mr. Frank Gardner	(970) 216-7819
Health and Safety Manager	Mr. Eric Lehnertz, CIH	(205) 918-4000
Site Safety and Health Officer	Mr. Jerry Pelfrey	(505) 491-8261
CIH = Certified Industrial Hygienist		

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2 PROJECT BACKGROUND AND SCOPE

The primary objective of this investigative action is to further define the nature and extent of contamination in soil, install three new groundwater monitoring wells, and sample them along with the existing groundwater monitoring well network on a bi-annual basis for two years. This additional investigative approach is a necessary objective to collect sufficient data to support the completion of a risk assessment.

A detailed summary of the site history is included in the Work Plan. The anticipated activities for this project include:

- Mobilization and demobilization of equipment
- Soil boring, monitoring well installation, and groundwater sampling

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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**	• Moderate All tasks and their control measures are addressed in Task Specific Activity Hazard Analyses (AHAs)	• Walking and surfaces • Heavy equipment and vehicular traffic • Slips, trips, and falls
_√_ **Utilities**	• Low	• Buried • Over head • 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	• Pesticides • Metals (see Attachment A)
_√_ **Physical**	• Moderate	• Thermal stressors • Equipment noise
_√_ **Biological**	• 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. 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:

- General Site Activities/Mobilization and Demobilization
- Soil Boring, Monitoring Well Installation, Groundwater Sampling

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 or site. Copies of applicable procedures and programs are included in Basewide HASP, as indicated.

Table 3-2. Written Safety Procedures and Programs

Reference Procedure or Program	Applicable Section(s)
Bhate Hazard Communication Program	All (Refer to Basewide HASP)
Bhate Respiratory Protection Program	All (Refer to Basewide HASP)
Bhate Hearing Conservation Program	All (Refer to Basewide HASP)

3.4 Permits

No Bhate work permits are anticipated for this project. The Site Manager shall coordinate a utility clearance and obtain an appropriate dig permit from the proper HAFB personnel.

4 PERSONAL PROTECTIVE EQUIPMENT

The following personal protective equipment (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.	Steel toed boots	Leather gloves as needed	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve
Equipment Operation and Well Installation	Hard Hat[2] (for overhead hazards), Safety Glasses[1] with rigid side shields.	Steel toed boots	Leather gloves as needed	None[3, 4] N95 Air Purifying Respirator with organic vapor cartridges based on monitoring	Minimum of long pants and shirts with a minimum 4-inch sleeve Tyvek coveralls may be worn as recommended by the Site Safety and Health Officer (SSHO)

Note:

[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 40 hours of use with no continuous exposures over the established Permissible Exposure Limits (PELs)
- Changes that may be otherwise identified in 29 Code of Federal Regulations (CFR) 1910.120.

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5 SITE 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 well 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)	Instrument	Action Level(s) and Frequency	Actions
Soil boring and well installation	Volatile Organic Compounds (VOCs) (Total by Photoionization Detector [PID])	0 - 9 parts per million (ppm) Every 15 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		10 - 49 ppm (Sustained for more than 5 minutes)	Ensure personnel are upwind, notify the Site Manager. SSHO may upgrade PPE to Level C respiratory protection with organic vapor cartridge, as necessary.

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6 SITE CONTROL

Site-specific site control measures will be used to control access to the 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.

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	Located outside of contaminated areas, access will be from clean areas or from the Exclusion Zone through the Contamination Reduction Zone.
Contamination Reduction Zone	The Contamination Reduction Zone will be demarcated with caution tape or temporary construction fencing. Decontamination stations will be located here.
Exclusion Zone	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.

6.1 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	Personnel will be required to thoroughly wash hands and face prior to eating drinking or smoking. Disposable PPE will be collected for proper disposal. Additional decontamination procedures will be developed by the SSHO as needed.
Equipment decontamination	Work efforts will be made to minimize equipment contact with contaminated materials. Prior to leaving the work area and land-farm following placement of contaminated soils, equipment (tires, excavator/loader buckets, hand tools) will be dry decontaminated. Soils from the dry decontamination process will be disposed with the excavated materials. Decontamination tools may include brooms and shovels.

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7 COMMUNICATIONS

Cellular telephones will be available to summon emergency services as required. Refer to Sections 10, 11, and 12 of this Site-Specific HASP for site specific guidance on emergency situations and appropriate actions.

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8 MEDICAL SURVEILLANCE AND TRAINING

The medical surveillance and training requirements for Bhate's on-site personnel working on the well installation and groundwater sampling activities will follow the requirements outlined in the Basewide HASP Sections 7.4 and 5, respectively.

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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 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 equipment 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.	Equipment Servicing and Operation

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10 EMERGENCY ACTION AND RESPONSE

Personnel responsible for coordinating emergency response actions during the Site SD-08 well installation and soil and groundwater sampling activities are identified below in Table 10-1. A map showing directions to the authorized medical facility is attached in Figure 12-1.

Table 10-1. Emergency Coordinator and Alternate

Responsibility	Name	Phone Number(s)
Task Emergency Coordinator	Mr. John Hymer	Office (505) 679-2100 Cell (505) 491-9171
Alternate Emergency Coordinator	Mr. Jerry Pelfrey	Office (505) 679-2100 Cell (505) 430-8261

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 SD-08 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.
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 use of fire extinguisher) 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 clean-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, work plans 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.....(505) 572-5037

HAFB Fire Protection.....(505) 572-1117

HAFB Hospital – 49th Medical Group (Main switchboard).....(505) 572-2778

Civilian Hospital (Alamogordo) Gerald Champion Regional Medical Center.....(505) 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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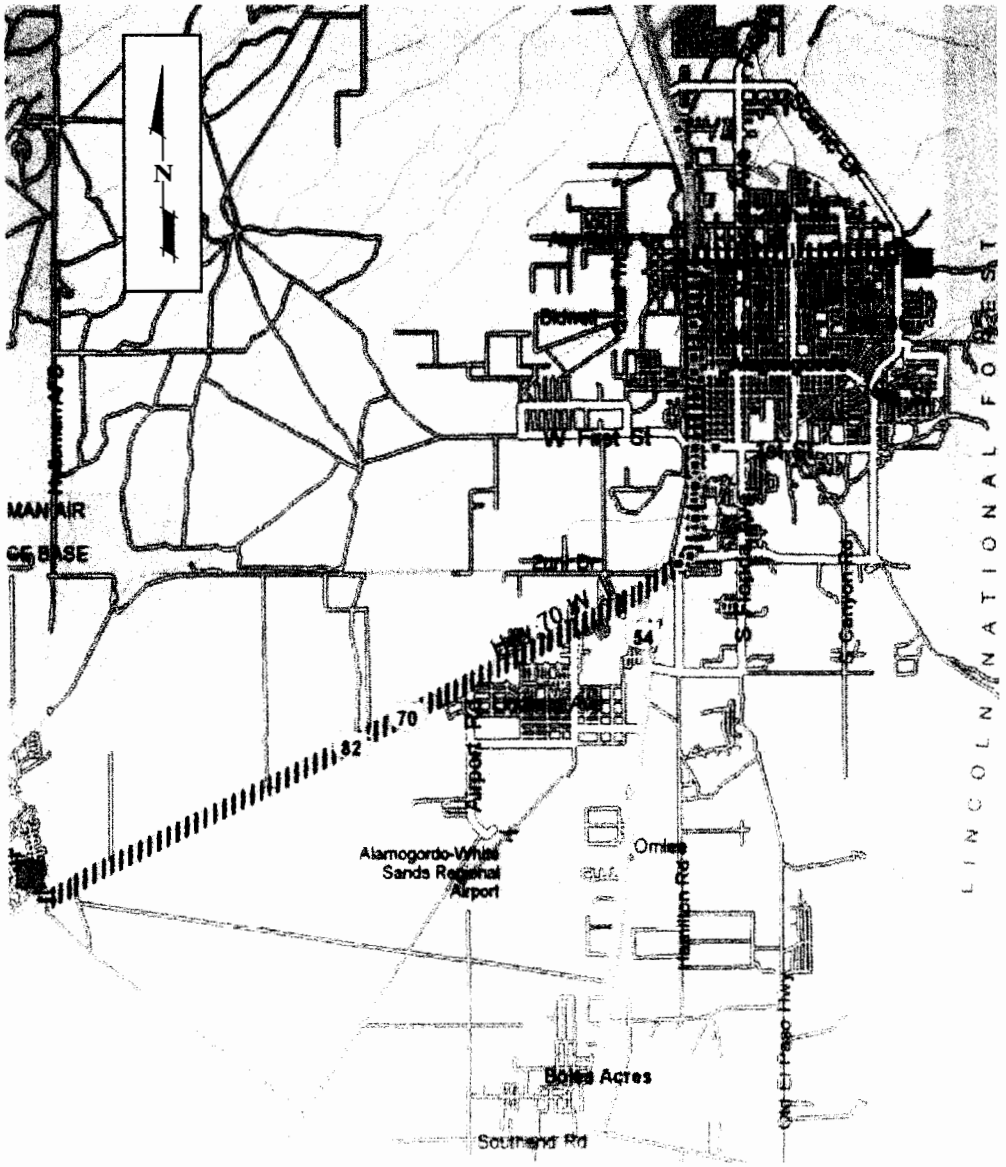
12 HOSPITAL DIRECTIONS

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. Bhate 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 in Figure 12-1.

Hospital Route Map



BHATE Bhate Environmental Associates, Inc. Environmental Engineers & Scientists	Source: Microsoft Expedia Street Maps HOSPITAL ROUTE MAP Holloman Air Force Base to Gerald Champion Regional Hospital	Holloman Air Force Base Health and Safety Plan
	Not to Scale / Date May 2005	

ATTACHMENT A

ACTIVITY HAZARD ANALYSES (AHAs) AND PRIMARY CONTAMINANTS OF CONCERN

Activity Hazard Analysis (AHA) – 01

Task: Additional Investigation Requirements for SD-08	**Bhate Project Number:** 9050043.01.04
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	**Location:** Holloman Air Force Base, New Mexico
	Analysis Approved by: Eric Lehnertz, CIH — **Date:** May 2005

Activity	Potential Hazards	Recommended Controls
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 walking and working surfaces	• Determine the best access route prior to transporting equipment tags and tools • Continuously inspect the work area for slip, trip, and fall hazards • 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
	Eye injury	• Use approved safety glasses with rigid side shields
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1 in all areas with overhead hazards
	Cuts, punctures, and abrasions	• Wear leather work gloves when handling materials or using tools
	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 • Warming breaks will be permitted as necessary to prevent cold stress
	Back Injury from Materials Handling	• Use proper lifting techniques • Loads greater than 50 pounds require assistance or mechanical equipment • 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
Safety Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE First Aid Kit Fire Extinguisher	Informal daily work area inspections to be conducted by the SSHO	Site personnel have read and understand the SSHP Site personnel possess all of the required training as specified in the SSHP Site personnel received site specific safety indoctrination SSHO will have CPR and First Aid training

Activity Hazard Analysis (AHA) – 02

Task: Additional Investigation Requirements for SD-08	**Bhate Project Number:** 9050043.01.04
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	**Location:** Holloman Air Force Base, New Mexico **Analysis Approved by:** Eric Lehnertz, CIH — **Date:** May 2005

Activity	Potential Hazards	Recommended Controls
Soil Boring and Sampling Hazards and recommended controls from AHA – 01 apply	Drill Rig Hazards Including but not limited to: Flying debris, falling objects, noise, hydraulic failures, unguarded machinery, equipment rollover, movement of large, heavy drilling tools, etc.	• Drill rig is to be operated and maintained by qualified operators • A Drill Rig Inspection Checklist should be completed daily to ensure that the rig is operating properly • The inspection will include fittings, cables, pins, connections, lubrication points, controls, emergency stops, etc. • To the extent possible, the terrain should be level and the condition of the ground such that unexpected movement of the rig is unlikely • Stabilize the rig prior to boring • Wear required PPE (hard hat, safety glasses, work gloves, ear muffs or plugs, steel toe work boots), ensure loose clothing is secured • Maintain good housekeeping on and around drill rig
	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 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 when conducting intrusive activities • SSHO shall conduct breathing zone monitoring for VOCs with a PID in accordance with requirements for site monitoring • SSHO may require an upgrade in PPE or modification to work based on monitoring results • Use appropriate decontamination methods

AHA – 02 (Continued)

Activity	Potential Hazards	Recommended Controls
Monitoring Well 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 monitoring well to prevent dust generation • Position body in an upwind location
Well Development / Groundwater depth measurement / Groundwater sampling	Exposure to groundwater contaminants	• Position body upwind from monitoring well prior to opening cap • Wear appropriate PPE including chemical resistant gloves 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	Informal daily work area inspections to be conducted by the SSHO	Site personnel have read and understand the SSHP Site personnel possess all of the required training as specified in the SSHP Site personnel received site specific safety indoctrination SSHO will have CPR and First Aid training

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							
Cadmium	0.005 mg/m³	0.01 mg/m³ 0.002 mg/m³ for compounds	Inhalation Ingestion	Dyspnea, nausea, headache, tight chest, pulmonary edema	Cancer, muscle aches, vomiting, diarrhea, kidney, lung damage	Lungs, kidneys, blood, respiratory system, prostrate	NA	8.65	0	NA	NA	NA
Lead	0.05 mg/m³	0.05 mg/m³	Inhalation Ingestion Contact	Eye irritation	Weakness, tremors, neuropathy, Hypo-tension	GI tract, CNS, kidneys, blood, gingival tissue	NA	11.34	0	NA	NA	NA
Mercury	0.1 mg/m³ (C)	0.025 mg/m³	Inhalation Ingestion Contact Absorption	CNS damage depending on group of mercurial compounds	Same as acute effects	CNS, kidneys, eyes, skin, respiratory system	NA	13.6	0.0012	NA	NA	NA
Chlordane	0.5 mg/m³ (skin)	0.5 mg/m³ (skin)	Inhalation Ingestion Contact Absorption	Blurred vision, confusion, ataxia, delirium, coughing, abdominal pain, nausea, vomiting, diarrhea, tremors	Lung, liver, and kidney damage. (known to cause cancer in animals)	CNS, eyes, lungs, liver, kidneys, skin	NA	1.6	0.00001	NA	NA	NA
DDD	NA	NA	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin, nose, and throat	Liver and kidney damage, causes cancer in animals	Liver, kidneys, CNS, skin	NA	1.385	1.5×10^{-7}	NA	NA	NA
DDE	NA	NA	Inhalation Ingestion Contact Absorption	Headache, dizziness, nausea, vomiting, sweating, tremors/jerks, convulsions	Liver and kidney damage, causes cancer in animals	Liver, kidneys, CNS, skin	NA	1.55	6.5×10^{-6}	NA	NA	NA
DDT	1 mg/m³ (skin)	1 mg/m³ (skin)	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin; paresthesia of tongue, lips, face, tremor, dizziness, confusion, headache, fatigue	Liver and kidney damage, causes cancer in animals	Liver, kidneys CNS, skin, PNS	NA	0.99	2.0×10^{-7}	162-171	NA	NA
Heptachlor	0.5 mg/m³	0.05 mg/m³	Inhalation Ingestion Contact Absorption	Tremors and convulsions possible	Liver damage	CNS	NA	1.66	0.0003	NA	NA	NA

Notes:
- NA = Not Applicable
- IP = Ionization Potential
- eV = Electron volt
- LEL = Lower Explosive Limit
- UEL = Upper Explosive Limit
- PEL = Permissible Exposure Limit
- STEL = Short-term Exposure Limit
- TLV = Threshold Limit Value
- C = Ceiling
- mg/m³ = milligrams per cubic meter of air
- ppm = parts per million
- GI = Gastrointestinal Tract
- CNS = Central Nervous System
- PNS = Peripheral Nervous System
- VP = Vapor Pressure
- mm Hg = millimeters of mercury
- f/cc = fibers per cubic centimeter of air
- TWA = Time Weighted Average
- STEL = Short Term Exposure Limit

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN ADDENDUM FOR ERP SITE SD-08

QUALITY ASSURANCE PROJECT PLAN ADDENDUM

ERP SITE SD-08
(SWMU 82 – BUILDING 131 WASHRACK)
HOLLOMAN AFB, NEW MEXICO

Prepared For

U.S. Army Corp of Engineers

Omaha, Nebraska

CONTRACT NO. DACA45-03-D-0023
TASK ORDER NOs. 2 & 7

August 2005

Prepared by:

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

Bhate Project Nos. 9040002.01.04 & 9050043.01.04

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM

ERP SITE SD-08

(SWMU 82 – BUILDING 131 WASHRACK)

HOLLOMAN AFB, NEW MEXICO

REVIEW SHEET

COMMITMENT TO IMPLEMENT THIS QUALITY ASSURANCE PROJECT PLAN ADDENDUM

Michael D'Auben		8-24-05
Project Chemist	Signature	Date
Frank Gardner		8-24-05
Project Manager	Signature	Date
John Hymer		8-24-05
Site Manager	Signature	Date

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM

ERP SITE SD-08

(SWMU 82 – BUILDING 131 WASHRACK)

HOLLOMAN AFB, NEW MEXICO

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4-1 Summary of Field QC Samples

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LIST OF ACRONYMS

AFB	Air Force Base
Bhate	Bhate Environmental Associates, Inc.
EDD	Electronic data deliverable
EQL	Estimated Quantitation Limit
ERP	Environmental Restoration Program
ERPIMS	Environmental Resources Program Information Management System
HAFB	Holloman Air Force Base
LCL	Lower Control Limit
LCS	Laboratory Control Sample
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
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SWMU	Solid Waste Management Unit
SOPs	Standard Operating Procedures
SVOC	Semivolatile Organic Compounds
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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QUALITY ASSURANCE PROJECT PLAN ADDENDUM

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 Environmental Restoration Program (ERP) Site SD-08 at Holloman Air Force Base (HAFB). This document is an addendum to the *Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico* (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 SD-08 outlined in the *Additional Investigation Requirements Work Plan, ERP Site SD-08 (SWMU [Solid Waste Management Unit] 82 – Building 131 Washrack) Holloman AFB [Air Force Base], New Mexico* (Bhate, August 2005) (SD-08 Work Plan).

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1 INTRODUCTION

The U.S. Army Corps of Engineers, Omaha District (USACE) has retained Bhate Environmental Associates, Inc., (Bhate) to perform additional investigation at ERP Site SD-08 (SWMU 82 - Building 131 Washrack) at HAFB, New Mexico for the New Mexico Environment Department (NMED). Bhate is performing this work on behalf of the HAFB ERP under the Service Contract with the USACE (Contract No. DACA-45-02-D-0023, Task Orders No. 2 and 7).

See the Basewide QAPP (Bhate, 2003) and SD-08 Work Plan (Bhate, August 2005) for additional information on HAFB and the SD-08 site.

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2 PROJECT LABORATORY

The analytical work for this project will be preformed by Accutest Laboratories, 4405 Vineland Road, Suite C-15, Orlando, Florida 32811. The laboratory personnel who will be involved with this project include:

Mr. Harry Behzadi, Accutest Laboratory Director (407) 425-6700

Ms. Sue Bell, Accutest Project Manager (813) 741-3338

Ms. Doris Curry, Accutest Quality Assurance Manager, (407) 425-6700

Accutest is certified by both the National Environmental Laboratory Accreditation Conference (NELAC) and the USACE and has extensive previous experience in working on USACE projects. The Accutest Laboratory Quality Assurance Manual (QAM) and Standard Operating Procedures (SOPs) have been reviewed by Bhate 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). There will be no screening data generated as part of this project. The definitive data generated by the laboratory will be presented with limited data deliverables (i.e. Level II data packages), using a 21 day turn-around-time. All definitive data produced by the laboratory will also be presented in an Environmental Resources Program Information Management System (ERPIMS) format electronic data deliverable (EDD).

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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 the Bhate Senior Chemist, Mr. Michael J. D'Auben, based on the guidelines of the United States Environmental Protection Agency (USEPA) National Functional Guidelines for Data Validation and the site specific laboratory QC limits.

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5 REFERENCES

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

Bhate, August 2005. *Additional Investigation Requirements Work Plan, ERP Site SD-08 (SWMU 82 – Building 131 Washrack), Holloman AFB, New Mexico.*

United States Environmental Protection Agency, July 2002. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.*

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

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TABLES

Table 3-1
Summary of Screening Data

Parameter	Matrix	Testing Method
None	--	--

Table 3-2
Summary of Definitive Data

Parameter	Matrix	Testing Method
Organochlorine Pesticides	Soil and Groundwater	USEPA SW-846 Method 8081A
Volatile Organic Compounds (VOCs)	Soil and Groundwater	USEPA SW-846 Method 8260B
Semivolatile Organic Compounds (SVOCs)	Soil and Groundwater	USEPA SW-846 Method 8270C
RCRA Metals	Soil and Groundwater	USEPA SW-846 Methods 6010B and 7470A/7471A
Total Dissolved Solids (TDS)	Groundwater	USEPA Method 160.1

Notes:
USEPA = United States Environmental Protection Agency
RCRA = Resource Conservation and Recovery Act

Table 4-1
Summary of Field QC Samples

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	Organochlorine Pesticides per EPA Method 8081A	6	0	0	1	0	0	7
	VOCs per EPA Method 8260B	6	0	0	1	0	0	7
	SVOCs per EPA Method 8270C	6	0	0	1	0	0	7
	RCRA Metals by EPA 6010B/7471A	6	0	0	1	0	0	7
Groundwater	Organochlorine Pesticides per EPA Method 8081A	5	0	0	1	0	0	6
	VOCs per EPA Method 8260B	5	0	1	1	0	0	7
	SVOCs per EPA Method 8270C	5	0	0	1	0	0	6
	RCRA Metals by EPA 6010B/7470A	5	0	0	1	0	0	6
	Total Dissolved Solids by EPA Method 160.1	5	0	0	1	0	0	6

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
VOCs = Volatile Organic Compounds
SVOCs = Semivolatile Organic Compounds
RCRA = Resource Conservation and Recovery Act

Table 4-2
Summary of Laboratory QC Limits
Accutest Laboratories, Orlando, FL

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
VOCs per EPA Method 8260B	µg/L	µg/kg	%	%	%	%	%	%	%	%	%	%
Acetone	25	50	45	127	51	136	44	142	15	14	140	33
Benzene	1	5	72	125	74	124	80	120	7	63	135	23
Bromodichloromethane	1	5	72	120	74	124	75	120	8	63	126	23
Bromoform	1	5	55	127	79	127	60	129	11	54	109	24
Chlorobenzene	1	5	79	113	78	117	82	112	7	64	130	24
Chloroethane	2	5	56	164	63	147	67	148	14	53	172	28
Chloroform	1	5	75	120	75	121	78	118	8	68	131	24
Carbon disulfide	2	5	60	151	59	148	65	147	12	47	165	29
Carbon tetrachloride	1	5	56	145	67	131	69	137	12	64	148	24
1,1-Dichloroethane	1	5	70	122	71	118	75	117	10	64	130	25
1,1-Dichloroethylene	1	5	61	137	64	126	67	134	15	55	149	28
1,2-Dichloroethane	1	5	64	124	72	120	68	121	7	60	114	22
1,2-Dichloropropane	1	5	74	123	74	126	78	122	8	65	128	23
Dibromochloromethane	1	5	63	119	78	120	68	118	9	60	119	23
cis-1,2-Dichloroethylene	1	5	74	125	75	124	81	120	9	66	132	24
cis-1,3-Dichloropropene	1	5	65	112	72	120	73	115	10	57	118	25
trans-1,2-Dichloroethylene	1	5	70	127	70	122	74	125	11	63	137	27
trans-1,3-Dichloropropene	1	5	59	116	75	118	69	115	11	58	115	25
Ethylbenzene	1	5	73	119	77	120	82	115	8	63	142	25
2-Hexanone	5	25	54	131	68	136	60	125	11	35	109	34
4-Methyl-2-pentanone	5	25	57	136	69	136	61	128	11	44	99	32
Methyl bromide	2	5	52	172	52	156	60	165	16	38	188	27
Methyl chloride	2	5	53	155	63	142	58	152	19	57	160	29
Methylene chloride	5	10	61	129	51	142	66	125	11	40	183	34
Methyl ethyl ketone	5	25	51	128	63	138	58	127	10	27	112	32
Styrene	1	5	64	124	74	120	58	125	11	54	130	26
1,1,1-Trichloroethane	1	5	72	133	70	131	78	132	8	70	149	25
1,1,2,2-Tetrachloroethane	1	5	64	120	76	121	67	119	10	45	121	33
1,1,2-Trichloroethane	1	5	72	116	77	118	74	115	9	60	114	25
Tetrachloroethylene	1	5	70	126	68	127	75	126	9	54	154	27
Toluene	1	5	67	123	74	118	81	114	8	62	142	29
Trichloroethylene	1	5	73	117	72	122	80	115	10	59	143	25
Vinyl chloride	1	5	63	161	64	144	70	151	18	64	165	27
Xylene (total)	3	15	73	122	78	122	81	118	7	64	142	24
Dibromofluoromethane (surr)	--	--	--	--	78	123	--	--	--	--	--	--
Toluene-D8 (surr)	--	--	--	--	71	137	--	--	--	--	--	--
4-Bromofluorobenzene (surr)	--	--	--	--	61	157	--	--	--	--	--	--
1,2-Dichloroethane-D4 (surr)	--	--	--	--	74	125	--	--	--	--	--	--

Table 4-2
Summary of Laboratory QC Limits
Accutest Laboratories, Orlando, FL

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
SVOCs by EPA Method 8270C	µg/L	µg/kg	%	%	%	%	%	%	%	%	%	%
Benzoic Acid	25	830	8	45	55	110	16	73	41	13	117	32
2-Chlorophenol	5	170	62	103	61	97	53	102	24	31	113	23
4-Chloro-3-methyl phenol	5	170	64	103	60	105	60	101	18	33	123	38
2,4-Dichlorophenol	5	170	59	103	64	102	55	100	24	54	105	20
2,4-Dimethylphenol	5	170	43	94	50	102	36	98	26	46	104	22
2,4-Dinitrophenol	25	830	12	125	41	120	14	135	39	5	110	46
4,6-Dinitro-o-cresol	10	330	47	119	59	123	40	127	24	27	119	35
2-Methylphenol	5	170	54	91	57	97	46	100	23	44	101	28
3&4-Methylphenol	5	170	48	86	56	98	43	100	23	38	107	31
2-Nitrophenol	5	170	64	104	62	100	53	104	25	38	111	21
4-Nitrophenol	25	830	22	50	52	116	32	81	28	44	111	22
Pentachlorophenol	25	830	50	111	54	111	44	118	16	42	110	25
Phenol	5	170	25	53	59	96	31	77	26	32	111	29
2,4,5-Trichlorophenol	5	170	66	104	65	104	61	102	18	53	108	19
2,4,6-Trichlorophenol	5	170	60	103	64	102	55	103	21	53	107	20
Acenaphthene	5	170	62	101	66	104	55	103	20	57	106	19
Acenaphthylene	5	170	65	113	66	106	55	113	20	55	110	18
Anthracene	5	170	69	107	66	109	66	105	14	59	109	21
Benzo(a)anthracene	5	170	68	106	66	111	65	103	16	52	120	20
Benzo(a)pyrene	5	170	70	114	65	115	65	113	16	48	124	21
Benzo(b)fluoranthene	5	170	68	110	64	115	62	110	17	50	122	21
Benzo(g,h,i)perylene	5	170	63	115	62	113	58	111	17	50	118	23
Benzo(k)fluoranthene	5	170	68	112	67	116	63	110	17	54	117	21
4-Bromophenyl phenyl ether	5	170	73	103	68	106	68	102	16	59	107	20
Butyl benzyl phthalate	5	330	69	108	62	114	65	108	17	57	118	20
Benzyl Alcohol	5	170	34	104	58	103	48	106	24	46	106	23
2-Chloronaphthalene	5	170	64	102	66	97	58	101	22	53	102	19
4-Chloroaniline	10	330	57	104	29	80	39	101	21	25	78	30
Carbazole	5	170	69	113	63	107	66	109	16	58	105	20
Chrysene	5	170	68	103	67	112	65	100	18	48	124	20
bis(2-Chloroethoxy)methane	5	170	57	103	57	89	49	100	24	45	94	19
bis(2-Chloroethyl)ether	5	170	64	106	61	95	54	103	24	47	99	24
bis(2-Chloroisopropyl)ether	5	170	52	120	56	100	49	109	22	44	100	23
4-Chlorophenyl phenyl ether	5	170	71	104	68	103	65	103	18	59	105	18
1,2-Dichlorobenzene	5	170	62	100	61	91	50	101	22	44	95	26
1,3-Dichlorobenzene	5	170	59	99	59	88	50	100	23	41	91	28
1,4-Dichlorobenzene	5	170	60	101	59	90	51	101	23	42	93	27
2,4-Dinitrotoluene	5	170	65	111	60	108	60	110	16	44	118	26
2,6-Dinitrotoluene	5	170	77	111	63	106	60	111	19	48	115	20
3,3'-Dichlorobenzidine	10	330	42	110	30	90	18	112	22	15	90	31

Table 4-2
Summary of Laboratory QC Limits
Accutest Laboratories, Orlando, FL

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
SVOCs by EPA Method 8270C	µg/L	µg/kg	%	%	%	%	%	%	%	%	%	%
Dibenzo(a,h)anthracene	5	170	62	115	63	110	57	111	20	45	121	23
Dibenzofuran	5	170	69	104	65	99	64	102	17	57	101	19
Di-n-butyl phthalate	5	330	68	109	62	110	63	107	17	55	112	20
Di-n-octyl phthalate	5	330	63	120	59	132	58	126	23	58	134	23
Diethyl phthalate	5	330	64	110	64	109	59	110	18	59	107	19
Dimethyl phthalate	5	330	44	120	66	105	40	116	25	56	108	20
bis(2-Ethylhexyl)phthalate	5	330	64	115	60	118	55	120	22	55	125	21
Fluoranthene	5	170	68	111	63	108	62	108	17	47	119	25
Fluorene	5	170	66	105	65	109	60	105	17	59	108	18
Hexachlorobenzene	5	170	69	103	65	106	64	102	16	56	107	21
Hexachlorobutadiene	5	170	55	90	55	93	45	93	26	42	94	25
Hexachlorocyclopentadiene	5	170	26	95	34	95	20	92	34	13	91	25
Hexachloroethane	5	170	59	104	58	91	51	105	26	40	93	32
Indeno(1,2,3-cd)pyrene	5	170	63	118	59	115	61	111	19	50	118	26
Isophorone	5	170	64	107	60	102	59	103	23	52	101	19
2-Methylnaphthalene	5	170	66	100	63	93	56	100	23	42	103	22
2-Nitroaniline	10	330	65	111	60	110	61	107	18	55	108	20
3-Nitroaniline	10	330	61	106	41	90	47	107	26	38	92	20
4-Nitroaniline	10	330	60	113	53	103	48	119	21	42	101	23
Naphthalene	5	170	62	101	64	94	52	102	23	42	105	24
Nitrobenzene	5	170	61	106	60	96	51	103	25	42	105	21
N-Nitroso-di-n-propylamine	5	170	64	109	54	99	57	103	24	41	107	23
N-Nitrosodiphenylamine	5	170	69	114	68	108	62	112	16	59	111	21
Phenanthrene	5	170	68	104	67	110	64	103	15	60	110	21
Pyrene	5	170	64	105	65	115	59	107	21	50	126	25
1,2,4-Trichlorobenzene	5	170	64	101	64	94	54	102	24	49	98	23
2-Fluorophenol (surr)	--	--	19	90	45	114	--	--	--	--	--	--
Phenol-d5 (surr)	--	--	10	68	44	124	--	--	--	--	--	--
2,4,6-Tribromophenol (surr)	--	--	36	137	50	128	--	--	--	--	--	--
Nitrobenzene-d5 (surr)	--	--	49	119	41	123	--	--	--	--	--	--
2-Fluorobiphenyl (surr)	--	--	45	118	46	122	--	--	--	--	--	--
Terphenyl-d14 (surr)	--	--	46	135	45	135	--	--	--	--	--	--
RCRA Metals by EPA Method 6010B/7470A/7471A	µg/L	mg/kg	--	--	--	--	--	--	--	--	--	--
Arsenic	10.00	0.50	80	120	80	120	83	116	12	75	113	20
Barium	200.00	20.00	80	120	80	120	82	116	13	75	122	20
Chromium	5.00	0.40	80	120	80	120	80	115	13	75	116	20
Cadmium	10.00	1.00	80	120	80	120	82	120	12	75	125	20
Lead	5.00	10.00	80	120	80	120	84	118	10	75	121	20
Mercury	0.05	0.01	80	120	80	120	62	131	20	47	157	20
Selenium	10.00	10.00	80	120	80	120	84	121	13	75	110	20
Silver	10.00	1.00	80	120	80	120	77	125	14	75	120	20

Table 4-2
Summary of Laboratory QC Limits
Accutest Laboratories, Orlando, FL

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
Organochlorine Pesticides by EPA Method 8081A	µg/L	µg/kg	%	%	%	%	%	%	%	%	%	%
Aldrin	0.05	1.7	70	127	67	130	73	135	25	57	142	23
alpha-BHC	0.05	1.7	65	136	70	135	75	134	24	53	147	24
beta-BHC	0.05	1.7	68	133	75	130	73	141	23	58	152	18
delta-BHC	0.05	1.7	48	126	53	126	29	148	32	37	148	23
gamma-BHC (Lindane)	0.05	1.7	69	137	73	136	75	140	21	59	146	21
alpha-Chlordane	0.05	1.7	74	127	78	129	73	135	22	59	147	21
gamma-Chlordane	0.05	1.7	75	130	78	132	74	138	26	55	152	20
Dieldrin	0.05	1.7	76	131	79	136	74	141	23	59	142	20
4,4'-DDD	0.1	3.3	76	140	76	142	81	142	24	56	167	25
4,4'-DDE	0.1	3.3	73	137	78	143	77	139	26	58	158	21
4,4'-DDT	0.1	3.3	74	134	84	141	65	147	29	60	157	25
Endrin	0.1	3.3	78	134	79	138	72	149	21	59	153	21
Endosulfan sulfate	0.1	3.3	73	127	78	128	66	140	31	52	151	24
Endrin aldehyde	0.1	3.3	5	104	5	103	5	113	49	5	106	50
Endrin ketone	0.1	3.3	80	128	79	129	75	138	25	44	163	22
Endosulfan-I	0.05	1.7	76	128	79	128	74	139	21	57	145	20
Endosulfan-II	0.1	3.3	77	131	78	132	70	145	25	52	146	22
Heptachlor	0.05	1.7	62	137	71	136	74	136	25	61	145	24
Heptachlor epoxide	0.05	1.7	74	130	76	133	75	138	21	58	147	20
Methoxychlor	0.1	3.3	77	131	81	137	69	145	27	58	154	25
Toxaphene	2.5	170	50	150	50	150	50	150	20	50	150	20
Tetrachloro-m-xylene (surr)	--	--	60	138	60	142	--	--	--	--	--	--
Decachlorobiphenyl (surr)	--	--	31	148	61	153	--	--	--	--	--	--
Total Dissolved Solids by EPA Method 160.1	mg/L	mg/kg	%	%	%	%	%	%	%	%	%	%
Total Dissolved Solids	6	50	90	110	--	--	--	--	--	--	--	--

Notes:
µg/kg = Micrograms per kilogram
µg/L = Micrograms per liter
EPA = United States Environemental Protection Agency
EQL = Estimated Quantiation Limit
LCL = Lower Control Limit
LCS = Laboratory Control Sample
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
UCL = Upper Control Limit
VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
RCRA = Resource Conservation and Recovery Act