WSMR 2004 FILE

WSMR 2004

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

22 JUN 2004

REPLY TO
ATTENTION OF
Environment and Safety Directorate

Ms. Cheryl Frischkorn
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

SUBJECT: Submittal of the *Final Work Plan Phase III RFI for Multiple Sites SWMU 8-17, 21, 22, 80, 140, & 156 (IRP Sites WSMR # 30-32, 57, 73, 79, and 84)*, dated June 2004

Dear Ms. Frischkorn:

White Sands Missile Range (WSMR) submits the subject document (2 hard copies/1 CD) for the listed Installation Restoration Program Sites and related Solid Waste Management Units (SWMU). WSMR submitted three Petitions for No Further Action dating from January 2000 to September 2001. These petitions were subject matter of a letter from your office dated March 11, 2002. In that letter, your office determined the petitions to be administratively incomplete and a list of requirements were attached. The enclosed work plan is in response to your letter and, we feel, the proposed work will provide adequate data and answers to address your concerns as expressed in your letter.

The following certification is provided as required by our permit:

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

Copies furnished, with enclosure, to Mr. James Harris, Region VI EPA (1 CD); Mr. Mike Kelly, U.S. Army Environmental Center (1 hard copy/1 CD); and, without enclosure, to Mr. James Bearzi, Mr. John Kieling, NMED-HWB; and BAE Systems.

Should you have any questions regarding this matter, please contact Mr. Jose Gallegos, at (505) 678-1007.

Sincerely,

Thomas A. Ladd
Director, Environment and Safety Directorate

Enclosures

White Sands Missile Range Environmental Document
Report WS-ES-EC-0422

FINAL

WORK PLAN

PHASE III RFI FOR MULTIPLE SITES

SWMUs 8-17, 21, 22, 80, 140, & 156
(IRP SITES WSMR # 30-32, 57, 73, 79, and 84)

White Sands Missile Range

June 2004

BAE SYSTEMS

White Sands Missile Range
Environment and Safety Directorate
White Sands Missile Range, New Mexico 88002

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6. AUTHOR(S) Brad Davis—BAE Systems Jason Capron—BAE Systems			
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Department of the Army U.S. Army White Sands Missile Range 100 Headquarters Avenue ATTN: SFIM-SW-WS-EC (Jose Gallegos) White Sands Missile Range, NM 88002			**10. SPONSORING/MONITORING AGENCY REPORT NUMBER** WS-ES-EC-0422
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12a. DISTRIBUTION AVAILABILITY STATEMENT			**12b. DISTRIBUTION CODE**
13. ABSTRACT (MAXIMUM 200 WORDS) This is the work plan for the Phase III RFI at the Main Post SWMU sites under the IRP for further study. The intent of the investigation is to address requests made by NMED in past correspondence regarding the SWMUs in preparation for a petition of NFA. Work to be performed at the SWMU sites includes ecological risk assessments, confirmation sampling, characterization sampling, and comparisons of background metals.			
14. SUBJECT TERMS **Mark Number: 200-1i** RCRA, SWMU 8, SWMU 9, SWMU 10, SWMU 11, SWMU 12, SWMU 13, SWMU 14, SWMU 15, SWMU 16, SWMU 17, SWMU 21, SWMU 22, SWMU 80, SWMU 140, SWMU 156, IRP, RFI, Main Post, No Further Action (NFA), Phase III RFI			**15. NUMBER OF PAGES** 70 **16. PRICE CODE**
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WSMR Response to NMED Comments and Administrative Requirements Provided in March 2002 Response to WSMR NFA Petitions

Comment No.	Relevant SWMU	NMED Requirement	Response Code	WSMR Response
1	All	Eco-risk assessment required.	C	WSMR will perform a screening-level ecological risk assessment for every SWMU or group of SWMUs in close proximity under the Phase III RFI following the *Screening-Level Ecological Risk Assessment / Scoping Assessment Site Assessment Checklist* and the *Ecological Site Exclusion Criteria Checklist and Decision Tree*.
2	16, 17, & 12/13	Background soil study needed to rule out arsenic as a contaminant from the unit.	C	WSMR will collect background samples for the Main Post area under the separate NMED-approved *Background Soils RCRA Facility Investigation for the Main Post, White Sands Missile Range* (BAE Systems, 2003). Appropriate statistical comparisons of past analytical results for arsenic to background levels will be made under the Phase III RFI.
3	80	Final RFI Report required including results from the confirmation sampling.	C	WSMR will collect confirmation samples from the SWMU 80 area as described in Section 4.1.1.4 of the Phase III RFI Work Plan with analytical results presented in the Phase III RFI Report.
4	80	Background soil study if needed.	C	WSMR will collect background samples for the Main Post area under the separate NMED-approved *Background Soils RCRA Facility Investigation for the Main Post, White Sands Missile Range* (BAE Systems, 2003). Appropriate statistical comparisons of any COPCs exceeding SSLs to background levels will be made under the Phase III RFI.
5	8/9	Final RFI Report required including results of the confirmation soil sampling.	C	WSMR will collect confirmation samples from beneath the former SWMU 8 UST as described in Section 4.3.2.4 of the Phase III RFI Work Plan with analytical results presented in the Phase III RFI Report.
6	14/15	WSMR needs to submit a Final RFI Report to sum up results after the soil was excavated.	C	WSMR will submit the results of confirmation samples collected for the 1997 Closeout Report with the Phase III RFI Report.
7	14/15	May need to collect background soil samples for comparison of some metals (Pb and As).	CWE	WSMR will collect background samples for the Main Post area under the separate NMED-approved *Background Soils RCRA Facility Investigation for the Main Post, White Sands Missile Range* (BAE Systems, 2003). Appropriate statistical comparisons of previous detections of arsenic exceeding current SSLs in unremoved subsurface soils to background levels will be made under the Phase III RFI. Significant levels of lead were not detected in subsurface soil samples and WSMR feels it is inappropriate to compare metals concentrations in temporal sediments to those in background soils.
8	21	Excavated soil returned to pit—need a Final RFI Report…show[ing] that the soil was clean before it was returned to the pit.	C	WSMR will collect confirmation/characterization samples from the area of returned soil at SWMU 21 as described in Section 4.2.1.4 of the Phase III RFI Work Plan with analytical results presented in the Phase III RFI Report.
9	22	Excavated soil returned to pit—need a Final RFI Report…show[ing] that the soil was clean before it was returned to the pit.	C	WSMR will collect confirmation/characterization samples from the area of returned soil at SWMU 21 as described in Section 4.2.2.4 of the Phase III RFI Work Plan with analytical results presented in the Phase III RFI Report.
10	140	Final RFI Report required including results from the confirmation sampling.	C	WSMR will collect confirmation samples from beneath the former SWMU 80 trench as described in Section 4.2.2.4 of the Phase III RFI Work Plan with analytical results presented in the Phase III RFI Report.
11	140	Background soil study may be needed if lead and/or arsenic are still detected at concentrations above the NMSSL after soil excavation.	C	WSMR will collect background samples for the Main Post area under the separate *Background Soils RCRA Facility Investigation for the Main Post, White Sands Missile Range* (BAE Systems, 2003). Appropriate statistical comparisons of any previous or current detections of lead or arsenic exceeding current SSLs in unremoved soils to background levels will be made under the Phase III RFI.

Response Code: (C) Concur, (DNC) Do Not Concur, (CWE) Concur With Exception

PHASE III RFI WORK PLAN FOR MULTIPLE SITES
SWMUs 8-17, 21, 22, 80, 140, & 156
(IRP SITES WSMR #s 30-32, 57, 73, 79, and 84)

Submitted to:

U.S. Army
White Sands Missile Range
Environment and Safety Directorate
White Sands Missile Range, New Mexico 88002-5048

June 2004

Submitted by:

BAE SYSTEMS
Building 126
White Sands Missile Range, New Mexico 88002

EXECUTIVE SUMMARY

White Sands Missile Range (WSMR) submitted a series of no further action (NFA) petitions to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) beginning in January 2000 for the removal of various solid waste management units (SWMUs) from the WSMR Resource Conservation and Recovery Act (RCRA) Permit. The petitions were submitted based on the results of previous investigations and closure reports documenting remedial activities and were denied by NMED in March 2002 on the basis that further characterization and ecological risk assessment were required.

The SWMUs were subsequently reopened within WSMR's Installation Restoration Program (IRP) for further study. These sites are designated as SWMUs 8-9, 10-11, 12-13, 14-15, 16, 17, 21, 22, 80, 140, and 156 in the RCRA Part B Permit Corrective Action Module VIII and respectively, WSMR-36, WSMR-74, WSMR-60, WSMR-33, WSMR-79, WSMR-73, WSMR-31, WSMR-32, WSMR-30, WSMR-84, and WSMR-56 in the WSMR IRP. This is the work plan for a Phase III RCRA Facility Investigation (RFI), designed to address specific concerns listed by NMED for the SWMUs listed above which are located on or in the vicinity of the Main Post. The intent of this Phase III RFI is to address information deficiencies in previous efforts to the extent satisfactory to the state in preparation for a future NFA petition for removal of the SWMUs from WSMR's RCRA Permit. This work plan documents the objectives of this investigation at each SWMU and describes the details of the technical and analytical approaches required to accomplish the tasks.

The approach and implementation to accomplish the objectives will be to collect additional data to address concerns identified by NMED in correspondence regarding the NFA petitions for the SWMUs. Screening level ecological risk assessments will be performed at each SWMU or group of co-located SWMUs to determine the potential for negative ecological impact resulting from historical activities at the SWMUs. Additional characterization data will be collected as requested by NMED at those SWMU sites where previous characterization efforts were incomplete. Confirmation samples will be taken at SWMU sites where past removal actions did not include appropriate confirmation samples. Finally, statistical comparisons will be made between soil metals concentrations detected in samples collected under this Phase III RFI and past investigations and background levels at the Main Post as determined in a background soils RFI conducted separately from this investigation.

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LIST OF ACRONYMS

AOC	Area of Concern
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
COC	contaminant of concern
COPC	contaminant of potential concern
DQO	data quality objective
DRO	diesel range organics
EIB	(New Mexico) Environmental Improvement Board
EPA	(United States) Environmental Protection Agency
FFTA	Former Fire Fighting Training Area
GPS	Global Positioning System
GRO	gasoline range organics
HSWA	Hazardous and Solid Waste Amendment
HWB	(New Mexico Environment Department) Hazardous Waste Bureau
IDW	investigation-derived waste
IRP	Installation Restoration Program
NFA	no further action
NFRAP	No Further Remedial Action Planned
NMED	New Mexico Environment Department
NOD	Notice of Deficiency
ORO	oil range organics
OSWER	Office of Solid Waste and Emergency Response
PCE	tetrachloroethylene
PRG	Preliminary Remediation Goals
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SOPs	(BAE Systems) Standard Operating Procedures
SSL	Soil Screening Level
STP	Sewage Treatment Plant
SVOC	semi-volatile organic compound
SVS	soil vapor survey
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TI	Technical Inspector
TPH	total petroleum hydrocarbons
USCS	Unified Soil Classification System
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
WSMR	White Sands Missile Range

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PHASE III RFI WORK PLAN FOR MULTIPLE SITES SWMUS 8-17, 21, 22, 80, 140, & 156 (IRP SITES WSMR #s 30-32, 57, 73, 79, and 84)

1.0 INTRODUCTION

White Sands Missile Range (WSMR) submitted a series of no further action (NFA) petitions to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) beginning in January 2000 for the removal of various solid waste management units (SWMUs) (Table 1-1), from the WSMR Resource Conservation and Recovery Act (RCRA) Permit. The petitions were submitted based on the results of previous investigations and closure reports documenting remedial activities and were denied by NMED in March 2002 on the basis that further characterization and ecological risk assessment were required.

The SWMUs were subsequently reopened within WSMR's Installation Restoration Program (IRP) for further study. These sites are designated as SWMUs 8-9, 10-11, 12-13, 14-15, 16, 17, 21, 22, 80, 140, and 156 in the RCRA Part B Permit Corrective Action Module VIII and respectively, WSMR-36, WSMR-74, WSMR-60, WSMR-33, WSMR-79, WSMR-73, WSMR-31, WSMR-32, WSMR-30, WSMR-84, and WSMR-56 in the WSMR IRP. This is the work plan for a Phase III RCRA Facility Investigation (RFI), designed to address specific regulatory concerns for the SWMUs listed above and summarized in Table 1-1. The intent of this Phase III RFI is to complete characterization and risk assessment, as necessary, to the extent satisfactory to the state in preparation for a future NFA petition for removal of the SWMUs from WSMR's RCRA Permit. This work plan documents the objectives of this investigation at each SWMU and describes the details of the technical and analytical approaches required to accomplish the tasks.

Table 1-1. SWMUs Included in the Phase III RFI.

IRP ID	SWMU ID	IRP Site Description
WSMR-30	80	STP Sludge/Waste Pile (Main Post)
WSMR-31	21	Main Post Former Fire Fighting Training Area and Pit
WSMR-32	22	Main Post Former Fire Fighting Training Area Waste Pile
WSMR-33	14 & 15	Used Battery Accumulation Areas
WSMR-36	8 & 9	POL Sumps at Building 1794
WSMR-57	156	Former Golf Course Pesticide Storage Shed
WSMR-60	12 & 13	UST Sump, Wash Pad, & Drain Bldg 1778
WSMR-73	17	Waste Underground Injection Pipe
WSMR-74	10 & 11	Vehicle Wash Pad, Drains, Oil/Water Separator
WSMR-79	16	Heavy Equipment Wash Pad and Drain
WSMR-84	140	LC-37 Paint Dump

1.1 White Sands Missile Range Background and Description

The WSMR is a US Army test facility, the majority of which is situated within the Tularosa Basin, with areas along the western and northwestern boundary extending into the Jornada del Muerto Basin. The WSMR is the largest land-area military installation in the United States, covering nearly 3,200 square miles of land. The installation is approximately 99 miles long and 25 to 40 miles wide. The WSMR was established 9 July 1945 as White Sands Proving Ground (the name was changed in 1958), to be America's testing range for the new concept of missile weapons. The New Mexico desert was selected to be the nation's testing range for several reasons: the desert is sparsely populated, has almost year-round clear weather and unlimited visibility, and as such, affords relatively easy recovery of spent missiles.

The WSMR now functions as an outdoor laboratory consisting of a large complex of test ranges, launch sites, impact areas and instrumentation sites required to develop and test tactical and strategic weapons and weapons systems. WSMR is designated as a national range whose mission is the support of missile development and test programs for the Army, Navy, Air Force, National Aeronautics and Space Administration, and other government agencies.

1.2 Background of WSMR's NFA Process for Pertinent Sites

A RCRA Facility Assessment (RFA) of WSMR was concluded by A.T. Kearney for the EPA, Region VI in August 1988. The RFA identified 138 SWMUs and 26 Areas of Concern (AOCs). The results of this RFA were used by the United States Environmental Protection Agency (EPA) to prepare the Hazardous and Solid Waste Amendment (HSWA) Corrective Action Module of the RCRA Permit. The EPA approved and issued the Permit to WSMR on 29 September 1989. Stipulations of the Permit required WSMR to investigate and cleanup 92 SWMU sites and 4 AOCs.

According to the terms of the WSMR HSWA module to the RCRA permit, sites of environmental concern designated as SWMUs are being investigated, characterized and remediated with the concurrence of WSMR, the Administrative Authority, and the public. The Administrative Authority for the WSMR permit is NMED, which was granted HSWA authority on January 1, 1996.

The 92 SWMU sites identified in the Permit were assessed for releases to the environment during the implementation of the Phase I RFI. The Phase I RFI Report (I.T. Corp., 1992) identified 80 SWMUs that required further investigation. Of the 80 sites, 24 were approved for No Further Remedial Action Planned (NFRAP) in September 1993. A modification to the RCRA Permit was initiated to include this change in the HSWA Corrective Action Module of the Permit. The change was made and approved by EPA, Region VI, in December 1995.

Based on EPA and NMED direction, WSMR initiated Phase II of the RFI to further investigate the presence or absence of contaminants at 52 SWMUs identified by the Phase I Investigation as containing contaminants that may pose a risk to human health or the environment. In December 1994, WSMR completed Phase II of the RFI (Sverdrup, 1994) and submitted the report for regulatory review.

In 1996-1997, SWMUs 8, 14, 15, 21, 22, 80, 140, and 156 were remediated based on results of the RFIs. Closeout reports detailing remedial activities at these SWMUs were produced and submitted to NMED. The governing guidelines at the time for determining excessive levels of contamination were primarily EPA Preliminary Remediation Goals (PRGs), but also included other standards or guidelines, such as those established by the New Mexico Environmental Improvement Board (EIB), particularly for total petroleum hydrocarbons (TPH).

Beginning in January 2000, WSMR proposed to remove SWMUs 8-17, 19-22, 80, 132, 140, 145, 147, 150, and 156 from the HSWA module of the RCRA Hazardous Waste Management Permit. WSMR believed that the results of previous investigations and/or waste removal actions demonstrated that NFA was acceptable at these sites. The petitions were subsequently denied in March 2002 based on NMED's assertion that further characterization and ecological risk assessment was required.

1.3 Phase III RFI Objectives

The purpose of this investigation is to address deficiencies in the assessment, investigation, and/or remediation of each SWMU as identified by NMED-HWB. Depending on the results of the additional investigation and assessment efforts at each SWMU, additional assessment or remediation activities will be performed as necessary in preparation for a proposal of NFA. This work plan is designed to document the objectives of the Phase III RFI and describe the details of the technical and analytical approach to accomplishing all tasks. The general tasks planned for each SWMU are listed in Table 1-2 on the following page.

1.4 Approach and Implementation of the Phase III RFI

The approach and implementation for the Phase III RFI is to complete the following tasks for each SWMU (Table 1-2 on following page), where required:

- A screening level ecological risk assessment,
- Environmental sampling to confirm previous removal actions and/or characterize the extent of any possible remaining contamination, and
- Statistical comparisons between analytical results and background levels.

The approach and implementation to accomplish screening level ecological risk assessments for each site will be to determine "if there is any reason to believe that ecological receptors and/or complete exposure pathways exist at or in the locality of the site" (NMED, 2000). These determinations will entail site visits (by a wildlife biologist) to ascertain viable ecological habitat, biological receptors associated with each site, and potential exposure pathways.

Additional characterization and/or confirmation samples will also be collected and analyzed as necessary for each SWMU. For all new environmental sampling data collected, ERIS data deliverables will also be provided, including data management, preparation, and entry into the ERIS database system. The general environmental sampling approach for each IRP site is detailed below.

Table 1-2. Phase III RFI Tasks.

	IRP ID	SWMU Alias	IRP Site Description	SLERA[1]	BG Soil[2]	Env Smpl[3]
1	WSMR-30	80	STP Sludge/Waste Pile (Main Post)	☑	☑	☑
2	WSMR-31	21	Main Post Former FFTA and Pit	☑	☑	☑
3	WSMR-32	22	Main Post Former FFTA Waste Pile	☑	☑	☑
4	WSMR-33	14, 15	Used Battery Accumulation Areas	☑	--	--
5	WSMR-36	8, 9	POL Sumps at Building 1794	☑	--	☑
6	WSMR-57	156	Former Golf Course Pest Storage Shed	☑	--	--
7	WSMR-60	12, 13	UST Sump, Wash Pad, Drain Bldg 1778	☑	☑	--
8	WSMR-73	17	Waste Underground Injection Pipe	☑	☑	--
9	WSMR-74	10, 11	Former Waste Oil Tank/Sump-Bldg 1778	☑	--	--
10	WSMR-79	16	Heavy Equipment Wash Pad and Drain	☑	☑	--
11	WSMR-84	140	LC-37 Paint Dump	☑	☑	☑

1. SLERA = Screening Level Ecological Risk Assessment will be performed
2. BG Soil = Comparison of analytical results of this investigation and/or past investigations to background levels of metals will be performed when requested by NMED or warranted by results of the Phase III RFI
3. Env Smpl = Environmental soil sampling to confirm the success of previous removal actions or characterize existing conditions when previous removal was not adequate

A background study will be conducted separately from the activities in this work plan under an NMED-approved work plan [*Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003)] to ascertain statistical concentrations of metals naturally present in native soils. These background levels will be statistically compared to metals concentrations detected in this and past investigations as appropriate to determine if those concentrations are the result of environmental releases originating at the SWMU or of natural metal levels present in the soil.

WSMR 30 (SWMU 80)

Field activities to support the environmental sampling objectives will consist of the completion of 5 additional soil borings in the area of the former pile to collect confirmation samples. Because the exact location of the former pile is unknown, samples will be taken in a pattern designed to ensure that no fewer than 2 are representative of soils beneath the former pile. Samples will be analyzed for RCRA metals, the full suite of organic compounds, and total cyanide.

WSMR 31 (SWMU 21)

The objectives of environmental sampling in the field are to confirm that the extent of the previous removal actions was sufficient and that fill material returned to the site under the most recent removal action was sufficiently clean. Field activities to support these objectives will consist of the collection of 7 surface soil samples and 7 samples at depth from three additional soil borings made in the vicinity of the former training area. Because the exact location of former training activities and the exact extent of former removal actions are unknown, soil borings will be placed to ensure that no fewer than 2 are made into soils representative of those

underlying the former training area. Samples taken at depth will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), RCRA metals, TPH-diesel range organics (DRO), TPH-oil range organics (ORO), and TPH-gasoline range organics (GRO). Surface sampling will be designed to ensure that no fewer than 3 surface samples are taken from soils removed and replaced under the most recent removal action. Planned surface samples will be analyzed for RCRA metals, TPH-DRO, TPH-ORO, and TPH-GRO. Two surface samples will be treated as "samples of opportunity" to be taken in areas deemed suspicious in the engineering judgement of the sampling team. These samples will be analyzed only for the three TPH parameters.

WSMR 32 (SWMU 22)

The objectives of environmental sampling in the field are to confirm that the extent of the previous removal action was sufficient and that the fill material returned to the site was sufficiently clean. Due to the reasonably expected possibility that this fill material was not sufficiently clean, the sampling is also being performed to characterize the area potentially needing further investigation and remediation. Field activities to support these objectives will consist of the collection of 8 surface soil samples and 16 subsurface soil samples taken from 8 soil borings. The exact location or dimensions of the former pit and pile are not known, so all soil borings will be placed on an evenly spaced grid, 12.5 ft apart, in the suspected former area of the pit and pile. Subsurface samples will be analyzed for VOCs, SVOCs, RCRA metals, TPH-DRO, TPH-ORO, and TPH-GRO. Surface samples will be analyzed for RCRA metals, TPH-DRO, TPH-ORO, and TPH-GRO. Up to 17 additional surface samples will be taken across an area of lighter vegetative cover at the SWMU site, following a system of systematic sampling on a grid with 20 ft intervals. These soil samples will be analyzed for BTEX, SVOCs, RCRA metals, TPH-DRO, TPH-ORO, and TPH-GRO. Up to 10 more surface samples will be taken at locations of opportunity in the vicinity of SWMU 22 at the time of mobilization. These samples will be taken in areas of visibly stained soils to assist in characterizing any small volume "hot spots." These samples will be analyzed for RCRA metals, TPH-DRO, TPH-ORO, and TPH-GRO.

WSMR 33 (SWMUs 14 & 15)

No additional investigations beyond the ecological risk assessment process will be performed for this site. WSMR will provide a summary of the results of confirmation sampling previously performed for the 1997 Closeout Report in response to NMED's request for such. No additional sampling will be performed under the Phase III RFI.

WSMR 36 (SWMUs 8 & 9)

Environmental sampling will be conducted beneath a former underground storage tank (UST) with the objective of confirming completeness of previous removal efforts. Activities to support this objective will consist of the collection of 1 soil sample from the bottom of each of 5 soil borings. These soil borings will be installed in the area of the former UST and aboveground storage tank (AST) to a depth of 12 feet to ensure that samples are taken from soils representative of those underlying the former storage tanks. Samples will be analyzed for TPH-DRO, -GRO, and -ORO, VOCs, and SVOCs.

WSMR 60 (SWMUs 12 & 13)

No additional investigations beyond the ecological risk assessment process will be performed for this site. Appropriate statistical comparisons of previous analytical results to background levels of arsenic will also be made.

WSMR 74 (SWMUs 10 & 11)

No additional investigations beyond the ecological risk assessment process will be performed for this site.

WSMR 57 (SWMU 156)

No additional investigations beyond the ecological risk assessment process will be performed for this site.

WSMR 73 & 79 (SWMUs 16 & 17)

No additional environmental impact investigations will be performed for either site. Statistical comparison of arsenic concentrations detected in previous investigations to background levels will be conducted as well as the ecological risk assessment process.

WSMR 84 (SWMU 140)

Environmental sampling will be conducted at WSMR 84 with the objective of confirming the completeness of the previous removal effort. Activities to support this objective will consist of the collection of 3 soil samples within the former trench boundaries at 10 feet below the existing ground surface. Samples will be analyzed for the full suite of VOCs and RCRA metals.

1.4.1 Scope of the Phase III RFI

This Work Plan addresses each of these activities in detail. Each activity is intended to more fully characterize possible contamination, provide information to determine areas in which further data may be required, and provide data to conduct studies for corrective measures, if warranted. Sample siting for this work is based on the results of previous investigations at each SWMU. However, WSMR may alter field work described in this work plan based on field observations and the judgment of the sampling team to provide more representative samples of actual site conditions.

All aspects of quality assurance, quality control, data validation and data reporting will be in conformance with the WSMR Missile Range RCRA Permit, the New Mexico Hazardous and Radioactive Materials Bureau Standard Operating Procedures Manual (NMED-HRMB, 1998) and the Office of Solid Waste and Emergency Response (OSWER) Directive 9902.3-2A. Analytical data generated during the Phase III RFI will be compared to NMED Soil Screening Levels (SSLs) for a residential exposure scenario. If an SSL is not available, WSMR will use an appropriate equivalent EPA screening level. In assessing data from TPH analysis, WSMR will use the 2003 NMED TPH Screening Guidelines.

2.0 MAIN POST SITE DESCRIPTION

2.1 Location Information

2.1.1 WSMR

WSMR is located in Southern New Mexico, with land in Doña Ana, Socorro, Lincoln, Otero, and Sierra Counties (Figure 2-1). The majority of the range, including the Main Post area, is located in the Tularosa Basin.

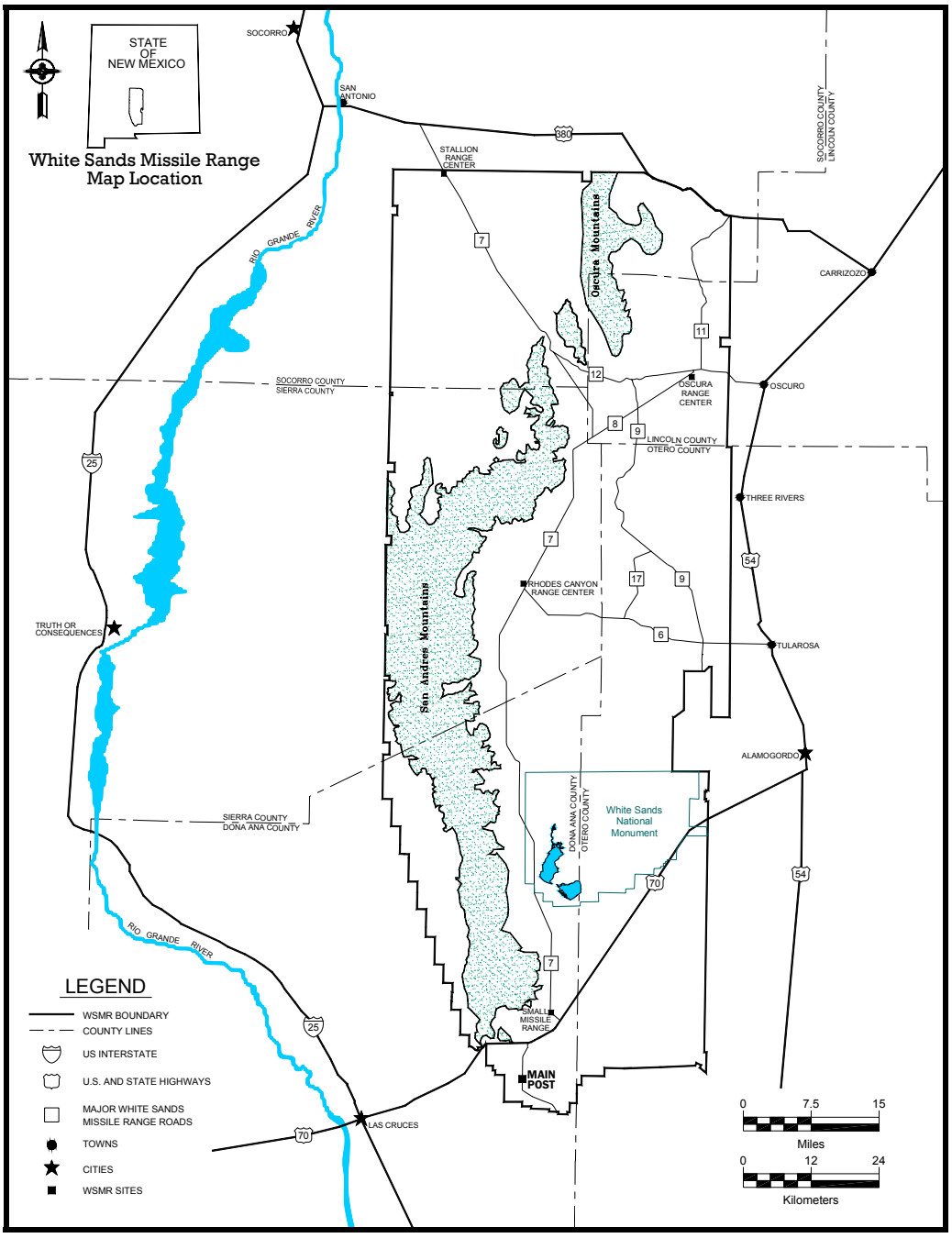

Figure 2-1. White Sands Missile Range Location.

2.1.2 Main Post

The Main Post area of WSMR, where the headquarters and most installation support activities are, is located at the southwestern corner of the installation, approximately 27 miles east-northeast of Las Cruces, NM and 45 miles north of El Paso, TX (Figure 2-1).

2.1.3 Individual WSMR Sites

All but one of the WSMR Sites (WSMR 84 /SWMU 140) pertinent to this report is located at the Main Post area. WSMR 84 (SWMU 140) is located approximately 12 miles east of the Main Post. These sites have been grouped into zones based on proximity, as detailed in Table 2-1 and shown in Figure 2-2 on the following page.

Table 2-1.
Zone Grouping and Location of WSMR Sites.

Zone	IRP ID / SWMU Alias	Location
I	WSMR 30 / SWMU 80	Approximately 100 feet southeast of Main Post Sewage Treatment Plant sludge drying beds.
II	WSMR 31 / SWMU 21	Approximately 250 feet south of Martin Luther King Blvd., near the intersection with Headquarters Ave.
	WSMR 32 / SWMU 22	Approximately 350 feet south of Martin Luther King Blvd. and immediately west of Headquarters Ave.
III	WSMR 33 / SWMUs 14 & 15	Immediately south (SWMU 14) and approximately 50 feet northeast (SWMU 15) of the Building 1776 Battery Shop.
	WSMR 36 / SWMUs 8 & 9	Approximately 300 feet east of Building 1794 at the Post Headquarters Maintenance Area.
	WSMR 60 / SWMUs 12 & 13	Immediately east of Building 1778 in the Main Post area.
	WSMR 74 / SWMUs 10 & 11	Immediately west of Building 1778 in the Main Post area.
IV	WSMR 57 / SWMU 156	Approximately 1,000 feet southeast of the Officer's Club at the Main Post Golf Course.
V	WSMR 73 / SWMU 17	Reportedly located at the southwest corner of Building 1753, the Heavy Equipment Maintenance Shop.
	WSMR 79 / SWMU 16	Southern section of the WSMR Main Post, west of Building 1736.
VI	WSMR 84 / SWMU 140	Approximately 12 miles east of the WSMR Main Post and 0.8 miles north of Range Road 2.

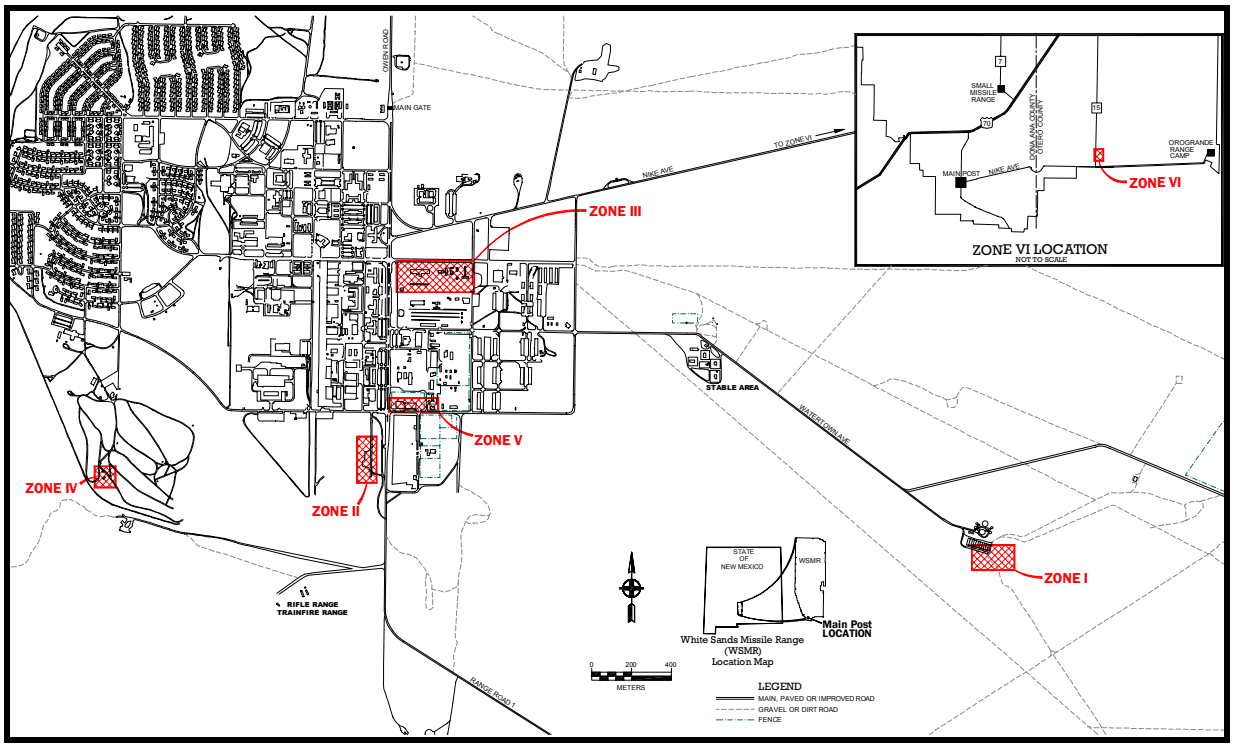

Figure 2-2. Zoning of SWMU Sites at the Main Post.

2.2 WSMR Regional Physiography and Ecology

2.2.1 Geology

WSMR lies within the Mexican Highland Section of the Basin and Range Province. This province is characterized by a series of tilted fault blocks forming longitudinal, asymmetric ridges, or mountains, and broad intervening basins. The geology of WSMR consists predominantly of the Tularosa Basin and surrounding mountain ranges. Figure 2-3 (on the following page) is a cross-section through the Tularosa Basin and surrounding mountain ranges. The San Andres Mountains, San Augustin, and Oscura Mountains border the Tularosa Basin on the west while the Sacramento Mountains form the eastern border. A narrow region of north-south-trending, large-displacement normal faulting separates the mountains from the basin resulting in the change in relief across the missile range. The average elevation of the Tularosa Basin is 4,000 ft above mean sea level. The majority of WSMR property including most test facilities is located within the Tularosa Basin (WSMR, 1998).

The San Andres range trends north-south for approximately 85 miles along the western border of WSMR and varies in elevation from approximately 5,700 ft at San Augustin pass, where Highway 70 crosses the mountains, to over 9,000 ft at Salinas Peak, the highest point on WSMR. The San Andres Mountains form the westward dipping limb of a broad anticlinal structure whose axial plane follows the Tularosa Valley. The mountains are composed of a thick sequence of sedimentary rocks [Mississippian to Pennsylvanian limestones, sandstones, and shales] which dip westward on the western limb of the anticline (Kottlowski et al., 1956). The Organ Mountain fault and Artillery Range fault zones extend from El Paso, Texas to the

Mockingbird Gap along the eastern base of the San Andres Mountains. These fault zones are composed of large-displacement normal faults which promoted the uplift of the fault block mountain ranges (San Andres and Oscura) above the Tularosa Basin and are the result of continued extension in the Rio Grande Rift (Seager, 1981).

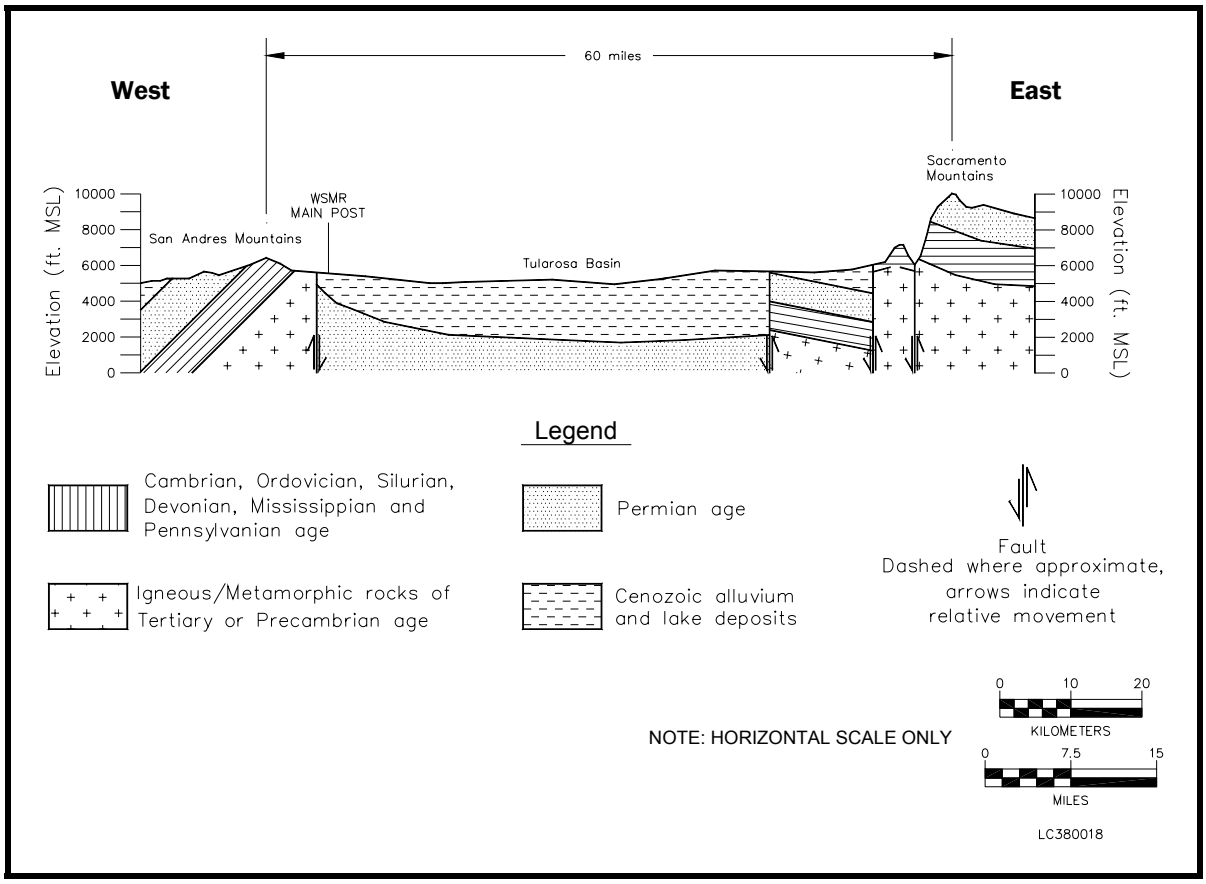

Figure 2-3.
Mexican Highland Section, Basin and Range Province, Tularosa Basin Cross Section.

The Oscura Mountains extend north and east from the San Andres mountain range, forming the northern terminus of the Tularosa Basin. The Oscura Mountains are bounded on the west by the Jornada del Muerto basin, on the east by the northern-most limit of the Tularosa Basin, and on the north by Chupadera Mesa. The Oscura Uplift is a basement-cored uplift formed by the large-displacement normal fault on its western margin (Organ Mountain fault and Artillery Range fault zone). Paleozoic sedimentary rocks cap the Precambrian basement rocks (Precambrian granite) and dip northward and eastward towards the Tularosa Valley floor and Chupadera Mesa.

The Sacramento Mountains form an asymmetrical ridge with a steep escarpment on the east and a broad alluvial apron on the west. The escarpment marks a major fault zone along the eastern edge of the Sacramento Mountains overlooking the downthrown Tularosa Valley. The fault zone is composed of normal faults where the Sacramento Mountains were uplifted relative to the downdropped Tualrosa Basin. The Sacramento Mountains contain a series of strike valleys that cut into well exposed rocks ranging from Precambrian granites to Paleozoic through tertiary

sedimentary rocks [limestones, sandstones, and shales] (Kottlowski, 1956). These sedimentary rocks, along with those in the San Andres Mountains, provide the source for gypsum and other evaporite minerals (mineral salts) prevalent within the Tularosa Basin.

The Tularosa Basin contains thick sequences of Tertiary and Quaternary age alluvial and bolson fill deposits. These sediments, more than 5,000 ft thick in some areas, consist mainly of silt, sand, gypsum and clay weathered from the surrounding mountain ranges. The average elevation of the basin floor is 4,000 ft above mean sea level and surface features consist of flat sandy areas, sand dunes, basalt flows, and playas (dry lake beds).

The nature of the bolson-fill deposits varies both laterally and vertically throughout the Tularosa Basin. Coarse-grained, poorly sorted sediments deposited near mountain fronts grade into fine-grained, well sorted sediments towards the center of the basin (Kelly, 1973). Sediments further from the mountain fronts also contain a greater percentage of clay and gypsum. Vertically, the sediments are reported to become finer-grained and more consolidated until reaching a laterally continuous clay unit at about 1,000 ft below ground surface (Kelly and Hearne, 1976).

In general, the stratigraphy is represented by unconsolidated to partially consolidated, fine to medium-grained sand with subordinate amounts of clay. Caliche is present as discrete layers and nodules throughout the stratigraphic section. Although no faults within the basin fill are mapped within the immediate area, Quaternary faulting is known to exist within the region. These faults are reported to occur within the unconsolidated bolson sediments, trend north to south, and are most common near the mountain fronts. Orr and Myers (1986) divide the Tularosa Basin fill deposits into 5 distinct mapable units which include:

- Coarse to fine-grained deposits occur in gently sloping alluvial fans along the basin margin. The alluvial fans spread outward from the surrounding mountain slopes and coalesce into flat alluvial plains toward the basin interior. These fan deposits interfinger with lacustrine (lake) and alluvial deposits of the central part of the Tularosa Basin.
- Fine-grained sediments formed from lacustrine deposition extend throughout most of the Tularosa Basin. These deposits consist mainly of clay and evaporites with minor sand beds and occur near surface in the northern part of the basin and at depth in the southern part of the basin.
- Fluvial-eolian sand, gravel, and clay deposits occur in the southern part of the basin, near Fort Bliss, extending from the Organ and Franklin Mountains and south to the Hueco Mountains.
- Gypsiferous evaporite deposits of the Lake Lucero-White Sands area occupy the White Sands National Monument (WSNM) and areas administered by WSMR including the Lake Lucero area and the alkali flats north of Lake Lucero. These deposits occur as dense recrystallized gypsum, gypsum sand dunes, and alluvial deposits. Hard caliche (cemented with recrystallized gypsum) is present at or near surface in the dry lake gypsum deposits of the central portion of the basin.
- The last depositional unit is described as composed of coarse-grained deposits saturated with saline water in the central portion of the Tularosa Basin.

Volcanic deposits (the Malpais) occur in the northern portion of the Tularosa Basin in the form of basaltic lava flows. The Malpais volcanics extend from northwest of Carrizozo, New Mexico to south of the ORC in the northern portion of WSMR. The Malpais volcanics rise up to 200 ft above the Tularosa Basin floor and are approximately 30 miles long and 0.5 to 5 miles wide (WSMR, 1998).

The Main Post is situated on the distal portion of the alluvial fan complex eroded from the Organ Mountains to the west. Deposits expected to be encountered at the Main Post correspond to the first mappable units described above. The predominant slope across the area causes runoff water to flow to the east towards the center of the Tularosa Basin. Coincidentally, the prevailing wind direction is from the west and southwest. Wind and water currents winnow fine-grained particles and disperse them eastward, while coarser (and very dense) material remains behind as sediment.

2.2.2 Surface Hydrology

Very little surface water exists at WSMR due to low annual precipitation, high evapotranspiration rates, and high infiltration characteristics of the soils. During the summer season, when thunderstorm activity is most common, playas within the basin may contain standing water. Arroyos which drain the surrounding mountains usually contain water only following heavy precipitation events. The Tularosa Basin is a closed basin with no surface water drainage outside of WSMR.

2.2.3 Geohydrology

The WSMR Main Post obtains its potable water supply from an aquifer in the upper bolson deposits. The majority of the groundwater recharge to this bolson aquifer occurs through the coarse, unconsolidated Tertiary/Quaternary alluvial fan deposits and arroyos along the eastern flank of the Organ, San Agustin and San Andres Mountains. This aquifer consists of a wedge-shaped belt of potable water more than 30 miles long from north to south, and 3 to 5 miles east from the mountain front. Groundwater in the vicinity of the Main Post is of sufficient quality (less than 1,000-mg/L total dissolved solids) for human consumption. McClean (1970) reported this freshwater zone extends down to about 1,800 ft below ground surface.

Recharge to the regional aquifer is from precipitation falling on the mountain ranges and alluvial fans which border the bolson on the west (WSMR, 1993). This precipitation infiltrates the unconsolidated, relatively coarse deposits of the alluvial fans, and the resultant groundwater flows toward the center of the Tularosa Basin, generally to the east-southeast. To the east, groundwater becomes more mineralized, primarily with sulfate and chloride, most likely due to the slow lateral migration rate of groundwater from recharge to discharge areas in the presence of readily soluble minerals in the bolson sediments. However, groundwater flow direction within the western Tularosa Basin region is presumed to discharge to the south as underflow into the contiguous, northern Hueco Basin of western Texas. No surface expressions of groundwater discharge have been reported within the western Tularosa Basin.

2.2.4 Ecology

2.2.4.1 Flora

The vegetation matrix around Main Post is defined as climax dune vegetation typically consisting of honey mesquite (*Prosopus glandulosa*), four-winged saltbush (*Atriplex canescens*), soaptree yucca (*Yucca elata*), sand dropseed (*Sporobolis cryptandrus*), broom snakeweed (*Gutierrezia sarothrae*), and annuals. Blowouts and wind-sifted actively moving sand dunes with little inter-dunal vegetation comprise dune land. Competition for moisture by mesquite limits grasses in this habitat. Grasses that sporadically occur include spike dropseed (*Sporobolus contractus*), mesa dropseed (*Sporobolus flexuosus*) and alkali sacatone (Sporobolus airoides). A list of vegetation occurring in the Main Post Area is provided in Appendix C.

White Sands Missile Range lists Sheer's pincushion cactus (*Coryphantha sheeri*) as a species of concern that infrequently occurs in this habitat type.

2.2.4.2 Fauna

Black-tailed jackrabbits (*Lepus californicus*) and desert cottontail rabbits *(Sylvilagus audubonii*) occur in the WSMR Main Post area with high frequency. Oryx (*Oryx gazella*), mule deer (*Odocoileus hemionus*), mourning dove (*Zenaida macroura*), and scaled quail (*Callipepla squamata*) also occur in the area. Non-game wildlife sited around the Main Post includes raptors such as red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*Buteo swainsoni*), and American kestrels (*Falco sparverius*). Songbirds common around Main Post include black-throated sparrows (*Amphispiza bilineata*), house finches (*Carpodacus mexicanus*), and Say's phoebes (*Sayornis saya*). Lists of wildlife species occurring in the Main Post Area are provided in Appendix C.

The Texas horned lizard (*Phrynosoma cornutum*) does occur in this habitat. This species is not listed as threatened or endangered, but is a New Mexico candidate (2C) species. The Texas horned lizard is very common and widespread throughout suitable habitats on White Sands Missile Range. Herpetologists for the New Mexico Department of Game and Fish have recommended that the Texas horned lizard be removed State candidate list.

2.2.5 Climatology

The elevation of the WSMR Main Post is approximately 4,000 ft above mean sea level. Snowfall is infrequent, although heavy snows have occurred. With an average annual rainfall of only 10.8 inches, mostly occurring during late summer as thunderstorms, often accompanied by hail, the area is considered semi-arid. Intense localized thunderstorms have caused flash flooding in the past. The average summer high temperature is 92 °F with lows of about 65 °F. During the winter months (December, January and February), the average high is 57 °F, with lows of about 36 °F. Average annual humidity readings are approximately 37 percent. Westerly winds can reach approximately 40 miles per hour, and wind is a climatic factor from February to about May.

3.0 PREVIOUS INVESTIGATIONS

The SWMUs of interest in this report have all been characterized by an RFA and two phases of RFI, excepting SWMU 80, for which a remediation action was performed following the Phase I RFI. Eight of the fifteen SWMUs have had remediation actions performed and corresponding Closeout Reports submitted to the NMED.

3.1 RCRA Facility Assessment

An RFA of WSMR was concluded by A.T. Kearney for the EPA, Region VI in August 1988. The RFA sought to identify SWMUs and document historic, anecdotal, or visual evidence of a release of contaminants to the surrounding environment, but did not involve any environmental sampling. The RFA identified 138 SWMUs and 26 AOCs.

3.2 Phase I RCRA Facility Investigation

The Phase I RFI was completed by I.T. Corp in 1992 to assess the possibilities of releases to the environment at the SWMUs. Environmental sampling was planned to determine if a release had occurred, to characterize any potentially hazardous constituents of such a release, and to determine whether further investigation and/or remediation was necessary.

3.3 Phase II RCRA Facility Investigation

The Phase II RFI was completed by Sverdrup Environmental in 1994 to further investigate the presence or absence of contaminants at those SWMUs identified by the Phase I RFI as containing contaminants that may pose a risk to human health or the environment. The Phase II RFI sought to use planned environmental sampling to further characterize the nature and extent of contamination at those SWMUs and to identify whether those contaminants could migrate to receptors.

3.4 Closeout Reports

Based on the results of the Phase I and II RFIs, SWMUs 8, 14, 15, 21, 22, 80, 140, and 156 were remediated by Radian and Dow Environmental. Closeout reports completed in 1996 and 1997 detailed the remedial activities and described the results of environmental confirmation sampling at the sites.

3.5 Ongoing Best Management Practices

Multiple Main Post-wide best management practices have been instituted by WSMR to monitor and report potential environmental releases in the main post area. These include a storm water runoff sampling program under an NPDES Permit and a multi-media inspection program. The storm water runoff sampling program monitors runoff from appropriate areas at the Main Post for contaminants of potential concern (COPCs) at various sites. The multi-media inspection program inspects and provides assistance to facilities of potential concern WSMR-wide for environmental compliance issues.

4.0 PHASE III RCRA FACILITY INVESTIGATION APPROACH

The fifteen SWMUs identified for this Phase III RFI have been grouped into six zones based on their proximity to each other. This grouping was done to reduce the redundancy of the work effort. The zones are shown in Figure 4-1.

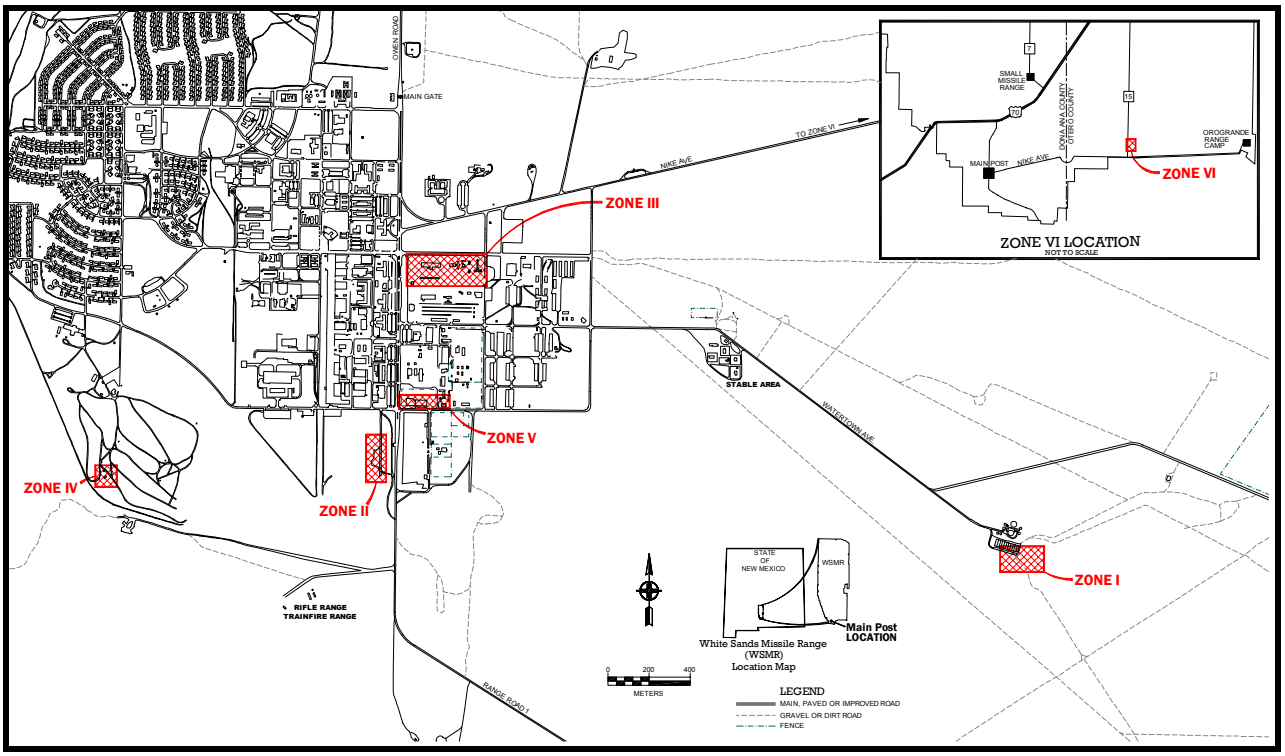

Figure 4-1. Zoning of SWMU Sites at the Main Post.

4.1 Zone I

4.1.1 WSMR 30 (SWMU 80) STP Sludge/Waste Pile

4.1.1.1 Description and Operational History of SWMU 80

A flash flood in 1978 damaged the Main Post Sewage Treatment Plant (STP) sludge drying beds. Debris from the flood damage clean-up, including reinforced concrete, excavated soil and sludge, was stockpiled at the SWMU 80 site. Dimensions of the sludge waste pile were approximately 75 feet by 50 feet by 2-6 feet high. The site was subsequently used for the stockpiling of dried sludge following construction of new sludge drying beds. SWMU 80 was located approximately 100 feet southeast of the sludge beds. Following characterization through the RFI, the waste material, which comprised the SWMU, was removed for disposal at the WSMR Main Post landfill.

4.1.1.2 Previous Investigations at SWMU 80

The RFA performed for SWMU 80 did not locate any records of historic analytic data or site assessments, but did note that the concrete forms of the demolished sludge drying beds could be seen in the waste pile. Surface sediment and sludge from the waste pile were sampled in the Phase I RFI. These samples detected elevated cyanide levels, although still below the current NMED SSL and total chromium concentrations in excess of the EPA Region 9 PRG (an NMED SSL for total chromium is not available). The Phase I RFI concluded that the concentrations detected in the pile did not represent a significant threat for leaching downward, but that cyanide adsorbing onto fugitive dust particles was of some concern. The site was not investigated during Phase II of the RFI. The waste materials were removed to the WSMR Main Post Landfill during a remedial action in 1996, with excavation extending to 2 feet below surrounding terrain, but confirmation samples were not collected. Following excavation, the area was backfilled, leveled, and hydro-seeded. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.1.1.3 Preliminary Site Conceptual Model for SWMU 80

Nature and Extent of Contamination

Because confirmation samples were not collected, the extent of contamination beneath the former waste pile is unknown. Based on the results of waste pile sampling in the Phase I RFI, it is possible that chromium and cyanide contamination exists beneath the pile, but likely not at concentrations exceeding standards. Sediment sample results from the Phase I RFI indicate that no appreciable contamination was present downslope from the waste pile.

Site Specific Geology

No site-specific subsurface data has been located for soils at the SWMU 80 site. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands. The on-site geologist will select representative cores from soil borings made at the time of sample collection to characterize subsurface geology at the site.

4.1.1.4 Phase III RFI Data Collection at SWMU 80

Data collected as part of the Phase III RFI is serving primarily to address the possible ecological risk posed by contaminants potentially released to the environment by the waste pile prior to its removal and to remedy information deficiencies due to incomplete confirmation sampling in previous investigations. Soil samples will be collected at the site to confirm that the removal of the waste pile in 1996 was successful in removing all contaminated materials. The exact location of the former pile cannot be ascertained, and the contours of the existing terrain suggest that the depth of backfill may have exceeded the depth of excavation during the removal action. A systematic scheme of sampling has been chosen to cover the general area of the former pile.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the appropriate BAE Systems Standard Operating Procedures (SOPs). The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site following appropriate guidance.

Phase III Soil Sample Collection

Because the exact former location of the pile is unknown, achieving precise confirmation sampling of the soils existing beneath that pile is improbable. Boreholes will be made using a hollow-stem auger or push probe following procedures listed in Section 5.1.3 and BAE Systems SOPs. These boreholes will be placed in locations as shown in Figure 4-2 (on following page).

Given the approximate size of the former pile and the size of the area where the pile was formerly located, it is expected that at least three of these borehole locations will be directly within the area of the former pile. It is not necessary that all of the samples taken be from directly under the former pile, as the purpose of the effort is confirmation of removal, not characterization. If significant concentrations of any COPCs are detected in any sample, appropriate characterization will be made to ensure adequate scope for subsequent removal actions.

While the Closeout Report for the 1996 removal action stated that excavation occurred to a depth of 2 ft bgs, current site reconnaissance leaves some uncertainty about the actual depth of the former excavation base after backfill and grading. Therefore, samples will be taken from the boreholes at depths of 5 ft below the existing ground surface. This sample depth will be sufficiently shallow to be representative of soils beneath the base of the former excavation but not so shallow as to actually be indicative only of fill or graded soils. Because clean fill soils were potentially brought to the site and graded in an undefined area, surface samples will not be taken.

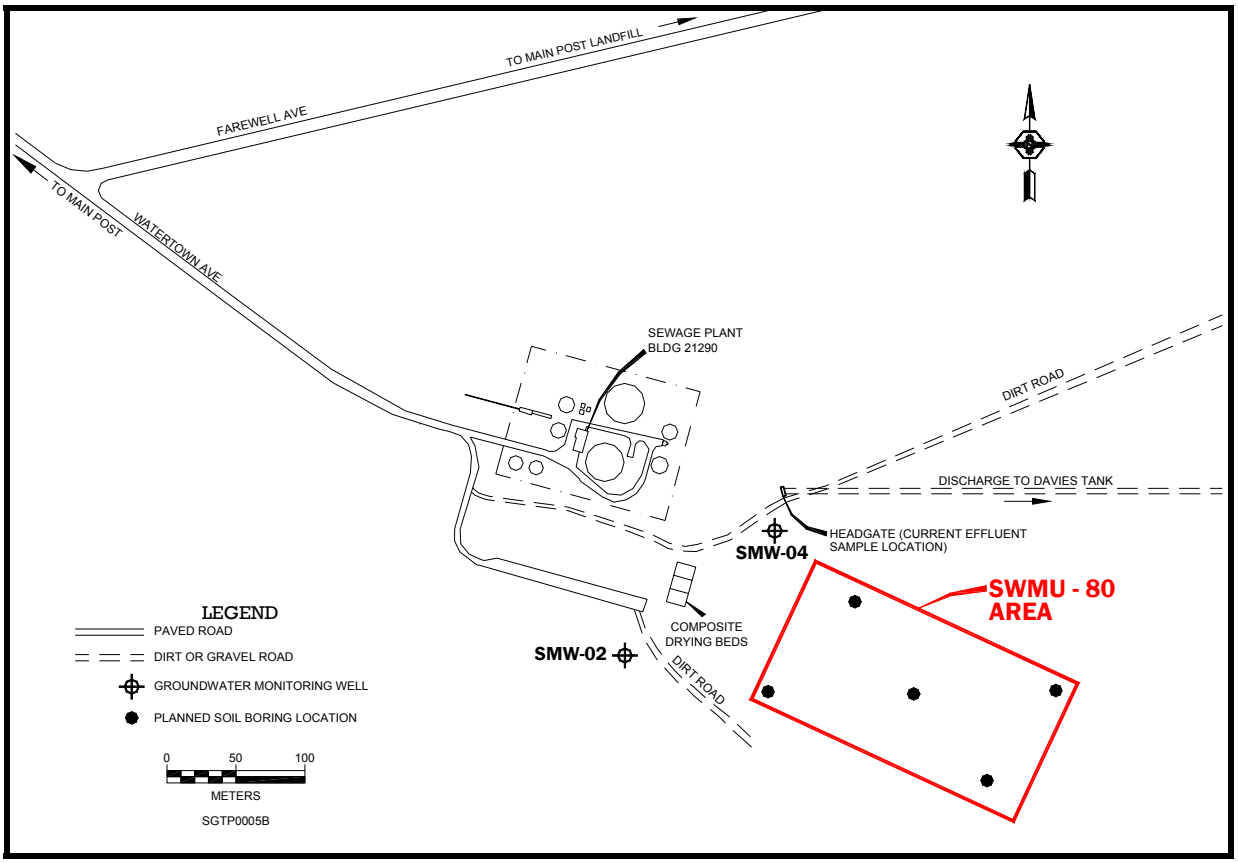

Figure 4-2. Planned Sampling Locations at WSMR 30 (SWMU 80).

All samples will be analyzed for the analytes listed in Table 4-1. In the event that no significant contaminant detection is made in any samples, the successful removal of the former pile will be deemed to be reasonably confirmed. In the event that significant detections of RCRA metals are made in one or more soil samples, an examination of deviance from background levels will be made based on the background soil study as described below. If metals levels are found to significantly exceed background levels, or if a significant detection of another target analyte is made, planning for additional characterization and removal, as necessary, will be made for the site.

Table 4-1. Analytical List for SWMU 80 Sample Collection.

Proposed Analytes	Analytical Method *
Total RCRA Metals	6010-B
Total Cyanide	9012-A
VOC	8260-B
SVOC	8270-C

* Method stated or equivalent method will be used to analyze samples.

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for the STP and SWMU 80. Appropriate statistical comparisons will be made between background data and the analytical results for inorganic contaminants of potential concern (COPCs) in confirmation samples. In the event that an inorganic constituent is found to significantly exceed background levels in a confirmation sample, a determination of environmental impact resulting from the SWMU will be made. As part of this determination, the exceeding constituent will also be compared to the appropriate action level(s). If the action level(s) are exceeded, recommendations will be made in the Phase III RFI Report for future additional characterization and/or remediation efforts as are appropriate. If the environmental impact does not exceed the appropriate action level(s), it will be noted in the Phase III RFI Report but no further characterization or removal efforts will be recommended unless the full scope of environmental data indicates that a significant aspect or portion of the previous source removal was incomplete.

4.2 Zone II

4.2.1 WSMR 31 (SWMU 21) Main Post FFTA and Pit

4.2.1.1 Description and Operational History of SWMU 21

The Former Fire Fighting Training Area (FFTA) is located immediately south of the WSMR Main Post. During its operation from the early 1960's until 1982, petroleum-based fuels were ignited to simulate fire emergencies. The site is located approximately 250 feet south of Martin Luther King Boulevard (formerly Raritan Avenue), near the intersection with Headquarters Avenue. The FFTA site occupies an area approximately 120 feet by 30 feet. Training for the WSMR fire department involved the release and ignition of petroleum-based fuels. Storage tanks at the site reportedly held waste jet fuel and diesel fuel (I.T. Corp, 1992). The Phase II RFI stated that after the FFTA was deactivated in 1982, the site was excavated to a depth of 8 feet in search of oil-contaminated soil. Records were not available as to the disposition of the soil, but SWMU 22 (FFTA Waste Pile) may have been the recipient of the soil.

4.2.1.2 Previous Investigations at SWMU 21

The RFA conducted for SWMU 21 did not locate any records of historic contaminant releases, site assessments, or sampling activities, but it did report several areas of stained soil. The Phase I RFI consisted of a soil vapor survey (SVS), near-surface soil sampling, and sampling up to 20 feet below ground surface (bgs) with soil borings. The SVS detected benzene, toluene, ethylbenzene, and xylenes (BTEX) and carbon dioxide hot spots in the vicinity of the fuel storage tanks. Elevated concentrations of TPH were detected in all near surface soil samples, some exceeding current screening guidelines, but TPH was detected only in low concentrations or not at all in all samples taken at depth. Lead concentrations above the current NMED SSL were also detected in some near-surface samples. The Phase II RFI sought to further characterize the nature and extent of contamination with additional surface soil and shallow

boring samples. Concentrations of TPH exceeding guidelines were again detected at the surface but not at depth. Arsenic levels above the current NMED SSL were also detected at the surface and at depth. In 1996, a 50 by 50-foot area was excavated to a 1-foot depth and confirmation samples were taken at the floor of the excavation. A portion of this soil, where TPH testing showed some concentration of gasoline range organics, was removed to the WSMR Landfill and the majority of the soil was returned to the site. Three ASTs were also scheduled for removal, but, upon mobilization, they were found to no longer be present. Results of the confirmation sampling were reported in the Closeout Report. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.2.1.3 Preliminary Site Conceptual Model of SWMU 21

Nature and Extent of Contamination

Given the operational history of the site, the predominant contaminants expected to be present are unburned petroleum hydrocarbons, any persistent byproducts of the burned hydrocarbons, and any chemical extinguishing agents which may have been used in training. The volume of fuel left unburned following the training cycles cannot be determined and the nature, volume, and disposition of soil potentially removed in 1982 is not known with certainty. The Phase II RFI concluded that the extent of contamination was limited horizontally to the area around the storage tanks and vertically to the upper 1 foot of soil. Soil was removed to 1 foot depth during the 1996 closeout, and samples taken at the floor of the excavation did not detect further contamination. The majority of the soil excavated during the remediation action was returned to the site following composite waste characterization sampling.

There are 2 predominant possible modes of contaminant introduction at this site. One is the introduction during training exercises, which would be an intermittent load presumably introduced at approximately the same area at each interval and where several possible contaminant groups would be introduced — the raw hydrocarbons, any byproducts from the burn and extinguishing, and any raw extinguishing or fire retardant chemicals. This mode of introduction is known to have occurred at the site. The second is the introduction from a leak from the storage units. This would be a more continuous, predictable introduction and would only be introducing the raw hydrocarbons to the environment. It is not known if such leaking existed, and verification of the possibility is difficult because training activities happened in the vicinity of storage activities.

It is expected that contamination resulting from training activities existed as localized hot spots during the Phase I and II RFIs, due to intermittent variable loading. The excavation of the surface soils and subsequent return of the majority of that material during the 1996 removal action likely served to partially mix the soil and homogenize possible contamination. Any contamination existing below or outside the area of the excavation would not have been significantly affected by the removal and replacement.

Elevated concentrations of arsenic and lead were also detected during the Phase II RFI on the surface and at depth in the training area, but are not coincident with each other or other potential site contaminants.

Site Specific Geology

No site-specific subsurface data has been located for soils at the FFTA. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands. The on-site geologist will select representative cores from soil borings made at the time of sample collection to characterize subsurface geology at the site.

4.2.1.4 Phase III RFI Data Collection at SWMU 21

Data collected as part of the Phase III RFI will serve primarily to fulfill data needs for a screening level ecological risk assessment and to address information deficiencies in previous investigations to the extent that is pragmatic. Soil samples will be collected down to greater depth to verify the absence or removal of contaminated material in the previous excavations. The soil excavated and replaced in 1996 will also be sampled to further characterize any hazardous contaminants potentially present.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, both Zone II sites will be considered in conjunction and one assessment performed. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Phase III Soil Sample Collection

Soil samples will be collected with the objective of verifying the completeness of the 1996 closure action. This will include taking confirmation samples from soils beneath that excavation and from soil returned to the excavation during backfill. Because the exact location of former training activities and excavations are unknown, achieving precise confirmation sampling is improbable.

Surface and subsurface samples will thus be taken in the vicinity of the training area and excavation following a systematic approach which will ensure that a sufficient number of samples are taken from actual backfill and underlying soils.

Three boreholes will be made using a hollow-stem auger or push probe to a depth of 10 ft bgs following Section 5.1.3 and BAE Systems SOPs. These boreholes will be placed in the area of the former training area and storage tanks as shown in Figure 4-3. Samples will be taken from SB-01 and SB-03 at the surface (0-0.5 ft bgs), 2 ft bgs, and 10 ft bgs. Samples will be taken from SB-02 at the surface (0-0.5 ft bgs), 2 ft bgs, 5 ft bgs, and 10 ft bgs. Surface samples will also be taken at the two other locations shown on Figure 4-3 and at two locations of opportunity — at the time of field sampling; two samples will be taken from areas most likely to represent contaminated zones as determined by visual inspection.

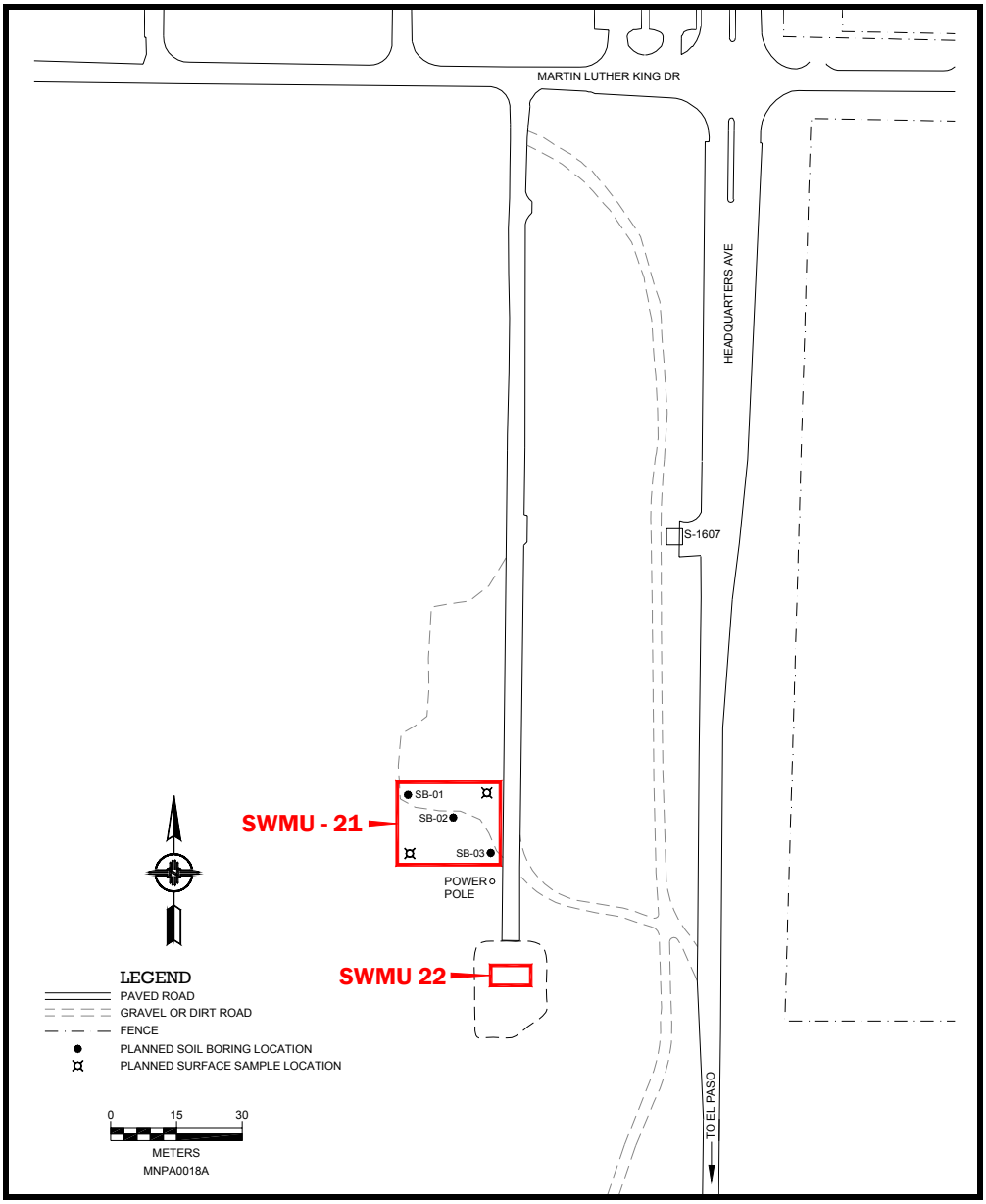

Figure 4-3. Planned Sampling Locations at WSMR 31 (SWMU 21).

While the 1996 removal action only entailed excavation to 1 ft bgs, it is possible that the 1982 removal action extended to 8 ft bgs. Confirmation samples are therefore being taken at a depth exceeding the potential impact from both removal actions.

A total of 14 primary samples will be collected, and one duplicate collected for a subsurface sample. The seven primary samples and duplicate collected below the surface will be analyzed for the analytes listed in Table 4-2. The five planned primary surface samples will be analyzed for the analytes listed in Table 4-3. The two surfacial "samples of opportunity" will be analyzed for TPH-DRO, -ORO, and -GRO by Method 8015M.

Table 4-2. Analytical List for SWMU 21 Sample Collection Below Ground Surface.

Proposed Analytes	Analytical Method *
Total RCRA Metals	6010-B
VOC	8260-B
SVOC	8270-C
TPH DRO, ORO, and GRO	8015-M

* Method stated or equivalent method will be used to analyze samples.

Table 4-3. Analytical List for SWMU 21 Surface Sample Collection.

Proposed Analytes	Analytical Method *
Total RCRA Metals	6010-B
TPH DRO, ORO, and GRO	8015-M

* Method stated or equivalent method will be used to analyze samples.

The intent of these sampling activities is to confirm that previous remedial actions were successful in removing contamination from the site. Subsurface samples should confirm the presence/absence of contaminant migration. Since the contaminated soils have been generally homogenized with regards to contaminants, the results of surface sampling should be descriptive of TPH concentrations in the soil returned to the site after the 1996 remedial action. The analytical results from this sampling event will be incorporated with those from previous site investigations and presented in the final RFI Report. In the event that significant detections of RCRA metals are made in any soil samples taken under this work plan, a comparison to background levels will be made as described below. Further appropriate characterization and remediation will be planned for this site as required.

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for SWMU 21. Appropriate statistical comparisons will be made between background data and the analytical results for inorganic COPCs in confirmation samples and characterization samples in past investigations. In the event that an inorganic constituent is found to significantly exceed

background levels in a confirmation sample, a determination of environmental impact resulting from the SWMU will be made. As part of this determination, the exceeding constituent will also be compared to the appropriate action level(s). If the action level(s) are exceeded, recommendations will be made in the Phase III RFI Report for future additional characterization and/or remediation efforts as are appropriate. If the environmental impact does not exceed the appropriate action level(s), it will be noted in the Phase III RFI Report but no further characterization or removal efforts will be recommended unless the full scope of environmental data indicates that a significant aspect or portion of the previous source removal was incomplete.

4.2.2 WSMR 32 (SWMU 22) Main Post FFTA and Waste Pile

4.2.2.1 Description and Operational History of SWMU 22

The purpose of the SWMU 22 waste pile has not been identified and, therefore, its operational history is unknown. SWMU 22 was first addressed in the RFA (Kearney, 1988). The site is located approximately 350 feet south of Martin Luther King Boulevard and immediately west of Headquarters Avenue. The RFA identified the site as SWMU 22 because of its proximity to the FFTA and due to its petroleum-stained soil and gravel stockpiles (Kearney, 1988). The RFA gauged the pit dimensions at 25 by 50 feet, but did not give a depth, perhaps implying that the pit was shallow. Use of the pit was not recorded and it was only suspected to be associated with the FFTA because of its proximity. The Phase I RFI described the site in 1992 as more of a "pile" than a "pit" (IT Corp, 1992). The Phase I RFI speculated that the soil/gravel pile was excavated from the FFTA (SWMU 21). If the site was in fact related to the FFTA, then the operational dates may coincide. The FFTA was closed in 1982.

4.2.2.2 Previous Investigations at SWMU 22

The RFA conducted for SWMU 22 did not locate any records of historic contaminant releases, sampling, or site assessments. Soil and gravel stained with petroleum hydrocarbons were noted upon visual inspection, however. The Phase I RFI included an SVS, grab sampling of the excavated pile and surface soil, and sampling from one soil boring to a depth of twenty feet. Several surface samples and a sample taken at depth 4-5 feet contained TPH levels exceeding guidelines. Lead concentrations above action levels were also detected in several surface samples. The Phase II RFI included additional surface sampling and shallow subsurface sampling. Lead and TPH concentrations above action levels were again detected in multiple samples, and arsenic above the current NMED SSL was also detected at the surface and at depth. In a 1996 removal action, soil was excavated until no visually stained soils remained and confirmation samples were taken from one foot below the floor of the excavation and from composited excavation material. No contaminant was detected above state or federal guidelines and the excavated soil was returned to the site and graded. Site reconnaissance performed for this work plan indicated that the area over which this soil was graded was potentially significantly larger than the area of the original pit and pile. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.2.2.3 Preliminary Site Conceptual Model of SWMU 22

Nature and Extent of Contamination

Previous investigations have identified several contaminants present at the site, potentially at levels of current concern — TPH, lead, and arsenic. Because the dimensions of the 1996 excavation are unknown and because excavated material was returned to the site and graded over an uncertain area, a characterization of current extent of contamination based upon historic data is not possible. Because the excavation entailed the removal of all visibly contaminated soil and subsequent return, it is likely that denser, hot spot areas of contamination were mixed with other soils, partially homogenizing the bulk soil volume removed before return of the material to the site.

It is known that detections of contaminants at levels exceeding current NMED SSLs were made in and around the waste pile during the Phase I and Phase II RFI. It is also known that TPH contamination extended down to at least 4-5 ft bgs. An area of low density, sparse shrub lacking the mesquite trees characteristic of the local flora also currently exists at the site. This area could possibly describe the areal extent of the return of fill soils to the site, in which case the area of potential contamination goes significantly beyond the pile dimensions listed in previous reports.

Site Specific Geology

No site-specific subsurface data has been located for soils at SWMU 22. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands. The on-site geologist will select representative cores from soil borings made at the time of sample collection to characterize subsurface geology at the site.

4.2.2.4 Phase III RFI Data Collection at SWMU 22

Data collected as part of the Phase III RFI will serve primarily to fulfill data needs for a screening level ecological risk assessment and to address information deficiencies in previous investigations to the extent that is pragmatic. Soil samples will be collected down to greater depth in the vicinity of the former pile to verify the presence/absence of contaminated material in the previous excavations. The area of lighter vegetative cover and areas with visibly stained soils will also be sampled at the surface in an effort to further characterize the soil potentially excavated and replaced in 1996.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads, and surface clearance performed as necessary.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, both Zone II sites will be considered in conjunction and one assessment performed. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as

Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Phase III Soil Sample Collection

Soil samples will be collected with the primary objective of verifying the completeness of the 1996 closure action. This will include taking confirmation samples from soils beneath that excavation and from soil returned to the area during backfill and grading. The exact location of the excavation and the extent of grading after backfill are unknown, making precise sampling difficult. However, the approximate location of the former pile can be identified from the locations of samples taken under previous RFIs, and the area of lighter vegetative cover in the vicinity indicates a past surface clearance and the possible extent of soil grading after backfill. Surface and subsurface samples will be taken in the vicinity of the pit following a systematic approach to confirm that the 1996 removal action had sufficient vertical extent to remove all contaminated soils. Surface samples will be taken in the area of low density, sparse shrub following a systematic approach to characterize potentially contaminated soils graded in the 1996 removal action. Hot spot surface samples of opportunity will also be taken from locations both within and beyond the boundaries of the systematic surface sampling, selected using good engineering judgment, as part of an assessment for need for further characterization and removal.

Eight boreholes will be placed in the area of the former pit and pile using a hollow-stem auger or push probe to a depth of 6 ft bgs following Section 5.1.3 and BAE Systems SOPs. These boreholes will be evenly spaced in a systematic pattern every 12.5 ft, as shown in Figure 4-4 (on following page). Samples will be taken from all borings at the surface (0-0.5 ft bgs), 2-3 ft bgs, and 5-6 ft bgs. All of these samples will be analyzed for the analytes listed in Table 4-4 (on following page). One duplicate for surface samples and one duplicate for samples at depth will be taken and analyzed for the same parameters as the corresponding primary samples. Because previous investigations detected contamination down to 5 ft bgs and the exact extent of the removal action is unknown, it is necessary to sample soils representative of those formerly underlying the pit and pile.

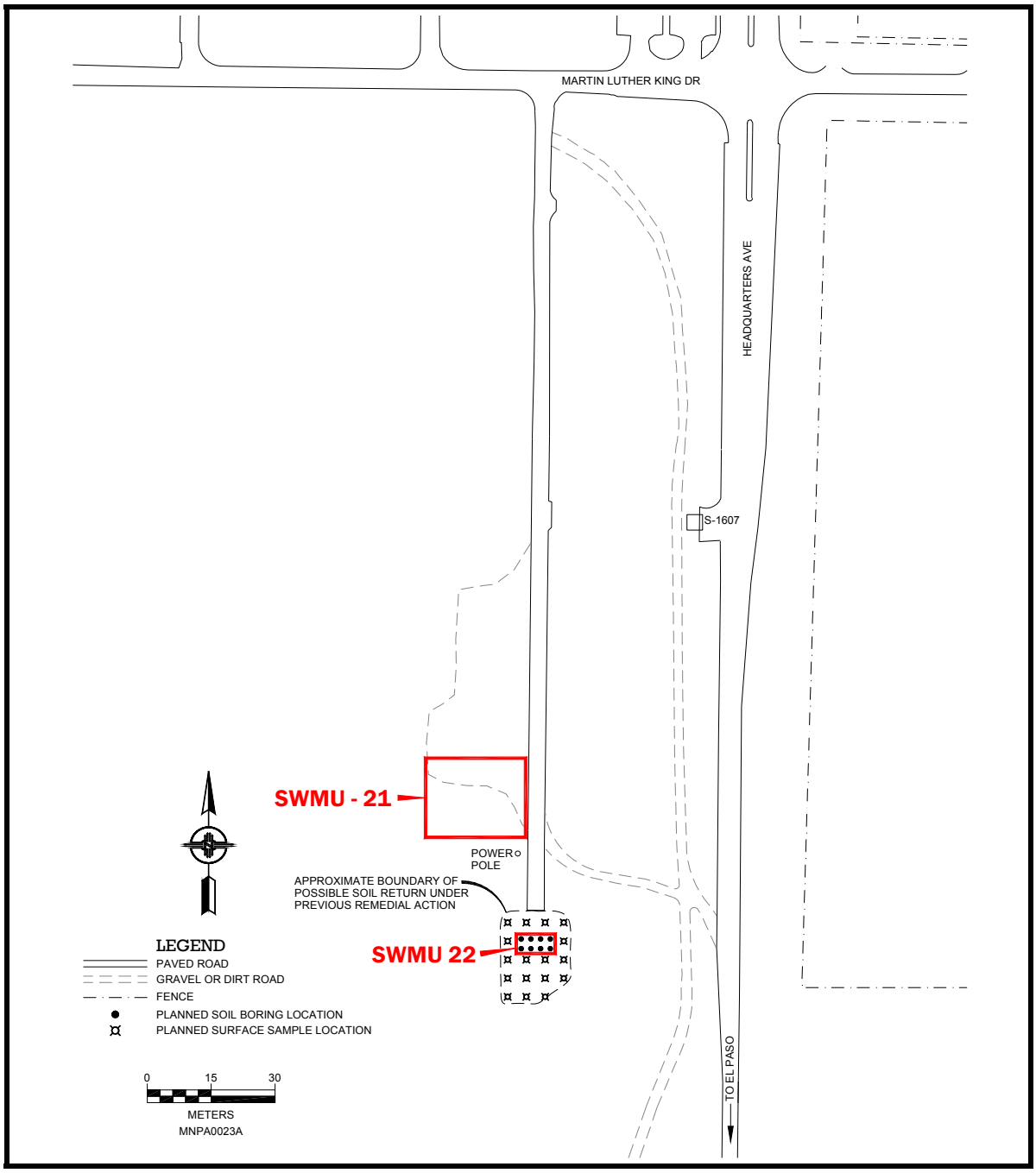

Figure 4-4. Planned Sampling Locations at WSMR 32 (SWMU 22).

Table 4-4. Analytical List for SWMU 22 Sample Collection.

Proposed Analytes	Analytical Method *
Total RCRA Metals	6010-B
VOC (subsurface samples only)	8260-B
BTEX (surface samples only)	8021-B
SVOC	8270-C
TPH DRO, ORO, and GRO	8015-M

* Method stated or equivalent method will be used to analyze samples.

Surface soil samples will be collected by hand following Section 5.1.1 and BAE Systems SOPs in the area of sparser vegetative cover. Samples will be collected every 20 ft, following a systematic scheme as shown on Figure 4-4. These samples will be analyzed only for COPCs as identified in previous investigations — RCRA metals by Method 6010-B and TPH-DRO, -ORO, and -GRO by Method 8015M. Data obtained from these samples will serve to describe the nature of the soils in this area and better define the current disposition of soils formerly in the pit and pile area. If necessary, this data will be used to direct further characterization and remediation planning. Up to 17 primary samples will be collected, and 2 duplicate samples will be taken and analyzed for the same parameters.

Up to 10 samples of opportunity will also be taken from surface soils in the site vicinity, as selected by the on-site supervisor. This will include both soils within the boundaries of the systematic sampling and in the nearby vicinity. These samples will be analyzed for the analytes listed in Table 4-5. Data obtained from these samples will serve to characterize potential areas of localized elevated contamination. This will assist in describing the need for and the scope of any additional potential removal action.

Table 4-5. Analytical List for SWMU 22 Samples of Opportunity.

Proposed Analytes	Analytical Method *
Total RCRA Metals	6010-B
TPH DRO, ORO, and GRO	8015-M

* Method stated or equivalent method will be used to analyze samples.

In the event that significant detections of RCRA metals are made in any soil samples taken under this work plan, a comparison to background levels will be made as described below. Further appropriate characterization and remediation will be planned for this site as required.

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for SWMU 21. Appropriate statistical comparisons will be made between background data and the analytical results for inorganic COPCs in confirmation samples. In the event that an inorganic constituent is found to significantly exceed background levels in a confirmation sample, a determination of environmental impact resulting from the SWMU will be made. As part of this determination, the exceeding constituent will also be compared to the appropriate action level(s). If the action level(s) are exceeded, recommendations will be made in the Phase III RFI Report for future additional characterization and/or remediation efforts as are appropriate. If the environmental impact does not exceed the appropriate action level(s), it will be noted in the Phase III RFI Report but no further characterization or removal efforts will be recommended unless the full scope of environmental data indicates that a significant aspect or portion of the previous source removal was incomplete.

4.3 Zone III

The Zone III SWMU sites are in close proximity to each other and NMED has not requested significant additional environmental sampling. A plan view of the SWMUs is shown in Figure 4-5.

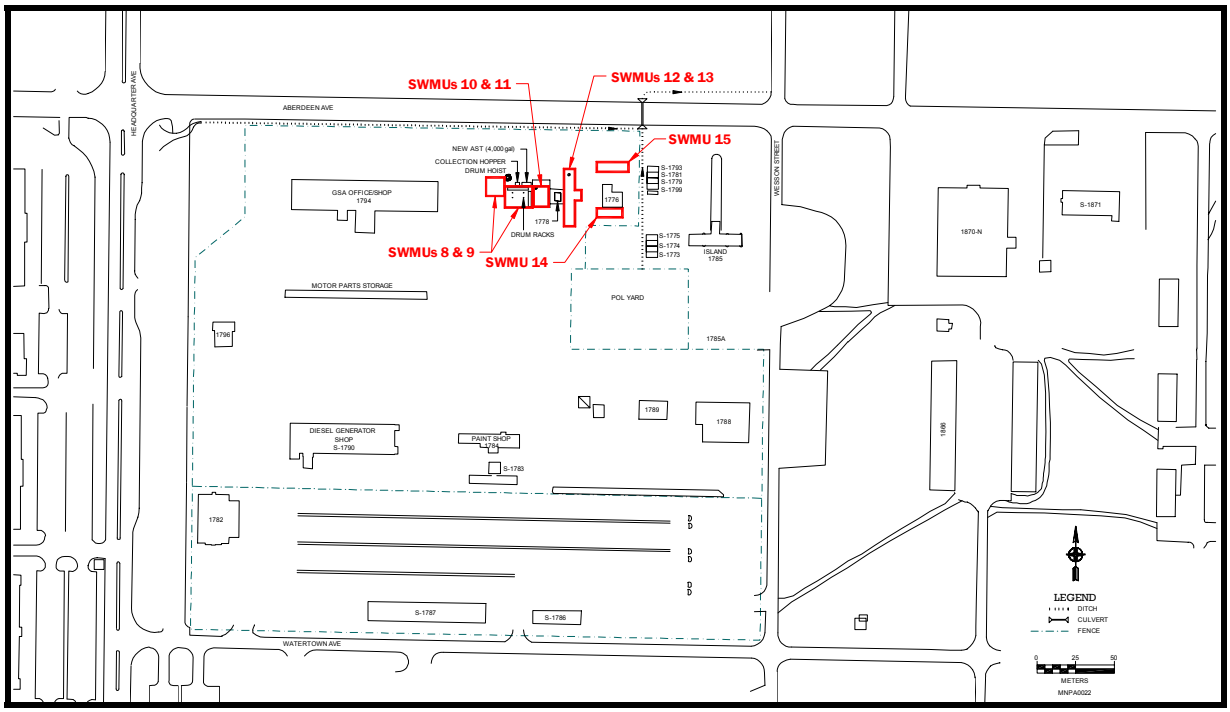

Figure 4-5. Location of Zone III SWMU Sites.

4.3.1 WSMR 33 (SWMUs 14-15) Used Battery Accumulation Areas

4.3.1.1 Description and Operational History of SWMUs 14-15

The former Used Battery Accumulation Areas are located immediately south (SWMU 14) and approximately 50 feet northeast (SWMU 15) of the Building 1776 Battery Shop as shown on Figure 4-5. Building 1776 is within the secured fence surrounding the Maintenance Area on the Main Post. Lead-acid batteries were stored on asphalt pavement at SWMUs 14-15. A sump located on the east side of Building 1776 collects solids prior to wastewater entering the sanitary sewer system. The sanitary sewer system ultimately discharges the wastewater flowing through this sump into the Sewage Treatment Plant.

Approximately 40,000 pounds of used batteries were collected annually at this facility and stored prior to off-site recycling (Kearney, 1988). Used battery storage operations were moved in 1990 to a facility constructed with a roof and berms to prevent and contain accidental releases. A site reconnaissance performed on September 10, 2003 did note approximately 10 batteries present on a wooden pallet at the SWMU 14 site.

The WSMR RFA could not determine the inception date for battery storage adjacent to Building 1776. Battery storage reportedly ceased at the site in 1990 when the covered battery storage area was built. During the operation of SWMUs 14 and 15, batteries were stored on wooden pallets to a height of 3 to 4 feet. Pallets could then be loaded onto trucks for transport to recycling sites.

4.3.1.2 Previous Investigations at SWMUs 14-15

The RFA did not identify any records of previous sampling or site assessments, but it did cite an EID inspection report dated October 1986, stating that five or six batteries were emptied daily into a drain with a sump that overflowed into the sanitary sewer line and that this disposal activity was halted immediately at the time of inspection. The Phase I RFI noted etching and discoloration of the pavement and took shallow soil samples, surface sediment samples from a storm water drainage ditch, and a composite sludge sample from the sump. Lead concentrations exceeding action levels were detected in the composited sludge sample, and the reported arsenic concentration in this sample also exceeds the current NMED SSL. The Phase II RFI included additional sampling to further characterize the contamination. Reported lead concentrations again exceeded guidelines in the sump sludge and also in one surface sediment sample. Arsenic concentrations above the current NMED SSL were also detected in multiple sediment samples. Radian International, LLC completed a removal action and accompanying closeout report in 1997. The contents of the solids-separation sump were removed to the WSMR Hazardous Material Minimization Center and the inlet to the sump was plugged. The concrete apron on the south side of Building 1776 was demolished and removed to the WSMR Concrete Recycling Area and the asphalt drainage ditch was excavated and material removed to the WSMR Industrial Landfill and the WSMR Asphalt and Concrete Recycling Area. Confirmation sampling with analysis focusing on lead concentrations returned results below the current NMED SSL. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.3.1.3 Preliminary Site Conceptual Model of SWMUs 14-15

<u>Nature and Extent of Contamination</u>

The nature of contaminants expected to be potentially present can be taken from the operational history of the site—uncovered lead-acid battery storage and draining. Therefore, the primary COPC originating from the used battery storage areas is lead, although other metals may also have been introduced to the environment prior to source-removal. Because the draining activity was stopped and the storage area relocated, the source of contamination at these SWMUs has been removed. Based on confirmation samples collected by Radian following a removal action, the extent of lead contamination at SWMUs 14 and 15 has been removed.

The area surrounding SWMU 14 & 15 is completely covered with asphalt or concrete, and has been throughout its known operational history. Therefore, any significant uncontrolled environmental releases would be expected to be transported from the site primarily by a surface runoff mechanic. Past controlled releases to the drains would be expected to result in contamination to remain entrained in the sump feature. Smaller portions of surface releases could bypass surface cover and infiltrate into subsurface soils or migrate from the site on wind-blown particles. However, sampling during previous investigations has not demonstrated significant subsurface contamination. The prevailing wind directions at the site are from the west and southwest.

Site Specific Geology

No site-specific subsurface data has been located for soils in Zone III. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands. An on-site geologist will select representative cores from soil borings made at the time of sample collection at SWMUs 8 and 9 to characterize subsurface geology at the site.

4.3.1.4 Phase III RFI Data Collection at SWMUs 14-15

NMED has requested a summary of results of confirmation samples collected at SWMU 14 & 15 following the 1997 removal action. WSMR will provide a summary of all analytical data associated with the 1997 Closeout Report. WSMR will also complete an ecological risk assessment per NMED's administrative requirement.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, all Zone III sites will be considered as one site due to their immediate proximity to one another and the existence of ground cover across the entire area. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for Zone III. Appropriate statistical comparisons will be made between background data and the past analytical results for arsenic in soil samples taken in subsurface soils at SWMU 14 & 15.

In the event that arsenic is found to significantly exceed background levels in a confirmation sample, a determination of environmental impact will be made for the site. As part of this determination, the exceeding constituent will also be compared to the appropriate SSL. If the SSL is exceeded, recommendations will be made in the Phase III RFI Report for future additional characterization and/or remediation efforts as are appropriate. If the environmental impact does not exceed the appropriate SSL, it will be noted in the Phase III RFI Report but no further characterization or removal efforts will be recommended.

No subsurface analytical data will be collected in the Phase III RFI for this SWMU site, so it is not appropriate to plan a comparison of results to background metals concentrations for samples taken under this investigation. It is also not appropriate to compare subsurface background samples with sediments previously sampled within Zone III, even though those sediments may be composed predominantly of native soils.

4.3.2 WSMR 36 (SWMUs 8-9) POL Sumps at Bldg 1794

4.3.2.1 Description and Operational History of SWMUs 8-9

SWMUs 8 (Waste Oil Tank) and 9 (Sump) are located approximately 300 feet east of Building 1794 at the Post Headquarters Maintenance Area, as shown on Figure 4-5. Maintenance activities generating waste oil are conducted predominantly at the Heavy Equipment Maintenance Area (Building 1753), the Vehicle Maintenance Shop (Building 1794), and several remote operations. The Post Headquarters Maintenance Area is paved with asphalt. Storm water runoff is generally to the east, following the topography, which slopes toward the center of the Tularosa Basin.

The Waste Oil Tank was a 5,000-gallon capacity steel UST. The tank was used to collect and store used motor oil from vehicle maintenance activities. Contracted oil recyclers periodically emptied the contents. This tank was removed in 1990 and was replaced by an AST set on the site of the SWMU 8 UST. The AST was removed in 1996 and the site of SWMU 8 was once again excavated in order to obtain soil samples, which had not been collected at the time of the original tank-pull in 1990. According to Dow (1997c), the soil samples from below SWMU 8 confirmed clean closure of the site. A 4,000-gallon AST was installed 25 feet northeast of the SWMU 8 site and this new tank continues to serve the function of the former SWMU 8 tank.

SWMU 9 has been connected to each waste oil storage tank and is connected to the waste oil storage tank currently in service**.** The "sump" is a portable, metal, inverted pyramid standing approximately 3.5 feet high. The SWMU 9 structure has also been referred to as a "collection hopper." Its function is to funnel waste oil into the storage tank while straining out debris. The open top of the square funnel is 4 feet on a side. The depth of the funnel is 17 inches. A screen in the sump strains trash and debris from the used oil, which flows from a drain line in the bottom of the sump into the waste oil storage tank.

4.3.2.2 Previous Investigations at SWMUs 8-9

The RFA performed for SWMUs 8 and 9 did not locate any record of historic contaminant releases, but light staining on the pavement in the area was reported. The Phase I RFI included an SVS and sampling from soil borings up to 15 feet bgs. Levels of TPH exceeding current NMED guidelines were detected in one sample at 4 feet depth, with trace levels of BTEX and tetrachloroethylene (PCE) also detected in the sample. The Phase I RFI concluded these detections were the result of small quantity spills rather than a sustained, systematic release. The Phase II RFI included additional soil sampling. A composite surface sample taken around a drum hoist pedestal had a TPH concentration exceeding the current guidelines, but no other contaminants concentrated above current standards were detected in any samples. The Phase II RFI recommended that a spill prevention plan be drafted to minimize future releases. In 1996, the SWMU 8 site was excavated to confirm the closure and removal of the UST in 1990. Confirmation sampling did not reveal any target analyte above 1996 or current standards and the Closeout Report concluded that a clean closure was confirmed. Although SWMU 8 and 9 are grouped together because they are classified as one WSMR IRP site, the Closeout Report only addresses SWMU 8 as no contaminant releases were identified as originating from SWMU 9 in previous investigations. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.3.2.3 Preliminary Site Conceptual Model of SWMUs 8-9

Nature and Extent of Contamination

The operational history of this site dictates that the primary potential contaminants introduced to the environment as a result of operations are those associated with waste oil, including TPH, solvents, and some metals. The results of previous investigations indicate that detected TPH may be related to the asphalt paving on the surface and/or small, accidental releases at the drum hoist pedestal. The potential underground release source was removed in 1990, and it was noted at that time that no leakage had occurred from the UST but that overfilling may have resulted in some environmental release.. Any TPH introduced to the subsurface by the asphalt cover likely does not contribute concentrations in exceedance of the soil's natural attenuation capability beyond the immediate vicinity of the pavement. Previous investigations at this site do not seem to suggest significant areas of contamination.

As with all Zone III sites, the area around these SWMUs is completely covered by an impermeable barrier.

Site Specific Geology

No site-specific subsurface data has been located for soils in Zone III. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands. An on-site geologist will select representative cores from soil borings made at the time of sample collection at SWMUs 8 and 9 to characterize subsurface geology at the site.

4.3.2.4 Phase III RFI Data Collection at SWMUs 8-9

Data collected as part of the Phase III RFI will serve primarily to fulfill data needs for a screening level ecological risk assessment and to address a need to confirm the complete environmental removal of the former UST. Soil samples will be collected down to greater depth beneath the former UST to verify the removal of contaminated material.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads, and surface clearance performed as necessary.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, all Zone III sites will be considered as one site due to their immediate proximity to one another and the existence of ground cover across the entire area. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Phase III Soil Sample Collection

Soil samples will be collected with the objectives of verifying the complete environmental removal of the UST at SWMU 8. The location and depth of the former UST are known within reasonably accurate vicinity into which 5 soil borings will be made, as shown on Figure 4-6 (on following page). These borings will be installed to a depth of 12 ft bgs using a rig-mounted hollow-stem auger or push probe following Section 5.1.3 and BAE Systems SOPs. Samples will be taken from all borings at a depth of 12 ft bgs and analyzed for the constituents listed in Table 4-6. One duplicate sample will be analyzed for the same parameters. These soil samples will be representative of soils previously underlying the SWMU 8 UST in determining that the removal of that UST was complete.

Table 4-6. Analytical List for SWMUs 8-9 Sample Collection.

Proposed Analytes	Analytical Method *
Total RCRA Metals	6010-B
VOC (subsurface samples only)	8260-B
SVOC	8270-C
TPH DRO, ORO, and GRO	8015-M

* Method stated or equivalent method will be used to analyze samples.

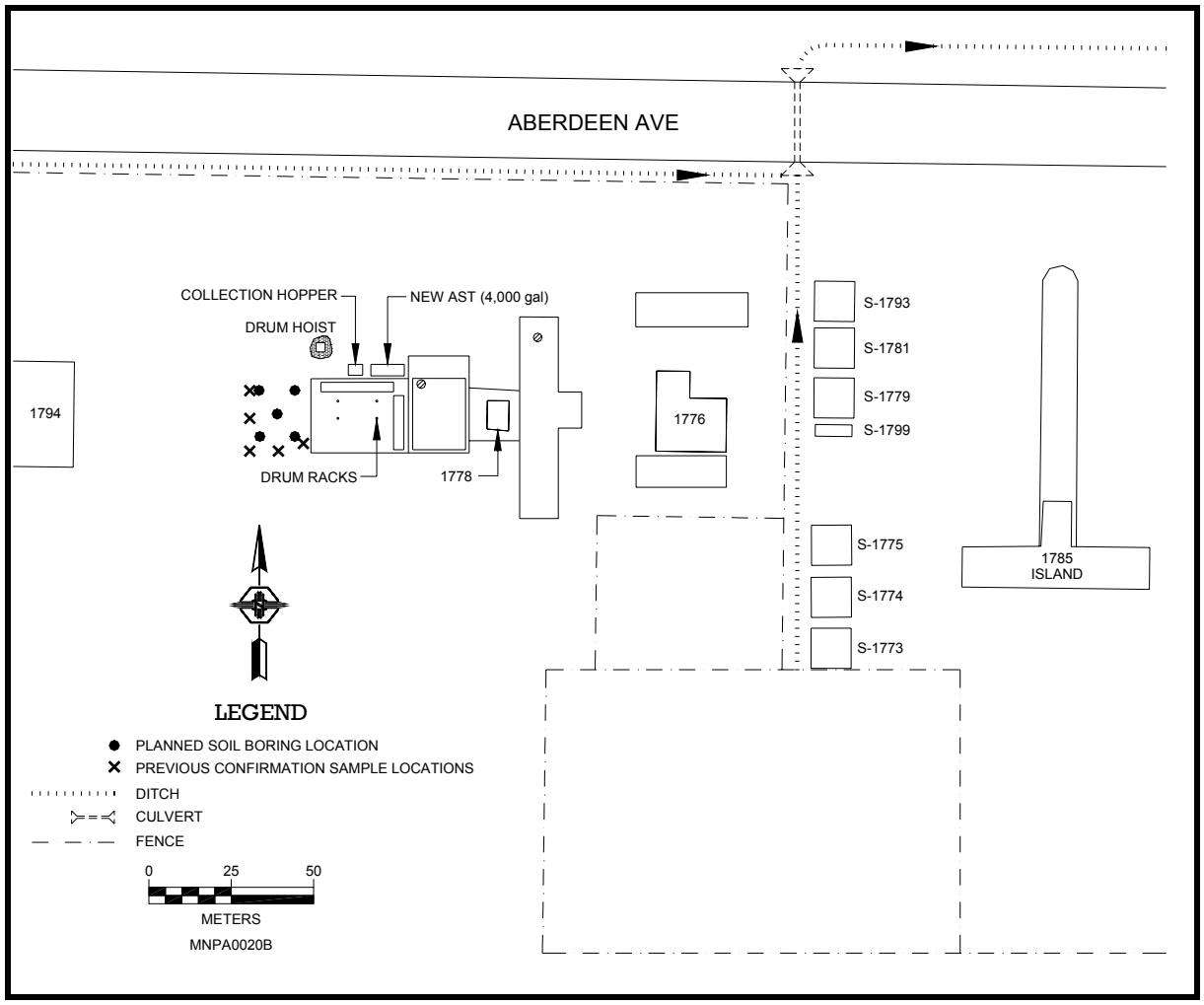

Figure 4-6.
Planned Sampling Locations at WSMR 36 (SWMU 8).

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils

for Zone III. If any RCRA metal is detected in confirmation samples at a concentration exceeding the appropriate SSL, statistical comparisons will be made between background data and that detection. If the detected concentration is also found to exceed background levels, a finding of environmental impact will be made and appropriate recommendations will be made.

4.3.3 WSMR 60 (SWMUs 12-13) UST Sump, Wash Pad

4.3.3.1 Description and Operational History of SWMUs 12-13

The Vehicle Wash Ramp and Drains (SWMU 12) and the Sump and Oil/Water Separator (SWMU 13) are located immediately east of Building 1778 as shown on Figure 4-5. The dimensions of the concrete wash pad are 40 feet by 15 feet and it slopes to a central, longitudinal drain that discharges to the 200-gallon sump with oil/water separator at the north end of the drain. The separator/sump is constructed of concrete and covered by a metal grate. When the facility was operational waste oil and debris from the separator/sump were periodically transferred to a waste oil tank for recycling and disposal, while the effluent flowed to the STP through the sanitary sewer.

The Vehicle Wash Ramp, Oil/Water Separator, and Drains were built in the mid-1950's. The concrete pad was designed to collect wastewater from the spray washing of vehicles. The wastewater formerly discharged through a subgrade pipe to the drainage ditch located east of the wash pad. After the Main Post STP was built, the oil/water separator outlet was plumbed to the sanitary sewer system for treatment and disposal of the wastewater. The oil/water separator works by gravity separation and the skimmed oil phase was drained into the Waste Oil Storage Tank. The wash ramp was dismantled in 1997 and hauled off-post for scrap.

4.3.3.2 Previous Investigations at SWMUs 12-13

The RFA for SWMUs 12 and 13 did not locate any record of historic contaminant releases and no visible evidence of a release was noted. The Phase I RFI sought to detect any hazardous contaminants potentially released from the site using an SVS and sediment sampling in the drainage ditch where the SWMUs formerly discharged. Elevated carbon dioxide levels were detected on the southeast side of the pad, but no contaminant was detected at high concentrations. The Phase II RFI involved sampling from three ten-foot boreholes next to the Vehicle Wash Ramp. The only significant detections were chromium and arsenic at 9.5 feet bgs in one borehole. The chromium level detected is below the current EPA Region 9 PRG for total chromium but was elevated enough to be somewhat anomalous when other samples taken did not detect chromium above the detection limit. The arsenic concentration reported for the sample is, however, above the current NMED SSL. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.3.3.3 Preliminary Site Conceptual Model of SWMUs 12-13

<u>Nature and Extent of Contamination</u>

There appears to be no significant contamination at the site. However, arsenic was detected at depth above the current NMED residential SSL, though all shallower samples were non-detect for arsenic. Chromium was detected at a relatively high concentration, though below the SSL,

in the same manner as the arsenic detection. A potential source for these detections is unknown based on facility use and subsurface characterization. The area around these SWMUs is completely covered by an impermeable barrier.

Site Specific Geology

No site-specific subsurface data has been located for soils in Zone III. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands. An on-site geologist will select representative cores from soil borings made at the time of sample collection at SWMUs 8 and 9 to characterize subsurface geology at the site.

4.3.3.4 Phase III RFI Data Collection at SWMUs 12-13

The petition for Class III Permit Modification to remove this SWMU from WSMR's RCRA Permit was denied on the basis of being administratively incomplete due to the absence of an ecological risk assessment. Therefore, the only new data collected under the Phase III RFI will serve to fulfill the data needs for a screening level ecological risk assessment.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, all Zone III sites will be considered as one site due to their immediate proximity to one another and the existence of ground cover across the entire area. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to

describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for Zone III. Appropriate statistical comparisons will be made between background data and the past analytical detection of arsenic in a subsurface soil sample at SWMU 12 & 13 at a concentration exceeding the current residential SSL. In the event that arsenic is found to significantly exceed background levels in a confirmation sample, a determination of environmental impact will be made for the site and appropriate recommendations will be made.

No subsurface analytical data will be collected in the Phase III RFI for this SWMU site, so it is not appropriate to plan a comparison of results to background metals concentrations for samples taken under this investigation.

4.3.4 WSMR 74 (SWMUs 10-11) Former Waste Oil Tank and Sump

4.3.4.1 Description and Operational History of SWMUs 10-11

The Vehicle Wash Pad and Drains (SWMU 10) and the Sump and Oil/Water Separator (SWMU 11) are located immediately west of Building 1778 in the Main Post area as shown on Figure 4-5. The dimensions of the concrete wash pad are 30 feet by 30 feet and it is surrounded by a 2-foot wide drain. The drain is 2-feet deep, constructed of concrete and covered with metal grates. The drain empties to a concrete, 500-gallon sump and oil/water separator at the northwest corner of the Vehicle Wash Pad.

The Vehicle Wash Pad and Oil/Water Separator were built in the mid 1950's. The concrete pad collects wastewater from the spray washing of vehicles. The wastewater formerly discharged through a subgrade pipe to the drainage ditch located east of the wash pad. After the Main Post STP was built, the oil/water separator outlet was plumbed to the sanitary sewer system for treatment and disposal of the wastewater. The oil/water separator works by gravity separation. The oil phase is periodically skimmed to the Waste Oil Storage Tank (SWMU 8).

4.3.4.2 Previous Investigations at SWMUs 10-11

A search of WSMR's records of hazardous waste-related activity and a visual inspection performed during the RFA revealed no historic evidence of contaminant releases at the site. Sampling performed during the Phase I RFI included an SVS, surface sediment sampling, and a shallow soil sample taken from the ditch to which the SWMUs originally discharged.
No contaminants were identified at concentrations exceeding guidelines, although an elevated lead concentration was detected in one sediment sample. The source of this concentration may have been SWMUs 14 and 15, as those sites also discharged to the drainage ditch. The Phase II RFI continued sampling from soil borings placed by the wash pad and former effluent discharge pipe, but no contaminants were detected at levels above their current guidelines. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.3.3.3 Preliminary Site Conceptual Model of SWMUs 10-11

<u>Nature and Extent of Contamination</u>

There appears to be no significant contamination at this site. Minor TPH contamination was identified and several VOCs were detected in one sample, but all at concentrations below the applicable guidelines.

Site Specific Geology

No site-specific subsurface data has been located for soils in Zone III. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands. An on-site geologist will select representative cores from soil borings made at the time of sample collection at SWMUs 8 and 9 to characterize subsurface geology at the site.

4.3.3.4 Phase III RFI Data Collection at SWMUs 10-11

The petition for Class III Permit Modification to remove this SWMU from WSMR's RCRA Permit was denied on the basis of being administratively incomplete due to the absence of an ecological risk assessment. Therefore, the only new data collected under the Phase III RFI will serve to fulfill the data needs for a screening level ecological risk assessment.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, all Zone III sites will be considered as one site due to their immediate proximity to one another and the existence of ground cover across the entire area. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

4.4 Zone IV

4.4.1 WSMR 57 (SWMU 156) Golf Course Pesticide Storage Shed

4.4.1.1 Description and Operational History of SWMU 156

Building T-1348 was located at the Main Post Golf Course approximately 1,000 feet southeast of the Officer's Club and was used for over 30 years to store pesticides, fungicides, and pesticide equipment. The metal building with wooden-plank flooring was set on a concrete foundation

measuring 20 by 50 feet. Subsequent to site sampling, the building and foundation were removed and the site was graded to conform to the golf course topography. The site was inactive by the time the Phase I RFI was conducted by IT Corporation in 1992.

4.4.1.2 Previous Investigations at SWMU 156

This site was not identified in the RFA, but identification and characterization of potential contaminant releases was begun in the Phase I RFI. Shallow soil samples were taken from within the storage shed foundation and several pesticides were detected, but none at levels above current standards. The Phase II RFI took slightly deeper samples within and adjacent to the foundation. Elevated levels of chromium were detected in several samples, though still below the current EPA Region 9 PRG for total chromium, as well as low levels of 4 pesticides in shallow samples. In 1996, the concrete pad, wooden floor, and top two feet of soil from the building footprint were removed to the WSMR landfill and Toxicity Characteristic Leaching Procedure (TCLP) analysis of confirmation samples taken from the excavation floor did not detect any analyte above standards. The excavated area was then bladed flat and contoured to the surrounding terrain. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.4.1.3 Preliminary Site Conceptual Model of SWMU 156

Nature and Extent of Contamination

From the operational history of the site, the expected predominant potential contaminants are fungicides and pesticides. Detectable levels of several pesticides were identified in previous investigations, although at levels below current action levels. Based on the data from past investigations, it is presumed that any historical environmental releases of contaminants were small and localized or non-persistent at the site. The source of potential contamination at the SWMU 156 site has been removed as well as the soil directly underlying that source.

Some levels of chromium and lead higher than in other samples were detected in samples approximately 20 feet from the building foundation. These concentrations are below current NMED SSLs in soils that were not removed during the remedial action.

Site Specific Geology

No site-specific subsurface data has been located for soils at SWMU 156. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands.

4.2.1.4 Phase III RFI Data Collection at SWMU 156

The petition for Class III Permit Modification to remove this SWMU from WSMR's RCRA Permit was denied entirely on the basis of being administratively incomplete due to the absence of an ecological risk assessment. Therefore, data collected as part of the Phase III RFI will serve only to fulfill data needs for a screening level ecological risk assessment.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

4.5 Zone V

4.5.1 WSMR 73 (SWMU 17) Waste Underground Injection Pipe

4.5.1.1 Description and Operational History of SWMU 17

The Waste Underground Injection Pipe (SWMU 17) was reportedly located at the southwest corner of Building 1753, the Heavy Equipment Maintenance Shop, at the WSMR Main Post. The dimensions, composition and depth of the pipe are unknown. SWMU 17 was reportedly used to dispose of waste oils and degreasing solvents from the Heavy Equipment Maintenance Shop, Building 1753. According to site personnel, the pipe was installed vertically in the ground and wastes were poured into the open end. The dates of operation are unknown. The anecdotal evidence of the existence of SWMU 17 was acquired from former site personnel during the RFA (Kearney, 1988).

4.5.1.2 Previous Investigations at SWMU 17

The RFA for SWMU 17 consisted of a visual inspection of the site and a search of WSMR's records, but no documentation of hazardous waste-related activity was found. The Phase I RFI performed an SVS at two sample points and attempted to locate the waste-injection pipe using a metal detector. A magnetic anomaly was detected and excavation of that area began in the Phase II RFI. A horizontal steel pipe oriented toward a water shut-off valve at Building 1753 was

uncovered. Samples were taken at the bottom of two excavated trenches and at the end of the pipe. Elevated TPH levels were detected in the sample taken at the end of the pipe, as was an arsenic concentration above the current NMED SSL. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.5.1.3 Preliminary Site Conceptual Model of SWMU 17

Nature and Extent of Contamination

A vertical injection pipe was not found in the area of investigation and sampling did not detect any major concentrations of VOCs or TPH, the most likely contaminants given the operational history of the site. Slightly elevated levels of lead were detected as well as arsenic levels in excess of NMED Residential SSLs. No source point of potential contamination has been identified as this site.

Site Specific Geology

No site-specific subsurface data has been located for soils at SWMU 17. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands.

4.5.1.4 Phase III RFI Data Collection at SWMU 17

The only data collected for SWMU 17 under this work plan will be that required to fulfill the data needs of a screening level ecological risk assessment. Data for background metals concentrations will be collected separately from this Phase III RFI and compared with data from the previous RFIs and Closure Action.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, both Zone V sites will be considered in conjunction and one assessment performed, as they are in close proximity and have virtually identical site conditions. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or

region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for SWMU 17. Appropriate statistical comparisons will be made between background data and the analytical detections of arsenic made in previous investigations. In the event that arsenic concentrations are found to significantly exceed background levels in a confirmation sample, a determination of environmental impact resulting from the SWMU will be made. As such a scenario would be concurrent with exceedance of the appropriate action level for arsenic, the NMED SSL for residential soils; recommendations would also be made in the Phase III RFI Report for future additional characterization and/or remediation efforts as are appropriate.

4.5.2 WSMR 79 (SWMU 16) Heavy Equipment Wash Pad

4.5.2.1 Description and Operational History of SWMU 16

The Heavy Equipment Wash Pad is located in the southern section of the WSMR Main Post, west of Building 1736. The wash pad is constructed of concrete and measures 50 feet by 40 feet. The pad slopes toward the center where a grate covers the drain. The drain flows to a drainage ditch located south of the wash pad. Drainage ultimately reaches Davies Tank (SWMU 85), located approximately three miles southeast of the Main Post. The Heavy Equipment Wash Pad came into use during the 1960's and has been used primarily for spray washing trucks and heavy equipment maintenance.

4.5.2.2 Previous Investigations at SWMU 16

The RFA performed at the site identified no record of historic contaminant releases but noted stained soil surrounding the discharge pipe and standing water in the drainage ditch containing black-colored oil. The Phase I RFI included an SVS and surface sediment grab sampling in the drainage ditch. Concentrations of TPH exceeding guidelines were detected in the drainage ditch but were also detected in the ditch upgradient from the SWMU discharge point, and the report concludes that degraded asphalt in the drainage ditch probably contributed to the TPH detections. Arsenic above the current NMED SSL was also detected in one sample. The Phase II RFI focused on sampling around the pad and drain pipe at depth to determine if contaminants had leached downward. TPH levels exceeding guidelines were again detected, but the Phase II RFI also concludes that these were due to the asphalt in the ditch since the highest detection was made up gradient from the outfall of the drainage pipe. An arsenic concentration at depth exceeding current standards was also detected in one borehole sample. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.5.2.3 Preliminary Site Conceptual Model of SWMU 16

Nature and Extent of Contamination

The results of soil sampling at SWMU 16 indicate that, while TPH has been detected at the site, concentrations reported are likely related to asphalt paving in the drainage ditch. Arsenic was detected at depth above the NMED residential SSL even though all shallower samples were non-detect for arsenic. A source for this detection is unknown, and limited subsurface data has been taken at this site.

Site Specific Geology

No site-specific subsurface data has been located for soils at SWMU 16. In general, surface and shallow sub-surface soils on the Main Post consist of gravelly sandy loams and gravelly loamy sands.

4.5.1.4 Phase III RFI Data Collection at SWMU 16

The only data collected for SWMU 16 under this work plan will be that required to fulfill the data needs of a screening level ecological risk assessment. Data and statistical interpretation for background metals concentrations will be collected separately from this Phase III RFI and compared with data from the previous RFIs and Closure Action.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

For purposes of assessing ecological risk, both Zone V sites will be considered in conjunction and one assessment performed, as they are in close proximity and has virtually identical site conditions. The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Background Soil Study

Samples representative of background soils will be collected prior to the execution of this work plan under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). The scope of that investigation is sufficient to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for SWMU 16. Appropriate statistical comparisons will be made between background data and the analytical detections of arsenic made in previous investigations. In the event that arsenic concentrations are found to significantly exceed background levels in a confirmation sample, a determination of environmental impact resulting from the SWMU will be made. As such a scenario would be concurrent with exceedance of the appropriate action level for arsenic, the NMED SSL for residential soils; recommendations would also be made in the Phase III RFI Report for future additional characterization and/or remediation efforts as are appropriate.

4.6 Zone VI

4.6.1 WSMR 84 (SWMU 140) LC-37 Paint Dump

4.6.1.1 Description and Operational History of SWMU 140

The LC-37 Paint Dump was an 8-foot deep trench measuring 70 by 35 feet and rimmed by a soil berm. The former site is located approximately 12 miles east of the WSMR Main Post and 0.8 miles north of Nike Road (Range Road 2). The trench is located approximately 50 feet east-northeast of the WSMR Survey Monument location designated "WSMR-5-1992." Dates of operation of the LC-37 Paint Dump are unknown. The trench was constructed as an unlined excavation. Construction debris was deposited in the trench and left uncovered.

4.6.1.2 Previous Investigations at SWMU 140

SWMU 140 was not included in the initial RFA by Kearney but was included in the Phase I and Phase II RFIs. The Phase I RFI noted no odors or visible soil contamination, but did note the presence of debris including approximately three-dozen 5-gallon plastic paint cans containing dried residue and two empty 55-gallon drums. Shallow sampling was done in the trench but no contaminant was detected at concentrations above 1992 or current guidelines. The Phase II RFI performed further shallow sampling and sampled in 20 foot boreholes on the periphery of the trench. Lead was detected above applicable guidelines in one surface sample, though it was noted to have visible paint shards. Arsenic was also detected at a concentration exceeding current NMED SSLs. The debris was removed from the trench and recovered for recycling, taken to the WSMR Main Post Landfill or the WSMR metal salvage yard, or shipped to an incinerator. Shallow confirmation samples taken beneath the trench detected no contaminant concentrations above current standards. The trench was partially filled with surrounding soil and contoured to the terrain. Pertinent data from the previous investigations will be summarized in the Phase III RFI Report.

4.6.1.3 Preliminary Site Conceptual Model of SWMU 140

Nature and Extent of Contamination

The only known source of potential contamination in the area has been removed. Confirmation samples collected near the surface (one foot below the trench) detected no metals or VOC concentrations above current NMED SSLs. However, sampling during the Phase II RFI detected arsenic concentrations above the current NMED Residential from 4.0 feet down to 19.0 feet bgs beyond the boundaries of the trench.

Site Specific Geology

No site specific subsurface geologic data is available for this site. A field geologist will document observations of soil taken from a borehole at the time of collection of confirmation samples.

4.6.1.4 Phase III RFI Data Collection at SWMU 140

Data collected as part of the Phase III RFI will serve to fulfill the needs for a screening level ecological risk assessment and additional confirmation of source removal. Soil samples will be collected down to greater depth than previous confirmation samples to reconfirm the absence of contaminated material beneath the former trench.

All field activity will be conducted according to the Health and Safety Plan presented in Appendix A to ensure the reasonable protection of all field personnel and following the relevant BAE Systems SOPs. The site will be accessed from nearby roads.

Screening Level Ecological Risk Assessment

The site wildlife biologist will conduct a site visit to collect data and descriptive information necessary for the completion of the *Screening-Level Ecological Risk Assessment / Scoping Assessment / Site Assessment Checklist* provided by NMED, included as Attachment A. This information will include the identification of viable ecological habitat, biological receptors associated with the site, and potential exposure pathways. Topographic maps and aerial photographs will be scrutinized to determine landscape features and the location of and distance to potential existing habitats of concern that may be considered sensitive or harbor threatened or endangered species. The most current lists of state and federally listed species of special status (sensitive, of concern, threatened, or endangered) will be consulted to verify the presence or absence of such species at the site. If warranted, natural resource experts familiar with the site or region will be consulted to aid in the assessment of potential sensitive habitats and any additional ecological receptors that may be expected at the site. For sites that are determined to be paved, it will be reported so in the Phase III RFI Report. A Screening Level Ecological Risk Assessment Checklist will not be filled out for paved sites.

If the screening level ecological risk assessment concludes that a full ecological risk assessment is warranted, such will be performed at the site.

Phase III Soil Sample Collection

Additional confirmation samples will be taken from the soils underlying the former trench. The exact configuration of the former trench is unknown, but the location is well defined by previous sample locations, and the depth is known to have been approximately eight feet. Therefore, confirmation samples will be taken from 10 feet below the existing ground surface.

Three boreholes will be placed in the area of the former pit and pile using a hand auger, hollow-stem auger, or push probe, depending on soil hardness, to a depth of 10 ft bgs following Sections 5.1.2 and 5.1.3 and BAE Systems SOPs. These boreholes will be placed along the approximate centerline of the former trench as shown in Figure 4-7. Soil samples will be collected from all borings at a depth of 10 ft bgs. All of these samples will be analyzed for the constituents listed in Table 4-7. RCRA metals by Method 6010-B and VOCs by Method 8260B (or equivalent methods). One duplicate sample will be collected.

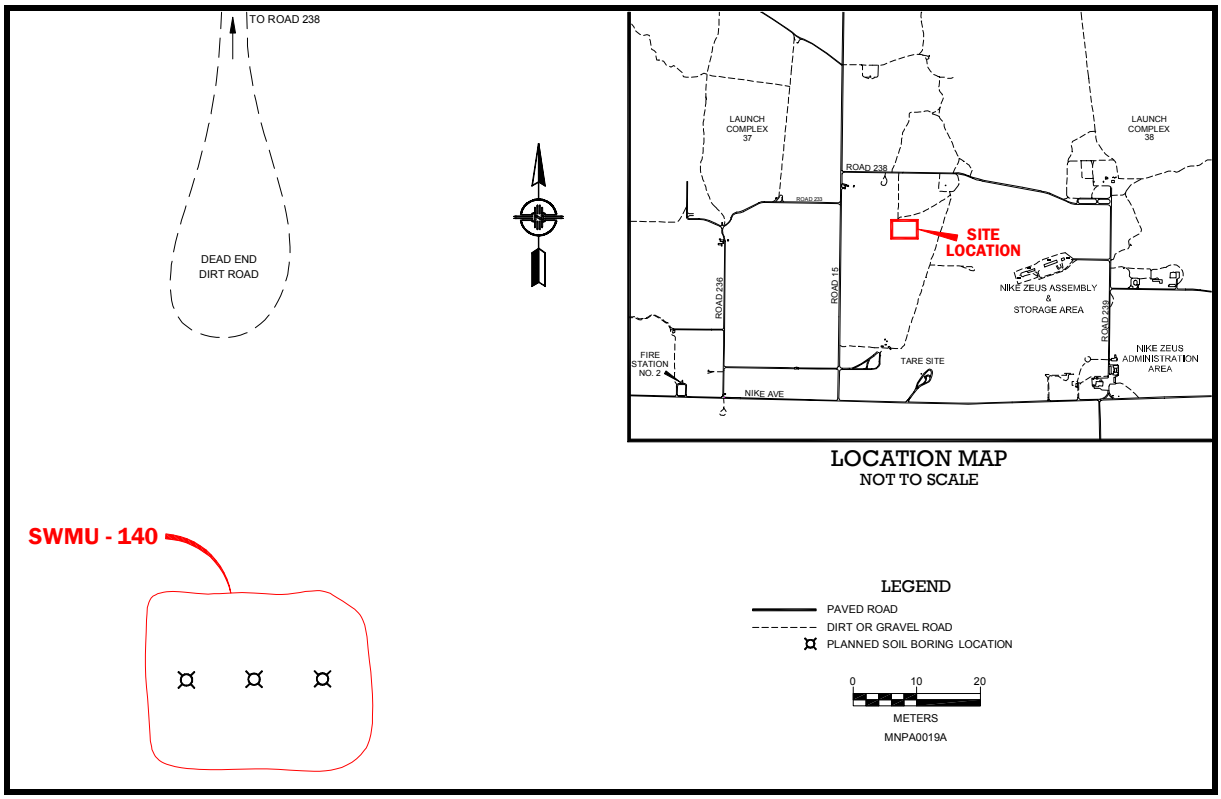

Figure 4-7. Planned Sampling Locations at WSMR 84 (SWMU 140).

Table 4-7. Analytical List for SWMU 140 Sample Collection.

Proposed Analytes	Analytical Method *
Total RCRA Metals	6010-B
VOC (subsurface samples only)	8260-B

* Method stated or equivalent method will be used to analyze samples.

Background Soil Study

Local geology at SWMU 140 is significantly different from that at the Main Post, but samples will be collected in the vicinity of the SWMU under the *Background Soils RCRA Facility Investigation Work Plan for the Main Post, White Sands Missile Range* (BAE Systems, 2003). Analysis of these samples will provide sufficient data to describe the background levels of 40 CFR 265 Appendix IX inorganic constituents in soils for SWMU 140. Appropriate statistical comparisons will be made between background data and the analytical detections of arsenic made in previous investigations. These statistical comparisons will also be performed for all RCRA metals detected under the Phase III RFI. In the event that an inorganic constituent is found to significantly exceed background levels in a confirmation sample, a determination of environmental impact resulting from the SWMU will be made. As part of this determination, the exceeding constituent will also be compared to the appropriate action level(s). If the action level(s) are exceeded, recommendations will be made in the Phase III RFI Report for future additional characterization and/or remediation efforts as are appropriate. If the environmental impact does not exceed the appropriate action level(s), it will be noted in the Phase III RFI Report but no further characterization or removal efforts will be recommended unless the full scope of environmental data indicates that a significant aspect or portion of the previous source removal was incomplete.

5.0 DATA COLLECTION DESIGN AND PROCEDURES

5.1 Field Activities

The principal operations of the field investigation will be soil sampling, management of investigation-derived wastes (IDW), and various field measurements. All intrusive activities will be preceded by utilities and unexploded ordnance (UXO) clearance. The field investigation will be enveloped by the field quality assurance/quality control (QA/QC) program in order to ensure that the data quality objectives are met.

This section defines, in general terms, the procedures for the identification and collection of soil samples and decontamination of drilling and sampling equipment. All field activities will conform to BAE Systems SOPs, where applicable.

5.1.1 Surface Soil and Sediment Sampling Procedures

Surface soil samples will be collected using a decontaminated stainless steel shovel, hand trowel, scoop, or similar tool. All sampling and compositing equipment will be decontaminated prior to sample collection using decontamination procedures presented in Appendix B. Before and during sampling, all decontaminated sampling equipment and bottles will be placed on clean plastic sheeting to avoid contamination. One or more samples may be obtained for a given location, and all samples will be collected in conformance with SOPs. Soil will be placed in a compositing bowl and will then be composited with a decontaminated stainless steel spoon, spatula, or trowel. Compositing consists of breaking aggregates apart and mixing the soil together to homogenize the soil as much as possible. Following compositing the soil from this bowl will be placed into the sampling jars. Excess soil around the top of the sample jars will be wiped away with a clean cloth or paper towel to ensure the cap will fit tightly. When all sample jars required are filled, excess soil will be containerized with other soil cuttings and properly disposed.

New, disposable gloves will be worn to collect each soil sample. Prior to leaving the sample location, a surveying stake with the location number written on it will be placed at or immediately adjacent to the actual sampling location, except in the case of sediment samples. The boring location coordinates will be taken using a Global Positioning System (GPS) receiver.

At a minimum, the following information will be recorded in a bound field logbook for each sample collected:

- Date and time of collection,
- Sample location,
- Sample number,
- Weather conditions,
- Depth of sample collection,
- Sample type (duplicate, split, field blank if applicable),
- Visual observation of soil (color, layers, Unified Soil Classification System (USCS) description, etc.), and
- Sampler's name and personnel present.

5.1.2 Hand Auger Soil Sampling Procedures

Where called for in the work plan, soil samples will be collected using a decontaminated, hand driven, stainless steel auger. All sampling and compositing equipment will be decontaminated prior to sample collection using decontamination procedures presented in Appendix B. Before and during sampling, all decontaminated sampling equipment and bottles will be placed on clean plastic sheeting to avoid contamination. One or more cores may be obtained for a given depth interval, and all samples will be collected in conformance with applicable SOPs. Soil from the auger will be placed in a compositing bowl and will then be composited with a decontaminated stainless steel spoon, spatula, or trowel unless the soil sample will be analyzed for VOCs. Compositing consists of breaking aggregates apart and mixing the soil together to homogenize the soil as much as possible. Following compositing the soil from this bowl will be placed into the sampling jars. Soil samples to be analyzed for VOCs are packed directly into jars following collection. Excess soil around the top of the sample jars will be wiped away with a clean cloth or paper towel to ensure the cap will fit tightly. When all sample jars required are filled, excess soil will be containerized with other soil cuttings and properly disposed.

New, disposable gloves will be worn to collect each soil sample. Prior to leaving the sample location, a surveying stake with the location number written on it will be placed at or immediately adjacent to the actual sampling location. The boring location coordinates will be taken using a GPS receiver.

At a minimum, the following information will be recorded in a bound field logbook for each sample collected:

- Date and time of collection,
- Sample location,
- Sample number,
- Weather conditions,

- Depth of sample collection,
- Number of cores collected to obtain adequate sample volume,
- Sample type (duplicate, split, field blank if applicable),
- Visual observation of soil (color, layers, Unified Soil Classification System (USCS) description, etc.), and
- Sampler's name and personnel present.

5.1.3 Hollow Stem and Direct Push Soil Boring Sampling Procedures

Subsoil samples for chemical analysis will be collected using split-barrel samplers where called for in the Work Plan. All split-barrel samplers will be driven to depth by either a hollow stem auger drill rig or push probe depending on site conditions. All sampling and sample composite equipment will be decontaminated according to the procedures in applicable SOPs. All investigation-derived waste will be managed in accordance with procedures described in Section 5.6 and Appendix B.

Standard-steel 2-inch, 3-inch, or 4-inch (depending on soil conditions) outer-diameter split-barrels will be used inside hollow stem augers or push probes to collect the samples for chemical tests. The drilling contractor will be required to provide clean samplers at the start of the job. Standard steel samplers will be used rather than stainless steel, since stainless steel is easily damaged in dense soil or soil with debris, gravel or cobbles. Split-barrel samplers may be driven over a depth of 24 inches. This drive depth may be necessary to obtain enough samples to fill all containers with adequate material for analysis.

When the split-barrel is removed from the boring and opened, any material appearing to be slough will be removed. The remaining material will be composited in a stainless steel bowl prior to filling the sample containers unless the sample will be analyzed for VOCs by Method 8260B. VOC samples will be collected first and prior to soil compositing. Compositing consists of breaking aggregates apart and mixing the soil together to homogenize the soil as much as possible. Following compositing the soil from this bowl will be placed into the sampling jars. Excess soil around the top of the sample jars will be wiped away with a clean cloth or paper towel to ensure the cap will fit tightly. When all sample jars required are filled, excess soil will be containerized with other soil cuttings and properly disposed.

New, disposable gloves will be worn to collect each soil sample. Prior to leaving the sample location, a surveying stake with the location number written on it will be placed at or immediately adjacent to the actual boring location and coordinates will be taken using a GPS receiver. At a minimum, the following information will be recorded in a bound field logbook for each sample collected:

- Date and time of collection,
- Sample location,
- Sample number,
- Weather conditions,
- Depth of sample collection,
- Number of cores collected to obtain adequate sample volume,

- Sample type (duplicate, split, field blank if applicable),
- Visual observation of soil (color, layers, Unified Soil Classification System (USGS) description, etc.), and
- Sampler's name and personnel present.

5.2 Field Quality Assurance/Quality Control (QA/QC) Procedures

In order to ensure that sampling equipment is cleaned properly, proper sampling procedures are implemented, and that laboratory performance is adequate to produce quality data, several forms of QA/QC samples will be collected and analyzed as part of the investigation. QC samples are collected in the field and sent to the same laboratory as the rest of the field samples. QC samples include trip blanks, field blanks, and replicates.

5.2.1 Duplicate Samples

Duplicate samples are extra samples collected at a location, in theory, identical to the field sample collected. Field duplicate samples will be collected by splitting samples following compositing, or, in the case of VOC samples, by collecting co-located soil. Replicate samples are used as duplicates of the field samples for QC purposes.

Replicate samples will be collected in duplicate at each SWMU site as called for in Section 4 of this Work Plan. Both the primary and duplicate samples will go to the primary laboratory as sequentially numbered samples as per the applicable SOP.

5.2.2 Trip Blanks

Trip blanks are analyte-free water, shipped from and returned unopened to the laboratory in the same shipping containers containing VOC samples. Trip blanks will be carried with the sampling team(s) during VOC sampling events. One trip blank will be included in every shipping container containing VOC samples and will be analyzed at the laboratory for the same VOC parameters.

5.2.3 Equipment Blanks

Equipment rinsate samples will be collected from the final rinse water during decontamination of sampling equipment. Equipment blanks will be collected at the rate of one per site where sampling occurs.

5.3 Sample Handling and Testing

5.3.1 Sample Numbering

All samples, except trip blanks, collected for this investigation will be assigned sample numbers as follows:

For surface and subsurface soil samples: #### xx-yy (zzz.z-zzz.z) $$

where:	####	= site designator prefix
	xx	= sample location type
		where: HA = hand auger
		BH = bore hole
		SF = surface
	yy	= sample location number
	zzz.z-zzz.z	= sample depth interval (for non-surfacial samples)
	$$	= QA/QC modifier when needed, where:
		QA = QA sample for the independent lab
		QC = QC field replicate for the contract lab

Trip blanks will be numbered according to the number of the sample it is sent with followed by "TB".

5.3.2 Sample Labeling and Documentation

Labeling and field documentation are of great importance to identify all sample containers and record adequate information about the sample. Samples with no labels or conflicting information must often be discarded since their source is unknown or their integrity is compromised. Improper documentation of sample collection may result in data being generated that is useless because the location, depth of collection, or other vital information was not recorded.

All sample containers will be labeled with water-resistant adhesive labels. Black permanent ink felt-tipped markers will be used to complete labels. At a minimum, the following information will be recorded:

- Date and Time of Collection,
- Sampler's Name,
- Unique Sample Number,
- Method of Preservation (if applicable), and
- Requested Analysis.

All pertinent information about each sample will be recorded in a bound field logbook using permanent ink pens. Any procedures performed and problems encountered are documented in the logbook carried by each sampling crew. Corrections to items placed in the logbook will be made by a single line through the information with the corrector's initials by the line.

5.3.3 Sample Containers and Preservation

The appropriate type and number of sample containers will be used for each class of contaminants. These requirements are summarized in Table 5-1. All containers will have Teflon-lined caps or septa. All sample containers will be purchased as new containers, cleaned according to standard EPA cleaning protocols, and packaged in custody-sealed boxes.

5.3.4 Sample Preparation and Shipment

Sample bottles will be prepared and packaged for shipment to minimize bottle breakage and provide adequate sample temperature. Samples will be sent to all laboratories by overnight courier in large metal or rigid plastic ice chests or coolers. Arrangements will be made with each laboratory, including the independent QA lab, prior to sample shipment so that a person is available to receive and handle the samples. This is to ensure that sample temperatures and holding times are not exceeded.

Prior to shipment, the bottles and coolers will be packed according to the following procedures.

- Vermiculite, foam, or other inert packing material will be placed upon the floor of the cooler,
- Bottles will be wrapped in bubble wrap or placed in plastic sleeves to prevent bottle-to-bottle or bottle-to-cooler contact (no packing materials containing adhesives will be used on VOA vials to prevent potential contamination),
- Bottles or groups of bottles will be placed into clear Ziploc plastic bags and sealed,
- Bottles will then be placed into coolers in an upright position. Packing material will be placed around bottles so that they do not touch during shipment,
- Ice will be put into Ziploc bags and placed around and among the sample bottles,
- Adequate packing material will be placed within the empty spaces to prevent potential movement of bottles during shipment,
- The completed chain-of-custody form will be placed into a Ziploc bag, sealed and taped to the inside cover of the corresponding cooler,
- The cooler drain shall be taped shut,
- The cooler lid will be secured by wrapping the cooler in two different locations with strapping tape,
- The completed shipping label will be attached to the top of the cooler so that it is unobscured,
- The signed custody seal forms shall be affixed upon the front right and back left of each cooler/lid interface and covered with clear packing tape.

5.3.5 Laboratory Receiving

Upon receipt of the sample coolers at the appropriate laboratory, the laboratory will check the following items:

- The cooler will be checked for damage or leakage and verification that the chain-of-custody seals have not been broken,
- Contents of the cooler will be compared with the chain-of-custody to verify that all sample numbers and requested analyses match and that no samples are missing,
- Bottles will be inspected for breakage or leakage and the field personnel will be notified immediately so that another sample can be collected,
- The temperature of the bath ice will be measured (to verify that the contents of the cooler were kept below 4^{o}C) and recorded on the chain-of-custody form,
- The pH of liquid samples will be measured and recorded on the chain-of-custody form,

- Any discrepancies between cooler contents and chain-of-custody forms will be noted and/or comments provided regarding damaged samples or problems in the "Remarks" section of the chain-of-custody form, and
- The date, time, and signature should be recorded on the chain-of-custody form, acknowledging the condition and receipt of samples.

Once the laboratory has signed the chain-of-custody, it has assumed responsibility for the proper storage, analysis and disposal of the samples.

5.3.6 Laboratory Test Methods and Detection Limits

The analytical test methods are derived from SW-846 (USEPA, 1986) or USEPA 600 Series (USEPA, 1983). The test required methods, sample containers, preservatives, and maximum sample holding times for all chemical parameters and sample matrices are shown in Table 5-1.

Table 5-1.
Sample Containers, Test Methodologies, Hold Times, and Preservatives for Soils.

Analytical Parameter	Analytical Method	Soil*	
		Container	Max. Hold Time
Total RCRA Metals	SW-846 6010	8 oz. Glass	180 days
Total Cyanide	SW-846 9012A	4 oz. Glass	14 days
VOCs	SW-846 8260	4 oz. Glass	14 days
SVOCs	SW-846 8270	4 oz. Glass	14 days
Total Petroleum Hydrocarbons**	SW-846 8015	4 oz. Glass	14 days

* preservation for all soil samples is chilling to and maintaining the sample at 4°C (39.2°F)
**appropriate modifications for diesel, gasoline, and oil range organics are performed following method SW846-8015

5.3.7 Laboratory Blanks and Standards

The QA/QC procedures of the laboratory require various blanks and standards to be analyzed along with samples. Method blanks and reagent blanks verify the presence of interference and background levels of reagents and chemicals used in the analysis.

Check standards, surrogate standards, internal standards, and standard reference materials provide information regarding the level of confidence in reporting a concentration of an unknown sample. Matrix spikes and matrix spike duplicates evaluate the effect of the sample matrix upon the analytical method.

5.4 Sample Integrity and Documentation

Because analytical results are suspect if the integrity of samples is compromised, measures will be taken to protect the integrity of samples from the time of collection until analysis is complete. Integrity largely involves the security of the sample so that it is known that samples have not had an opportunity to be altered nor compromised. A large part of providing a program where all

samples can be identified and that information about their collection is known is the proper documentation of the sample collection and labeling of containers. Procedures for protecting the integrity of collected samples and properly documenting their collection are described below.

5.4.1 Security

Security will entail procedures for protecting samples from potential tampering by unauthorized personnel from the time of collection until analysis is complete. Security procedures are described below.

5 4.1.1 Sample Security in the Field

All samples collected in the field will remain in the possession of the sampling crew until shipment. Samples will be promptly placed in coolers. Locked vehicles or trailers will be used for interim storage as necessary. If coolers must be left unattended for extended periods of time, signed custody seals will be placed on the coolers.

5.4.1.2 Sample Security in the Laboratory

Once the sample coolers arrive at the laboratory, intact with unbroken custody seals, sample security and integrity will be the laboratory's responsibility. Upon arrival, the laboratory will check the temperature of the cooler contents, verify pH of water samples for metals, check cooler contents versus chain-of-custody, inspect contents for damaged or leaking containers, and verify the accuracy of paperwork.

It will be the responsibility of the laboratory to store the samples in a secure area which is accessible only to authorized personnel.

5.4.2 Custody

Sample custody consists of the forms and labels that document that the samples have been released and received by the proper individuals and that shipping containers have not been opened prior to receipt by the laboratory. Chain-of-custody forms and custody seals are commonly used to accomplish this as discussed in the following sections.

5.4.2.1 Chain-of-Custody Forms

The chain-of-custody form is used to record the sample number, number of containers, date and time of collection, requested analyses, and any remarks for each sample collected. It is also used to record the signatures of persons releasing and receiving the samples. Typically, the chain-of-custody form is filled out and signed by the sampler and then signed again by the receiving individual at the laboratory. Both the sampler and the laboratory retain a copy of the chain-of-custody form.

5.4.2.2 Custody Seals

To ensure that sample coolers have not been opened by unauthorized personnel during shipment, signed custody seals will be placed on at least two locations. The individual preparing the samples will sign and date the custody seals and place one on the front right and one on the back left side of the cooler/lid interface. The seals will be covered with clear packing tape. The laboratory will note upon receipt whether or not the seals were intact. Instances of broken seals will be noted on the chain-of-custody form.

5.4.2.3 Bill of Lading

The shipper's bill of lading can also serve as documentation of sample integrity. It documents the transfer of the samples from the sampler to the shipper since the shipper is not able to sign the chain-of-custody form. The sampler will retain a copy of the shipper's bill.

5.5 Corrective Action

Corrective actions that will be taken in response to non-conformances with established quality control procedures are described in USEPA's "A Compendium of Superfund Field Operations Methods".

5.5.1 Field Activities

Field activities that are improper will be corrected as quickly as possible. The project principle site engineer will be responsible to see that corrective action is initiated and documented whenever the error has the potential to compromise the quality of the data being generated or whenever there is a possibility that the error might be repeated.

5.5.2 Field Data

Corrective action for poor field data quality (as determined by replicate measurements or prior expectations) consists of remeasurement until successive readings agree within reasonable limits. If remeasurement is not successful, then instrument calibration, operation, and the user's technique will be evaluated.

5.5.3 Laboratory

Laboratory corrective action is described in the analytical method for that analysis.

5.5.4 Implementation and Reporting

Following problem identification, the responsible individual, as assigned by the Principle Geologist, will identify the root cause(s) of the problem and develop a corrective action. As appropriate, a corrective action report will be prepared. The report will describe the problem, potential ramifications, the corrective action, implementation, results of the implementation, and effectiveness of the corrective action.

Corrective action should be implemented at the lowest possible level. Corrective action which involves correcting a mistake with little potential of repetition need not be reported as long as the error is not repeated. For example, an erroneous water level measurement, such as 40 feet in a 30 ft. well, would be corrected by taking several additional readings which agreed with each other and looked reasonable. It would not be necessary to report this error.

Corrective action involving a potentially repetitive error or one which had been reported should be documented in writing. For example, an erroneous water level measurement due to a low battery in the water level indicator should be documented because previous suspect water levels may need to be flagged and/or checked.

5.6 Investigation Derived Waste

Several waste streams will be produced during this investigation. These wastes include drill cuttings, decontamination wastewater, and personal protective equipment (PPE). In order to protect human health and the environment, these items will be considered hazardous and managed as such until analysis proves otherwise. To minimize waste generation, the following guidelines will be followed:

- Removal of as much soil or sediment and other contamination from sampling equipment as possible before washing to minimize the quantity of wastewater generated.
- Avoid excessive travel through areas of known contamination to reduce the need for personnel and/or vehicle decontamination.

6.0 QA PROJECT PLAN

6.1 Data Quality Objectives Process

To support the overall investigation objectives, data quality objectives (DQOs) have been established. The DQOs are qualitative and quantitative statements which specify the quality of data required to meet the goals of the site characterization, risk assessment and remedial design. Data developed during the investigation will be used to determine the presence and lateral and vertical extent of soil and groundwater contamination, the direction as well as the rates of contaminant migration. The evaluation of this data will be used to screen corrective measures, and for implementation of corrective measures, if necessary.

DQOs will be used to:

- Ensure data comparability through the use of standard methods and controlled systems to collect and analyze samples;
- Provide analytical results of known and acceptable precision and accuracy; and
- Provide 95 percent data completeness for analytical results representing each matrix-method combination.

The level of analytical support to meet these goals will be between Level III and IV as described in "Data Quality Objectives for Remedial Response Activities: Development Process", U.S. Environmental Protection Agency, EPA 540/G-87/003, May 1987. As part of the analytical reporting requirements, the following data will be provided by all reporting laboratories:

- Sample identification numbers cross-referenced with laboratory identification numbers and QC sample numbers,
- Problems with arriving samples noted on chain-of-custody,
- Each analyte reported as an actual value or less than a specified detection limit, and
- Dilution factors, extraction dates, and analysis date.

QC samples results for laboratory blanks, surrogate spikes, matrix spikes, laboratory duplicates, field duplicates, field blanks, and trip blanks. The data developed during the investigation will meet the chosen objectives for precision, representativeness, accuracy, completeness, and comparability.

6.1.1 Accuracy

Accuracy is the degree to which a measurement agrees with the actual value, i.e., the amount of measurement bias. Accuracy is expressed as a percent recovery of a known concentration of reference material.

The accuracy of an analytical procedure is determined by the addition of a known amount of material (matrix spike) to a field sample matrix or a standard matrix. A standard matrix is made up of distilled water or sterile, clean soil with approximately the same physical properties (porosity, permeability, plasticity, grain size, etc.) as the field sample. The field sample matrix is described as all components of the sample mixture except the analyte (the compound being analyzed). The lab will be required to perform matrix spiking on 5% of field samples, as well as on 5% of laboratory control samples. Field sample matrix and standard matrix sample spiking show how the sample matrix-analyte chemical interactions affect the analytical results. The matrix behavior of the spiked field sample will be comparable to that of the matrix of the original sample. After analysis for the spike is completed, the accuracy of the procedure is expressed as a percent recovery as shown by the following equation:

$$\text{Percent Recovery} = \frac{(C_2 - C_1)}{C_0} \times 100\%$$

where: C_0 = amount of analyte added to the sample matrix,

C_1 = amount of analyte present in the unspiked sample matrix (equal to zero for the standard matrix), and

C_2 = amount of spiked material recovered in the analysis.

Typically, the amount of a reference analyte spiked into a field sample matrix is specified by the laboratory quality control program, or 3 to 5 times the background concentration of the analyte in the sample matrix. Samples cannot be spiked for all organic compounds which could possibly

exist in the field sample matrix, however, a set of surrogate compounds, each of whose physical and chemical properties is similar, is used as surrogate matrix spikes, or surrogates. Acceptable recovery ranges for each class of organic compounds are discussed in the analytical methods for each parameter.

6.1.2 Precision

Precision is a measure of the degree of reproducibility of an analytical value and is used as a check on the quality of the sampling and analytical procedures. Precision is determined by analyzing replicate samples. The significance of a precision measurement depends on whether the sample is a field replicate, lab replicate, or a matrix spike replicate.

Field replicates are taken at the rate of 10% or one per batch (each daily shipment of samples from a site), whichever is greater. Precision of the analytical method, at each stage, is determined by calculation of a relative percent difference (RPD) between duplicate analytical recoveries of a sample component, relative to the average of those recoveries:

$$RPD = \frac{|C2 - C1|}{(C2 + C1)/2} \times 100\%$$

where: C_1 = analyte concentration in the sample,
C_2 = analyte concentration in the sample replicate, and
| | = an absolute value (It is customary to express RPD as a positive number.

These calculations are usually performed on matrix spikes and matrix spike duplicates.

6.1.3 Completeness

Field completeness will be assessed by comparing the number of samples collected to the total number of samples planned. Analytical completeness will be assessed by comparing the total number of samples with valid analytical results to the number of samples collected. The overall project completeness is, therefore, a comparison between the total number of valid samples to the number of samples planned. The results will be calculated following data validation and reduction.

Completeness (C) is determined by:

$$C = \frac{P_1}{P_0} \times 100\%$$

where: P_0 = total number of samples planned, and
P_1 = number of valid data points

A value of 90% or higher is the goal. For values less than 90%, problems in the sampling or analytical procedures will be examined and possible solutions explored.

6.1.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. The determination of the representativeness of the data will be performed by:

- Comparing actual sampling procedures and chain of custody forms to those described in the work plan,
- Identifying and eliminating nonrepresentative data in site characterization activities,
- Evaluating holding times and condition of samples on arrival at the laboratory, and
- Examining blanks for cross contamination.

Representativeness is a qualitative determination. The objective of this work plan is to eliminate all non-representative data.

6.1.5 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performed under this work plan, data generated by laboratories in previous investigative phases, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. The comparability objectives of this work plan are (1) to generate consistent data using standard test methods; and (2) to salvage as much previously generated data as possible.

6.1.6 Sensitivity

Sensitivity is a general term which refers to the calibration sensitivity and the analytical sensitivity of a piece of equipment. The calibration sensitivity is the slope of the calibration curve evaluated in the concentration range of interest. The analytical sensitivity is the ratio of the calibration sensitivity to the standard deviation of the analytical signal at a given analyte concentration. The detection limit, which is based on the sensitivity of the analysis, is the smallest reported concentration in a sample within a specified level of confidence. Quantitation limits represent the sum of all of the uncertainties in the analytical procedure plus a safety factor. The detection limit is a part of the quantitation limit.

6.1.7 Chemical Data Validation

Raw laboratory data are typically reduced at the laboratory, resulting in a report containing the analytical data and the laboratory QC results. If needed, calibration and internal standards information, raw data, and all instrumentation output will be provided by the laboratory. Following receipt of chemical laboratory data, the validation process will include the following:

- Review of laboratory testing methods, detection limits, holding times, data qualifiers, etc.
- Review of data summaries and reports for transcriptional and typographical errors
- Review to determine propriety of sampling protocols
- Review to compare the data against trip blanks to detect contamination from sampling

- Review to compare field sampling replicates
- Review to compare field sampling replicates (QC samples)
- Review of laboratory QC including laboratory blanks, spike recovery and duplicates
- Review chain-of-custody forms, sample receipt data, damages to sample containers, etc.

6.1.8 Field Data and Measurements

All field instruments will be properly calibrated and used as directed by the manufacturer. Validation of field data will be determined primarily by making several readings and checking for reproducibility. All field personnel will be knowledgeable on the use and calibration of field instruments, the oversight of field data collection, validation, and record keeping. All field data will be recorded in the site logbook and presented in the Phase III RFI Report.

Field measurements will be performed to Level I (USEPA, 1983) standards. These will include measurement of pH, conductivity, and temperature on groundwater samples. Precision on field measurements will be assessed by duplicate measurements to determine reproducibility. These consecutive readings should be ± 1^{o} F for temperature, ± 0.02 units for pH, and ± 10% for conductivity.

6.1.9 Technical Data

Technical data refers to data of several types, such as potentiometric surface measurements, groundwater flow calculations, lithologic thicknesses generated from geologic and geophysical field data, isopleth profiles of contaminants and groundwater models. This information will be recorded in the site logbook as it is collected. Anomalous readings or results will be rechecked and presented to the Task Manager for verification. Technical data will be evaluated and reported in the Phase III RFI Report.

Data derived from this investigation will be filed with other project specific data. Additionally, electronic data received from the laboratory, including sample identification, analyte, analytical test method, reporting unit, detection concentrations, and laboratory reporting limits, will be imported into and saved in an analytical database. The data will be arranged and presented in a clear and logical format for submittal to the regulatory authority. Analytical data will be summarized in tabular format to include all detections, non-detections with laboratory detection limits, flagged data, unique sample identification, sample type (soil/water), sampling date, and reporting units. If warranted by the data results, graphs will be used to represent concentrations vs. distance from a set point at a site. Also, isopleth maps showing lines of equal concentrations of contaminants present will be generated to demonstrate potential contaminant migration patterns. Plan view maps will be generated showing location of sampling points and groundwater flow direction.

7.0 PROJECT MANAGEMENT

WSMR will utilize its environmental contractor, BAE Systems, to execute the requirements within this Work Plan. The project organization reflects the relationship between regulatory oversight of the project (NMED-HWB), the WSMR Technical Inspector (TI), and the

BAE Systems team assembled to plan, organize, control, and execute this investigation. Within the BAE Systems project management system, the key positions are the General Manager and the Principal Site Engineer/Geologist. The following sections list the responsibilities within the BAE Systems team.

7.1 Duties and Responsibilities

7.1.1 General Manager

The General Manager is the senior BAE Systems representative on the project, and functions as the focal point for WSMR. For this project, the General Manager's responsibilities include:

- Overall project management .
- Total planning, organization and execution of the Work Plan.
- Maintaining contact with the WSMR TI throughout the work.
- Directing the Principal Engineer in conducting a successful project.
- Providing resources to the Principal Engineer to accomplish project responsibilities.
- Guiding the Principal Engineer on the approach to a public relations program.
- Reviewing and approving all deliverables.

Dr. Donald K. Emig, P.E. serves as the General Manager for BAE Systems.

7.1.2 QA/QC Manager/Deputy General Manager

The Deputy General Manager for this project is responsible for the following:

- Acting for the General Manager in his absence.
- Reviewing project progress.
- Ensuring project QC protocols and procedures are followed.
- Conducting audits to ensure that all deliverables are properly reviewed and checked.
- Documenting that all quality objectives have been met.
- Assisting the Principal Engineer in evaluating alternatives to meeting project objectives.
- Providing guidance on the allocation of resources.

Mr. Fred Bourger serves as the Deputy General Manager and QA/QC Manager for BAE Systems.

7.1.3 Principal Engineer/Task Manager

The Principal Engineer for this project will be responsible and accountable to the General Manager for overall direction and performance of the project including the following:

- Developing and executing the Work Plan.
- Directing the Principal Site Engineer/Geologist.
- Keeping Program Manager and WSMR TI appropriately informed.
- Approving uses of technical resources.
- Coordinating all assigned resources.
- Periodic review of progress and progress reporting.

- Resolving Work Plan issues.
- Schedule and budget tracking.
- Assuring quality and timeliness of deliverables.
- Approving work performed by subcontractors.
- Technical liaison between the Principal Site Engineer/Geologist and the General Manager.

Mr. Fred Bourger will also serve as the Principal Engineer/Task Manager for this project.

7.1.4 Principal Site Engineer/Geologist

The Principal Site Engineer/Geologist will be responsible for coordinating all site activities, including those of the on-site contractors, and all laboratory activities. These include execution of the fieldwork in accordance with appropriate sections of this Sampling and Analysis Plan. Specific responsibilities include:

- Developing the Work Plan.
- Day to day execution of the Work Plan.
- Reporting project progress to the Principal Engineer/Task Manager.
- Coordinating, directing and overseeing field technical support staff.
- Developing quality and timely deliverables.
- Monitoring and oversight of work performed by subcontractors.
- Providing overall direction and supervision of the drilling, well installation, geophysical. logging, location surveys, surface soil sampling, data validation and related activities.
- Ensuring that all staff and subcontractors meet WSMR security requirements.
- Completing all appropriate field logs for project activities.
- Providing overall supervision of the collection, handling, and shipping of all samples.
- Monitoring all drilling and sampling operations to ensure that all project site personnel are fully implementing and executing the provisions of this Work Plan.
- Understanding the quality requirements of each field task, and bringing to the attention of management, conditions which may adversely impact the quality of the data or other work product.
- Execution of all field QC procedures.
- Preparing daily reports of project progress for the Principal Site Engineer.
- Oversight of field drilling, sampling and well installation activities.
- Development of lithologic logs of all borings.
- Interpretation of geophysical borehole logs.
- In-situ hydraulic conductivity testing.
- Evaluation of field data.

Mr. Brad Davis will serve as the Principal Site Engineer/Geologist and Task Coordinator for this project. Mr. Jason Capron will provide site engineering services for this project.

7.1.5 Site Health and Safety Officer

The Site Health and Safety Officer will report to the Deputy General Manager and be responsible for:

- Serving as the on-site responsible individual who has the authority necessary to implement the Site-Specific Health and Safety Plan (Appendix A) and verify compliance with applicable safety and health requirements.
- Reporting to and coordinating with the Deputy General Manager on health and safety matters.
- Reporting safety-related incidents or accidents to the overall Health and Safety Officer and taking corrective actions to mitigate hazards and potential losses.
- Verifying that personnel working on-site have completed medical surveillance and health and safety training.
- Maintaining health and safety equipment on-site.
- Directing personnel to change work practices if they are deemed hazardous to the health and safety of the personnel.
- Removing personnel from the site if their action or condition endangers their health and safety or the health and safety of their co-workers.
- Temporarily suspending field activities, if health and safety of personnel are endangered, pending further consideration by the overall Health and Safety Officer and General Manager.
- Maintaining documentation of health and safety measures taken at the site, including
    - Communication of provisions of the Site-Specific Health and Safety Plan,
    - Levels of protection and required upgrades,
    - Environmental monitoring results, and
    - Incident reporting.
- Upgrading or downgrading levels of protection in response to changing field conditions, with the concurrence of the overall Health and Safety Officer.
- Reporting all infractions of the Site-Specific Health and Safety Plan to the overall Health and Safety Officer and General Manager.

Mr. Brad Davis will serve as the Task Coordinator/On-Site Supervisor for this project.
Mr. Jason Capron will serve as the On-Site Supervisor in the absence of Mr. Brad Davis.

7.1.6 Project Chemist

As part of the project team, the Project Chemist will provide technical support during sample collection and analysis. The project chemist will report to the Principal Site Engineer and duties will include:

- Evaluating analytical data to determine usability of results.
- Verifying laboratory procedures and QA protocols.
- Immediate notification of Principal Site Engineer of potential data problems.
- Confirming field QC procedures to obtain representative data .

Ms. Karen Costa will serve as the Project Chemist.

7.1.7 Site Biologist

As part of the project team, the Site Biologist will provide technical support for ecological issues on this project. Duties will include:

- Providing oversight for biological pedestrian surveys of all sites.
- Completing a screening-level ecological risk assessment for project sites.
- Reporting to the Principal Site Engineer/Geologist on progress.

BAE Systems will assign a qualified individual to serve as the Project Biologist.

7.2 Data Management and Reporting

BAE Systems will provide the personnel, services and equipment necessary for the completion of the scope of work described in this Work Plan. This section provides a description of the work to be performed and the items to be delivered to WSMR. The work will be performed in general accordance with the approved Phase III RFI Work Plan and the site-specific Work Plans contained herein.

7.2.1 Work Plan

This Work Plan developed in response to regulatory comments and identified information deficiencies, will be submitted to the NMED for review and approval. The Work Plan contains detailed plans for sampling and analysis for the project sites. The Work Plan also contains a Site Specific Health and Safety Plan and IDW Management Plan as Appendices A and C, respectively.

7.2.2 Site Specific Health and Safety

BAE Systems prepared a Site Specific Health and Safety Plan for this project to serve as an addendum to the Accident Reporting and Safety Program dated May 2003, developed by BAE Systems, for all activities conducted at WSMR. The Accident Reporting and Safety Program provide minimum safety standards and accident prevention fundamentals to cover a range of activities at WSMR and its satellite installations. To supplement the information in the Accident Reporting and Safety Program, this plan describes specific activities to complete this site investigation. A copy of the Site Specific Health and Safety Plan is in Appendix A.

7.2.3 Letter Report of Generated Wastes

No later than 60 days following the completion of drilling and sampling activities, a letter report will be submitted to WSMR which outlines the analytical results of wastes generated during field investigation activities. Characterized wastes include drill fluids and cuttings and wastewater generated during decontamination activities. The total quantity of materials will be presented along with recommendations for proper disposal. BAE Systems expects that only drill cuttings, personal protective equipment, and decon water will be generated for this project.

7.2.4 Monthly Status Reports

BAE Systems will submit to WS-ES, a monthly progress report which describes the work performed since the previous report, work currently underway, and work anticipated during the next month. The monthly status report will also outline any technical problems or other issues that could cause project delays.

7.2.5 Site Characterization Report

A site characterization report will be prepared to summarize the findings of the investigation, present conclusions drawn from the findings, and make recommendations for further action at the site. The Work Plan for this RFI will provide data for characterization of the SWMU sites. Information pertaining to the physical characteristics (geology and surface features) of the sites will be gathered during implementation of the RFI Work Plan. Characterization of the nature and extent of possible contamination in the soil and groundwater at the site will be determined during this investigation and included in the site characterization report. Additionally, contaminant fate and transport, including possible contaminant migration, routes of migration, and contaminant persistence, will be developed from data gathered during the investigations. If contaminants of potential concern are found during the investigations, a baseline risk evaluation will address potential human health risks and potential environmental/ecological risks. This will serve as the basis for determining the need for further monitoring of the site, and for development of any remedial or Corrective Action Plans for the sites.

The format for the site characterization report will consist of, but not be limited to the following:

Executive Summary

1.0 Introduction
- 1.1 Purpose
- 1.2 Site Backgrounds
  - 1.2.1 Site Descriptions
  - 1.2.2 Site Histories
  - 1.2.3 Previous Investigations

2.0 Study Area Investigations (Discussions of field activities conducted for site characterization)
- 2.1 Surface Features
- 2.2 Contaminant Source Investigations
- 2.3 Geological Investigations
- 2.4 Hydrological Investigations
- 2.5 Soil and Vadose Zone Investigations
- 2.6 Groundwater Investigations

3.0 Physical Characteristics of the Study Areas (Results of field activities)
- 3.1 Surface Features
- 3.2 Meteorology
- 3.3 Surface Water Hydrology
- 3.4 Geology

3.5 Soils
3.6 Hydrogeology
3.7 Demography and Land Use
3.8 Land use

4.0 Nature and Extent of Contamination
4.1 Source(s)
4.2 Soils and Vadose Zone
4.3 Groundwater

5.0 Contaminant Fate and Transport
5.1 Routes of Migration
5.2 Contaminant Persistence
5.3 Contaminant Migration (results of modeling)

6.0 Baseline Risk Assessment
6.1 Human Health Evaluation
6.2 Environmental Evaluation

7.0 Summary and Conclusions

8.0 Recommendations

Appendices
Laboratory Data and QA/QC Evaluation Results
Risk Assessment Methods
Field Data

8.0 PUBLIC INVOLVEMENT PLAN

The purpose of the Public Involvement Plan for the investigation of the listed SWMUs is to provide a plan for the involvement of the public for proposed corrective actions. Dependent on the outcome of the investigation, the public will be notified of the proposed corrective actions once the nature and extent of contamination is known at the site. The WSMR will do one or all of the following depending on the interest of the public:

1. Conduct an open house/informal meeting in a public location where people can talk with NMED and WSMR one-to-one regarding the SWMUs.
2. Maintain an easily accessible public repository of information on the site-specific corrective action program. This information shall include all permits, approved work plans and reports associated with the investigation and corrective action.
3. Publish a newsletter for distribution to the interested public describing the proposed action.

The WSMR currently maintains an easily accessible public repository of data and reports of environmental activities on the Range.

The schedule for implementing the public involvement plan, once the investigation report is completed, is included in the following table:

Table 8-1. Public Involvement Plan Schedule.

Task	Completion Date
WSMR / NMED Meeting	TBD
Submission of RFI Work Plan	TBD
• NMED RFI approval and Notice to Proceed	TBD
• RFI Implementation	TBD
• Facility Investigation Summary Report	60 days after completion of RFI
Publication of Public Notice	TBD
Public comment period	45 days following publication of public notice
NMED issue Notice of Decision	30 days following public comment period

The Public Involvement Plan Schedule is tentative and will be affected by submission of reports, internal and regulatory approval and the commencement of the Investigation scope of work for the SWMUs.

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APPENDIX A

Site Specific Health and Safety Plan for the
Main Post Phase III RFI at White Sands Missile Range

TABLE OF CONTENTS

SECTION **PAGE**

List of Figures

List of Tables

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LIST OF ACRONYMS

bgs	below ground surface
dBA	decibels, A-weighted
DGM	Deputy General Manager
EOD	Explosive Ordnance Disposal
HSO	Health and Safety Officer
HSWA	Hazardous and Solid Wastes Amendment
HWB	Hazardous Waste Bureau
IDLH	Immediate Danger to Life and Health
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
LEL	Lower Explosive Limit
mg/kg	milligram per kilogram
NFA	no further action
NMED	New Mexico Environment Department
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SSHSP	Site Specific Health and Safety Plan
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TPH	total petroleum hydrocarbon
TWA	time-weighted average
UEL	Upper Explosive Limit
UXO	Unexploded Ordnance
VOC	volatile organic compound
WSMR	White Sands Missile Range

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REVIEWS AND APPROVALS

This plan serves as a site-specific addendum to the Accident Reporting and Safety Program dated May 2003, developed by BAE Systems, for all activities conducted at White Sands Missile Range. The Accident Reporting and Safety Program provide minimum safety standards and accident prevention fundamentals to cover a range of activities at White Sands. To supplement the information in the Accident Reporting and Safety Program, this plan describes specific activities to complete the Phase III RFI on White Sands Missile Range. This Site-Specific Health and Safety Plan was approved by the following individuals:

Jason Capron
On-Site Supervisor
BAE SYSTEMS

6/8/04
Date

Bradley Davis
Task Coordinator/On-Site Supervisor
BAE SYSTEMS

6/9/04
Date

Benito Avalos
Health and Safety Officer
BAE SYSTEMS

6/8/04
Date

Fred Bourger
Deputy General Manager/Task Manager
BAE SYSTEMS

6/10/04
Date

Donald K. Emig Ph.D., P.E.
General Manager
BAE SYSTEMS

6-10-04
Date

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SITE SPECIFIC HEALTH AND SAFETY PLAN FOR THE MAIN POST PHASE III RCRA FACILITY INVESTIGATIONS

1.0 INTRODUCTION

White Sands Missile Range (WSMR) submitted a series of no further action (NFA) petitions to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) beginning in January 2000 for the removal of various solid waste management units (SWMUs) (Table 1-1), from the WSMR Resource Conservation and Recovery Act (RCRA) Permit. The petitions were denied by NMED In March 2002 on the basis that further characterization and ecological risk assessment were required.

The SWMUs were subsequently reopened within WSMR's Installation Restoration Program (IRP) for further study. A Phase III RCRA Facility Investigation (RFI) has been designed to address specific regulatory concerns for the SWMUs listed in Table 1-1. The intent of this Phase III RFI is to complete characterization and risk assessment, as necessary, to the extent satisfactory to the state in preparation for a future NFA petition for removal of the SWMUs from WSMR's RCRA Permit. The general tasks planned for each SWMU to accomplish this objective are listed in Table 1-1.

Table 1-1. Phase III RFI Tasks.

	IRP ID	SWMU Alias	IRP Site Description	SLERA[1]	BG Soil[2]	Env Smpl[3]
1	WSMR-30	80	STP Sludge/Waste Pile (Main Post)	☑	☑	☑
2	WSMR-31	21	Main Post Former FFTA and Pit	☑	☑	☑
3	WSMR-32	22	Main Post Former FFTA Waste Pile	☑	☑	☑
4	WSMR-33	14, 15	Used Battery Accumulation Areas	☑	--	--
5	WSMR-36	8, 9	POL Sumps at Building 1794	☑	--	☑
6	WSMR-57	156	Former Golf Course Pest Storage Shed	☑	--	--
7	WSMR-60	12, 13	UST Sump, Wash Pad, Drain Bldg 1778	☑	☑	--
8	WSMR-73	17	Waste Underground Injection Pipe	☑	☑	--
9	WSMR-74	10, 11	Former Waste Oil Tank/Sump-Bldg 1778	☑	--	--
10	WSMR-79	16	Heavy Equipment Wash Pad and Drain	☑	☑	--
11	WSMR-84	140	LC-37 Paint Dump	☑	☑	☑

1. SLERA = Screening Level Ecological Risk Assessment will be performed
2. BG Soil = Comparison of analytical results of this investigation and/or past investigations to background levels of metals will be performed when requested by NMED or warranted by results of the Phase III RFI
3. Env Smpl = Environmental soil sampling to confirm the success of previous removal actions or characterize existing conditions when previous removal was not adequate

2.0 HEALTH AND SAFETY ORGANIZATION

2.1 Project Organization

The project organizational structure and key project personnel are shown in Table 2-1. The BAE Systems personnel assigned specific health and safety responsibilities are identified below.

Table 2-1. Project Personnel Organization Chart.

Donald K. Emig Ph.D., P.E. General Manager BAE SYSTEMS	• Overall project management.
Fred Bourger Deputy General Manager/Task Manager BAE SYSTEMS	• Responsible for all site activities.
Jason Capron On-Site Supervisor BAE SYSTEMS	• Responsible for assembly of the Site Specific Health and Safety Plan (SSHSP). • Responsible for execution of the Site Specific Health and Safety Plan when on-site.
Bradley Davis Task Coordinator/On-Site Supervisor BAE SYSTEMS	• Responsible for assembly of the Site Specific Health and Safety Plan (SSHSP). • Responsible for all site coordination issues during site activities. • Responsible for execution of the Site Specific Health and Safety Plan.
Benito Avalos Health & Safety Officer BAE SYSTEMS	• Responsible for project review of health and safety issues.

2.2 Responsibility and Authority of Key Personnel

The responsibility and authority of key personnel relative to the implementation of this Site-Specific Health and Safety Plan (SSHSP) are described below.

2.2.1 Deputy General Manager/Task Manager

The Deputy General Manager/Task Manager has the following responsibilities:

- Reporting to the General Manager.
- Overall responsibility for all on-site health and safety matters.
- Reviewing and recommending approval of the SSHSP.
- Verifying that the project is performed in a manner consistent with the Work Plan and the SSHSP.
- Approving the On-Site Supervisor for the project.
- Coordinating with the Health and Safety Officer (HSO) and the General Manager on health and safety matters.
- Temporarily suspending field activities if the health and safety of personnel are endangered.
- Reporting all infractions of the SSHSP to the BAE Systems HSO and the General Manager.

Mr. Fred Bourger is the Deputy General Manager/Task Manager for this project.

2.2.2 Task Coordinator/On-Site Supervisor

The Task Coordinator/On-Site Supervisor has the following responsibilities:

- Serving as the on-site responsible individual who has the authority necessary to implement the SSHSP and verify compliance with applicable safety and health requirements.
- Implementing the requirements of the SSHSP.
- Reporting to and coordinating with the Deputy General Manager on health and safety matters.
- Reporting safety-related incidents or accidents to the HSO and taking corrective actions to mitigate hazards and potential losses.
- Verifying that personnel working on-site have completed medical surveillance and health and safety training.
- Maintaining health and safety equipment on-site.
- Directing personnel to change work practices if they are deemed hazardous to the health and safety of the personnel.
- Removing personnel from the site if their action or condition endangers their health and safety or the health and safety of their co-workers.
- Temporarily suspending field activities, if health and safety of personnel are endangered, pending further consideration by the HSO and General Manager.
- Maintaining documentation of health and safety measures taken at the site, including
  - Communication of provisions of the SSHSP,
  - Levels of protection and required upgrades,
  - Environmental monitoring results, and
  - Incident reporting.
- Upgrading or downgrading levels of protection in response to changing field conditions, with the concurrence of the HSO.
- Reporting all infractions of the SSHSP to the HSO and General Manager.

Mr. Brad Davis will serve as the Task Coordinator/On-Site Supervisor for this project.
Mr. Jason Capron will serve as the On-Site Supervisor in the absence of Mr. Brad Davis.

3.0 SITE WORK PLAN SUMMARY

3.1 Project Objective

The components of this SSHSP cover site work for the completion of investigation at 16 SWMUs on WSMR. Investigatory work will include confirmation sampling (using hollow-stem auger and/or hand auger), and a biological pedestrian survey at some or all of the 16 SWMUs covered under this investigation. The majority of SWMUs are located on or in the vicinity of Main Post (Figure 3-1 on following page) of WSMR.

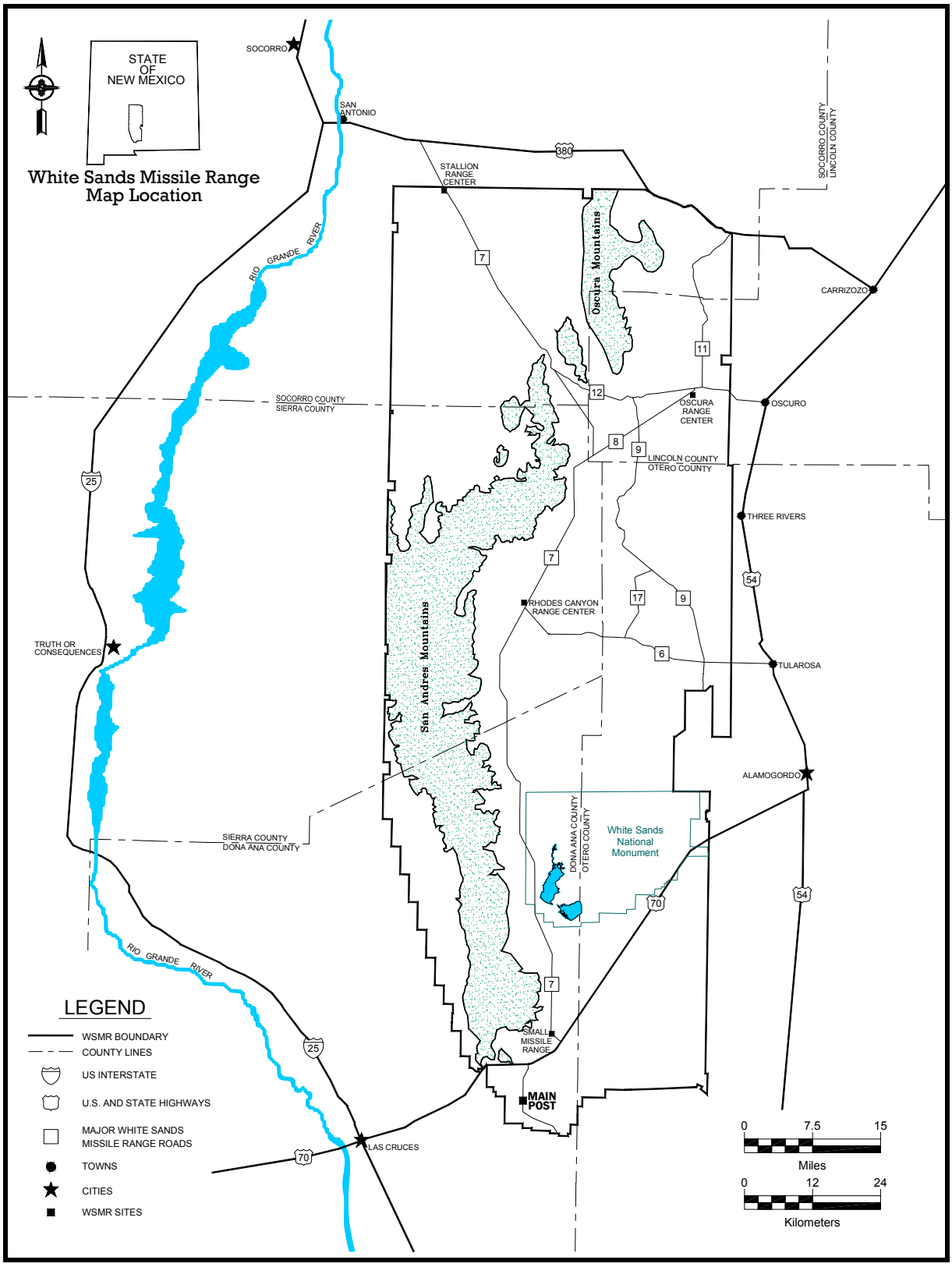

Figure 3-1.
Location of the Main Post on White Sands Missile Range.

3.2 Project Tasks

- Soil sample collection using hollow-stem auger
- Management of Investigation Derived Waste (IDW)
- Biological pedestrian survey

Personnel Requirements: Two BAE Systems personnel will be required during sample collection activities. One BAE Systems personnel will be required during the biological pedestrian survey. Up to three sub-contracted drilling company personnel will be required during hollow stem auger sample collection.

Note: All personnel assigned field work for this project shall receive a copy of this SSHSP and be made aware of appropriate potential site hazards prior to entering the sites, as listed in Sections 4.0 and 6.0 of this SSHSP.

4.0 SITE CHARACTERIZATION AND ANALYSIS

4.1 Anticipated Hazards

4.1.1 Potential Chemical Hazards

The potential chemical hazards to personnel at the 16 SWMU sites includes hazards from total petroleum hydrocarbons (TPH) and associated volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), lead, and arsenic.

No significant risk to personnel from chemical hazards is expected at this site, so Personal Protective Equipment (PPE) of Level-D with the addition of hard hats will be required for all on-site personnel. A photoionization detector (PID) will be used to monitor organic chemicals in the breathing zone, and PPE may be upgraded as required by existing conditions.

Total Petroleum Hydrocarbons

Route of Entry: Inhalation, ingestion, contact with skin and / or eye
Target Organs: Eyes, skin
Hazard: No significant hazard to human health
Symptoms: Irritation and redness of eyes, skin irritation, cough and chest pain

Lead

Route of Entry: Ingestion and inhalation
Target Organs: gastrointestinal, kidney, blood, immune system.
Hazard: toxic.
PEL: 0.05 mg/cubic meter IDLH: 100 mg/cubic meter
Symptoms: drowsiness, headache, nausea, vomiting, weakness, pallor, collapse.

Arsenic

Route of Entry: Inhalation, ingestion, contact with skin and / or eye
Target Organs: Skin, respiratory system, kidneys, central nervous system, liver, gastrointestinal tract, reproductive system
Hazard: toxic
PEL: 0.5 mg/cubic meter IDLH: 5 mg/cubic meter

Symptoms: irritation skin, possible dermatitis; respiratory distress; diarrhea; kidney damage; muscle tremor, convulsions; possible gastrointestinal tract, reproductive effects; possible liver damage

4.1.2 Physical Hazards

Drilling, sampling and survey activities include possible physical hazards which could result in cuts or punctures from sharp objects, falls from uneven terrain, steep grades or slippery surfaces, sprains and strains from lifting activities and noise. Personnel should be aware that if the level of personal protective equipment increases, dexterity and visibility may be impacted and performing some tasks may be more difficult.

Employee experience in the use of drilling equipment and awareness of potential hazards will reduce risk. All equipment operations must be in accordance with guidelines set forth in applicable Occupational Safety and Health Administration (OSHA) regulations. The primary hazards potentially encountered during this project will be those associated with heavy equipment operation. Drilling areas will be marked with caution tape to prevent accidental entry to the site.

The Accident Prevention Plan provided in Section 6.0 contains specific practices used to reduce or eliminate anticipated physical hazards (listed below) that may be present and encountered during the site operations. Below each indicated hazard is a list of operations and/or tasks that may involve the indicated hazard. An "X" indicates specific actions that will be taken to control the respective hazards. These control measures may include work practice controls, engineering controls, and/or use of appropriate personal protective equipment.

- Hazards Associated with Potential Exposure to Hazardous Chemicals or Materials
- Fire Hazards Associated with Handling or Working Near Flammable or Combustible Materials
- Slip, Trip, Fall Hazards
- Hazards Associated with Operation of Heavy Equipment
- Hazards Associated with Working in Hot Environments
- Hazards Associated with Working in Cold Environments
- Hazards Associated with Insects, Snakes, or Wild Animals
- Hazards Associated with Falling Objects
- Hazards Associated with Electricity
- Hazards Associated with Materials Handling
- Hazards Associated with Limited Communication Due to Location, Distance, or Noise
- Hazards Associated with Noise

- Hazards Associated with Underground or Overhead Utilities
- Hazards Associated with Unauthorized Personnel Onsite, and in Controlled Work Zones
- Hazards Associated with Excessive Traffic Through or Near the Work site
- Hazards Associated with Unexploded Ordnance (UXO)

4.1.3 Unexploded Ordnance

Although the potential is low, there is the possibility that unexploded ordnance (UXO) or other explosive materials may be present at the work area. However, this does not eliminate the potential for the presence or absence of subsurface UXO. All field personnel are required to review the UXO Orientation video and sign the orientation sheet prior to the start of field activities. Additionally, all field personnel must keep a signed copy of their UXO training form on hand at all times. The form will indicate that the bearer has received proper UXO training. Finally, all field personnel will be verbally briefed daily regarding procedures to follow if ordnance is discovered. UXO procedures are as follows:

- Mark the area around the UXO and avoid it
- Call 678-2222 and report the area the UXO was found and a brief description of the UXO to the Exploded Ordnance Department (EOD)
- Clear the area and await the arrival of EOD

4.1.4 Noise

Noise will be generated during site activities (drilling activities). As a precautionary measure, hearing protection, either earmuffs or earplugs, are mandatory while working adjacent to the drilling equipment. A noise meter will be onsite to monitor noise conditions (see Section 5.0).

4.1.5 Electrical Hazards

A new utility clearance will be obtained for all drilling locations to ensure that no underground electrical lines will be disturbed during subsurface work. A copy of the signed utility clearance documentation will be available at the site. Overhead utility lines can be observed and will be avoided during drilling operations. The minimum safe distance to overhead utility lines required by the drilling subcontractor will be observed. In the event that electrical power is required for sample collection activities, a portable generator will be used.

Electrical shock can occur by direct contact with live wires or with electrical equipment and instruments that are wet or have faulty wiring. Any extension cords used with the equipment should be checked for cuts or loose connections in the coating protecting the wires prior to use. All extension cords will also be connected to ground-fault circuit interrupters. Use of properly grounded and/or double insulated tools will also reduce the potential for electric shock. A potential exists for electrical induced explosion. The site will be monitored by a combustible gas meter to minimize the potential for explosion (see Section 5.0).

4.1.6 Biological Hazards

The field team should be aware that site activities might disturb the local wildlife population. Therefore, there is potential for field personnel to be bitten by snakes, animals, and insects. Prompt first aid measures are extremely important. All field team members should be properly briefed regarding the potential for encountering wildlife, as well as prompt first aid procedures in the event of a snake, insect, or animal bite.

Normally, the noise created by a person approaching a snake is sufficient to frighten snakes away. However, extreme caution is necessary when exploring areas where snakes might be found, such as behind rocks, under bushes, or in holes, crevices, and abandoned pipes. The rules to follow if bitten by a snake are:

- Do not cut the bite area, since it will exacerbate the effect of the venom;
- Do not apply suction to the wound, since this is minimally effective in removing venom;
- Do not apply a tourniquet since venom is most dangerous when concentrated in a small area;
- Do not allow the victim to run for help, since this accelerates circulation;
- Do seek immediate medical attention;
- Do keep the victim calm and immobile; and
- Do have the victim hold the affected extremity lower than the torso while waiting for medical assistance.

4.1.7 Heat Stress

Elevated temperatures may be a concern during this project. Heat and cold stress monitoring and prevention procedures will be initiated when appropriate. Heat stress reduction procedures shall consist of the following:

- Field personnel will be encouraged to drink fluids (chilled, potable water) frequently.
- When temperatures exceed 92 degrees Fahrenheit, all field personnel working outdoors will measure their heart rates no less than hourly. If the heart rate exceeds 110 beats per minute, the individual will rest for 10 minutes, drinking fluids throughout the rest period. If the heart rate has dropped below 110 beats per minute at the end of the rest period, the individual may return to work. If the heart rate exceeds 110 beats per minute, contact the onsite health and safety officer.
- Any personnel displaying signs or symptoms of heat stress will stop work and rest for at least 15 minutes. If symptoms persist beyond this rest period, the onsite health and safety officer will be contacted. Personnel displaying symptoms of heat stroke should immediately be taken to the nearest medical facility.

Symptoms of heat exhaustion include dizziness, light-headedness, nausea, slurred speech, fatigue, copious perspiration, cool clammy skin, and an increased resting heart rate. Symptoms of heat stroke include delirium, fainting, and hot, dry, flushed skin. Heat stroke is a life threatening condition, and immediate medical attention is required if any symptoms of heat stroke are observed.

4.1.8 Cold Exposure

Extreme cold temperatures may be a concern during this project. Cold stress monitoring and prevention procedures will be initiated when appropriate. Precautionary measures shall consist of the following:

- Field personnel will be encouraged to wear thermal underwear, long pants, long sleeve shirts, sweaters, sweatshirts, gloves, thick socks, and/or jackets to prevent problems related to cold exposure.
- Field personnel will be encouraged to drink fluids frequently.
- If temperatures drop below freezing and windchill causes subzero-degree (Fahrenheit) working conditions, field work will be limited to the warmest hours of the day or in extreme cases all work at the site will cease until temperatures and weather return to a safe level.
- Any personnel displaying signs or symptoms of hypothermia will stop work and add additional layer(s) of warmth to themselves. If symptoms persist beyond this, the onsite health and safety officer will be contacted. Personnel displaying symptoms of frostbite should immediately be taken to the nearest medical facility.

Symptoms of hypothermia include reduced feeling or tingling in affected area, especially in the fingers, toes, ears and face, slight numbness, and loss of color. Symptoms of frostbite include loss of feeling and movement in affected area and extreme change in color. Frostbite is preventable with the use proper attire and precautions. Frostbite can result in amputation of the affected appendage if medical attention is not administered promptly.

4.2 Personal Protection for Site Work

Prior to entering the area of activity, all personnel will be required to read and sign the Compliance Agreement (Section 7.0) to verify compliance with the provisions of this SSHSP. The level of protection expected for this site work will be Level D; gloves (leather and/or latex), hard-hat, steel-toed boots, and safety glasses. Visitors are expected to comply with relevant OSHA regulations and provide their own protective equipment. Continuous monitoring will be conducted to verify the safety of all site personnel.

4.3 Emergency Contact Numbers and Route to Emergency Medical Treatment

Table 4-1 (on following page) provides name and telephone numbers for emergency contact personnel. In the event of a medical emergency, personnel will take direction from the onsite senior responsible individual and notify the appropriate emergency organization. Radios and cell phones will be utilized to ensure outside contact is made in case of an emergency. In the event of a fire or spill, the onsite senior responsible individual will notify the appropriate WSMR Fire Department followed by the Emergency Operations Center. In the case of a spill of hazardous materials, the WSMR representative will be responsible for notification of the appropriate local, state, and federal agencies. Medical emergencies occurring on Main Post will be taken to the Macafee Health Clinic. Directions to the clinic from the various SWMU sites can be found on Figures 4-1.

Table 4-1. Emergency Contact Telephone Numbers.
(Fire and medical emergency numbers are bolded)

Organization	Contact	Telephone*
Fire Station #1 (Main Post)	**Robert J. Valles, Chief Francisco Vega, Jr., Assistant Chief Alfredo A. Cordero, Assistant Chief**	**Land Line on WSMR: 505-678-5105 Land Line/Cell Phone: 505-678-1234 Off Range: 505-678-1234**
HELSTF Ambulance Service/Medical Aid Station (Building 26020)		**Land Line/Cell Phone: 505-679-5164 or 505-679-5167 Off Range: 911**
McAfee Post Clinic Emergency Room (Building 530)		**Land Line/Cell Phone: 505-678-2882**
Mountain View Regional Medical Center 4311 E. Lohman Avenue Las Cruces, NM 88011		**Land Line/Cell Phone: 505-556-7600 or 911**
Police		Land Line on WSMR: 911 Land Line/Cell Phone: 505-678-1234 Off Range: 505-678-1234
Emergency Operations Center After Hours – Staff Duty Officer		505-678-3803
White Sands Missile Range Environment and Safety Directorate		505-678-2224
WS-ES-EC Technical Inspector (desk)	Jose Gallegos	505-678-1618
BAE Systems Office, Building 126, White Sands, NM, Front Desk	Stephanie Gamboa	505-678-0263
BAE Systems On-site Supervisor	Bradley Davis Jason Capron	505-678-3397 505-526-7951 (H) 505-678-3434 505-522-5651 (H)
BAE Systems Health and Safety Officer	Benito Avalos	505-678-1985 505-373-0998(H)
BAE Systems Deputy General Manager & Task Manager	Fred Bourger	505-678-3426 505-524-8033 (H)
BAE Systems, General Manager	Donald K. Emig Ph.D., P.E.	505-678-7907 505-649-2824 (Cell)
El Paso Electric Co.		505-526-5555
NM Poison Center		800-222-1222
FBI, Las Cruces		505-526-2351
National Spill Response Center		800-424-8802
ChemTrec (emergency info)		800-424-9300
NM OSHA		505-827-4230

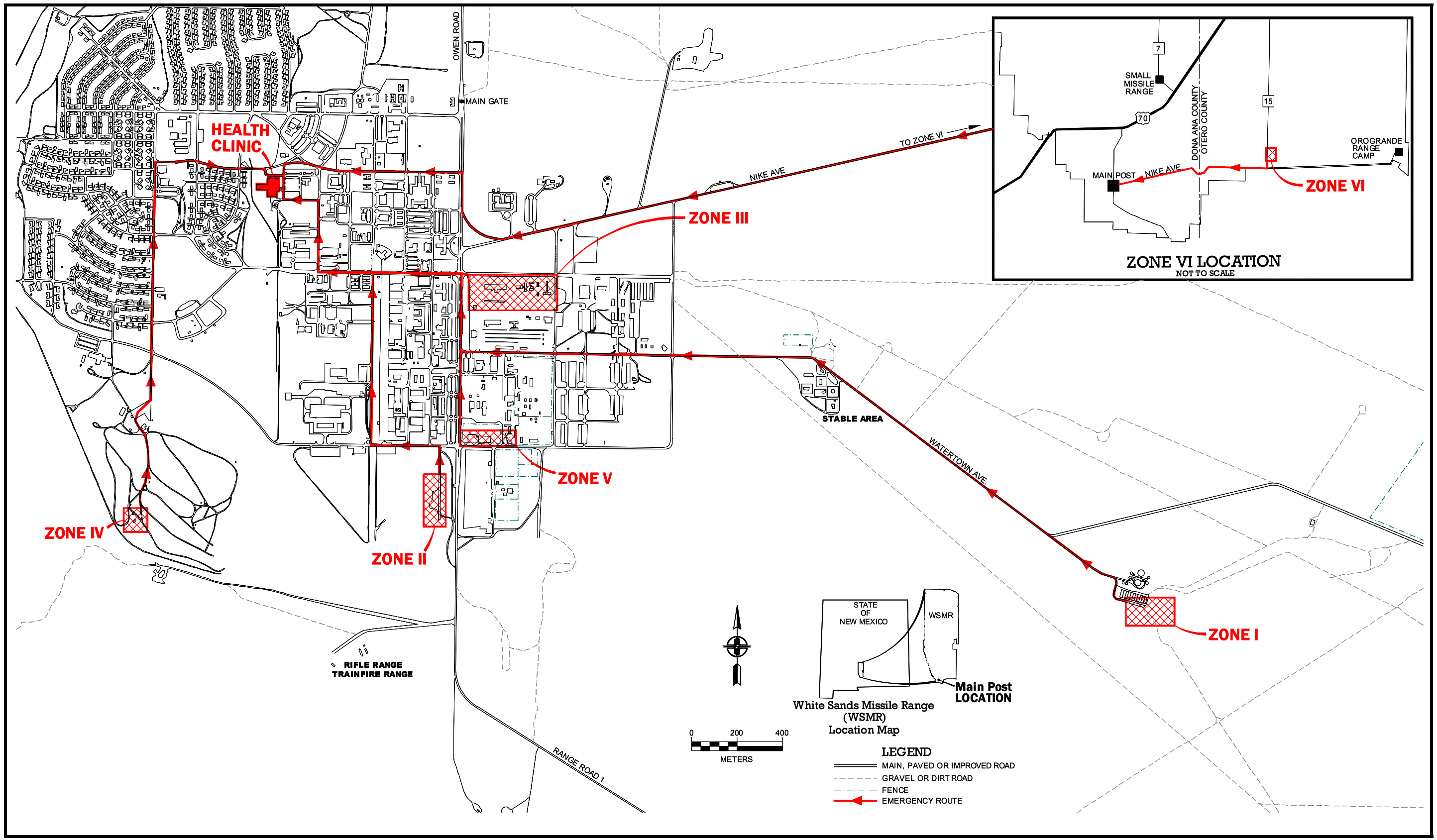

Figure 4-1. Routes from Zones I - VI to the Macafee Health Clinic.

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4.4 Smoking

Smoking within 50 feet of the work area is prohibited. A smoking area will be located greater than 50 feet from the site. All extinguished cigarette butts will be disposed of in an appropriate manner.

5.0 SITE MONITORING

Hazardous materials may be encountered during excavation. Site monitoring will be conducted to verify the safety of workers. Table 5-1 describes the site monitoring to be conducted.

Table 5-1. Site Monitoring Summary.

Chemical/ Physical Agent	Action Level	Monitoring Equipment	Sampling and Analysis	Frequency of Analysis
Volatile Organic Compounds	10 ppm[a] in the breathing zone	PID	Direct Reading	During drilling
Noise Levels	85 dBA[b]	Sound Level Meter	Direct Reading	During drilling

Notes a: ppm – parts per million
B: dBA – decibels, A-weighted

In the event that the action level is exceeded for volatile organic compounds, the area will be immediately evacuated and the contaminant allowed to dissipate. Prior to recommencing with work, the field crews will prepare with the appropriate clothing and respirator, and retest the site conditions. In the case of noise, exceedance of the action level will trigger the use of hearing protection.

6.0 ACCIDENT PREVENTION PLAN

Prior to beginning the project, the On-Site Supervisor will conduct a site safety meeting to alert workers to potential hazards at the work site. All site workers will be required to sign the Compliance Agreement (Section 7.0) following review of this health and safety plan. In addition to attending the site safety meeting, each worker must read this SSHSP before working at the site. Each day, prior to the start of work, a safety briefing will be held by the On-Site Supervisor. All personnel will be required to attend and sign the Daily Health and Safety Compliance Agreement. The maps, directions, and phone numbers for medical emergency response will be verified prior to starting work at the site.

Hazards Associated with Potential Exposure to Hazardous Chemicals or Materials:

- Soil sample collection
- Management of Investigation-Derived Waste (IDW)
- Biological pedestrian survey

Actions to be taken to control hazards:

__X__ Minimize free liquids to reduce airborne vapor concentrations.
__X__ Tops shall be securely attached to chemical containers when not in use to minimize airborne vapor concentrations.
_____ Utilize wet methods to control airborne dusts emissions.
__X__ Delineate and control access into the Exclusion Zone(s) and Contamination Reduction Zone(s).
_____ Utilize Chemical Protective Clothing and Equipment
_____ Decontaminate or remove outer protective clothing in the Contamination Reduction Zone, prior to entering the Support Zone from the Exclusion Zone.
__X__ Decontaminate all equipment leaving the Exclusion Zone in the Contamination Reduction Zone, prior to entering the Support Zone.
__X__ Wash hands and face prior to drinking/smoking breaks.
_____ Personnel working in the Exclusion Zone will be required to shower out at the end of the workday, prior to leaving the work site to go home.

Fire Hazards Associated with Handling or Working near Flammable or Combustible Materials:

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW

Actions to be taken to control hazards:

__X__ Monitor work environment as necessary with a combustible gas meter to determine the percent LEL concentration of combustible gases and vapors.
__X__ Should concentrations exceed the LEL (see Section 5.0) in a work area, operations within the area will cease immediately, and all potential sources of ignition removed from the area.
_____ All "Hot Work" performed in hazardous locations shall require the issuance of a Hot Work Permit issued by White Sands Missile Range safety office. Combustible or flammable materials shall be purged of combustible gasses and vapors (less than 10 percent LEL) prior to being cut.
__X__ Smoking shall not be permitted onsite, except in designated areas.
__X__ All containers of flammable or combustible materials must be properly labeled to indicate its contents and appropriate fire hazard.

Slip, Trip, Fall Hazards:

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

Actions to be taken to control hazards:

__X__ Workers shall ensure that walking/working surfaces are kept free of potential slip, trip, fall hazards.
__X__ Whenever possible, avoid routing cords, ropes, hoses, etc. across isles and walking paths.
__X__ Flag and/or cover inconspicuous holes to protect against accidental trips and falls.
_____ Delineate and/or guard open excavations to protect against falls.

Hazards Associated with Operations of Heavy Equipment or Motor Vehicles

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW

Actions to be taken to control hazards:

__X__ Personnel operating heavy equipment or vehicles shall maintain a constant awareness of personnel and stationary objects in the areas adjacent to its operation.
__X__ Spotters shall be utilized to assist operators in manipulating vehicles and equipment into tight or confined areas.
__X__ Equipment operators shall inspect their equipment prior to and during each use, to ensure it is working properly, and that all safety devices are functioning as they should.
__X__ Ensure operators are adequately trained and/or licensed as necessary to operate their equipment or motor vehicles.
__X__ All moving heavy equipment must have properly functioning backup alarms.
__X__ Motor vehicle operators are responsible for conducting a pre-trip vehicle safety inspection prior to its use. No motor vehicle with any known mechanical defect, which endangers the safety of the driver or passengers, shall be used.

Hazards Associated with Working in Hot Environments

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

Actions to be taken to control heat stress:

__X__ Drink plenty of fluids, preferably water before, during and after each activity
__X__ Acclimate to site conditions by slowly increasing work loads
__X__ Use cooling devices to aid natural body ventilation
_____ Conduct field activities in early morning or evening
___ Use shelter to protect against heat stress
_____ Rotate shifts of workers

Hazards Associated with Working in Cold Environments

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

Actions to be taken to control hazards:

__X__ Adequate protective clothing shall be worn at all times
_____ Provide shelter from wind and cold temperatures
_____ Do not remove chemical-protective equipment unless sheltered from wind and cold temperatures.
__X__ Field activities shall be curtailed if equivalent chill temperature is below zero degrees Fahrenheit.

Hazards Associated with Insects, Snakes, or Wild Animals

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

Actions to be taken to control hazards:

__X__ Ensure that personnel are aware of such hazards, and encourage them to be constantly on the lookout.
_____ Maintain a supply of insecticide sprays to be used as necessary to kill flying or crawling insects.
_____ Utilize heavy equipment to clear areas where high grass and brush have grown, prior to accessing these areas on foot.

Hazards Associated with Falling Objects

Operations and/or Tasks Associated with the Above-Referenced Hazards

- Soil sample collection
- Management of IDW

Actions to be taken to control hazards:

__X__ Require that hard hats be worn at all times by onsite personnel except in break areas.
____ Whenever possible, personnel will avoid walking or working beneath areas where overhead work is being performed.
_____ All overhead work platforms will be equipped with standard toe board to reduce the potential of objects falling from them.

Hazards Associated with Electricity

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

_X_ Ground Fault Circuit Interrupters (GFCIs) shall be used whenever possible, to protect workers from shock or electrocution while working with electrical equipment.
_X_ Repair or remove from service all damaged electric cords.
_X_ Route extension cords in a manner and/or location that would prevent potential damage to the cord.
_X_ All electrically powered hand tools shall be of the grounded or double-insulated type.
_X_ Obtain proper utility clearances prior to the start of field activities.

Hazards Associated with Materials Handling

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

Actions to be taken to control hazards:

_X_ Mechanical equipment (i.e., dolly, hoist, fork lift) shall be utilized whenever possible to minimize manual labor.
_X_ Size up the job before lifting and get help if needed. The maximum weight to be manually lifted by BAE Systems and/or subcontractor personnel is 27.2 kilograms (60 pounds).
_X_ Personnel will be reminded during daily safety meeting to utilize proper lifting methods to avoid muscle or back strains.

Hazards Associated with Limited Communication Due to Location, Distance, or Noise

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

Actions to be taken to control hazards:

_X_ Where direct verbal communication is limited, portable 2-way radios, and/or hand signals shall be utilized to facilitate communication among workers.

__X__ Where work sites are in remote locations without access to nearby existing telephones, a cellular (if service is available) or satellite telephone or two-way radios shall be maintained onsite for use in the event of an emergency.

Hazards Associated with Noise

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection using hollow-stem auger or direct push methods
- Management of IDW

Actions to be taken to control hazards:

__X__ Appropriate hearing protection shall be provided to and worn by personnel working in areas where noise levels are known or suspected to exceed 85 dBA (See Section 5.0).
____ Inspect noise control devices (i.e., mufflers) on equipment to ensure they are working properly.
____ Periodically inspect pressurized systems (i.e., compressed air or steam) for leaks that create potential noise hazards, and if any are found, repair as soon as possible.
____ Whenever possible, start noise equipment in a remote area to reduce the potential for personnel exposure to noise, and to facilitate verbal communication among personnel.

Hazards Associated with Underground or Overhead Utilities

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection using hollow-stem auger or direct push methods

Actions to be taken to control hazards:

__X__ White Sands Missile Range Installation Support shall be contacted to establish the location of underground utilities and communication lines through the area of anticipated excavation.
____ When excavating with heavy equipment near underground utilities, personnel on the ground will assist in probing to find the exact location of lines, and will use hand shovels to carefully remove the soil immediately adjacent to the lines.
____ When operating machinery near overhead electrical distribution and transmission lines, refer to 29 CFR 1926.550 (a)(15)(I)-(vii) for minimum clearances, and safe work practices.

Hazards Associated with Unauthorized Personnel Onsite and in Controlled Work Zones

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

Actions to be taken to control hazards:

___ Install temporary fencing, traffic cones, or other appropriate barriers to delineate the work site, and to deter unauthorized personnel from entering the work site. If necessary, post security guards at each point of access into the work site.
___ Maintain a visitors sign in/out log.
___ Post warning signs "Authorized Personnel Only" at all entrances to the work site.
_X_ Utilize badge identification system.
_X_ Delineate controlled work zones with temporary fencing and/or caution tape.
____ Post hazard warning sign at the entrances into controlled work zones.
____ Utilize security guards to provide site security during off-hours.
_X_ Prior to entry into contaminated zone, ensure that all personnel have a current 40-hour OSHA HAZWOPER certification card or appropriate identification.

Hazards Associated with Unexploded Ordnance

Operations and/or Tasks Associated with the Above-Referenced Hazards:

- Soil sample collection
- Management of IDW
- Biological pedestrian survey

_X_ All field personnel will review the UXO Orientation Video prior to field activities.
_X_ All field personnel will be required to sign the UXO Orientation sheet following review of orientation video.
_X_ All field personnel will receive a copy of the UXO Orientation sheet and will be required to keep it on-hand at all times.
_X_ If UXO is identified, all field personnel will be verbally notified to follow directions listed on the UXO Orientation sheet.

7.0 COMPLIANCE AGREEMENT

This SSHSP applies to all BAE Systems personnel and their contractors performing the aforementioned field activities. I have read this SSHSP and hereby agree to abide by its provisions and to aid the Site Safety Officer and his representative in its implementation. I understand that it is in my best interest to see that sight operations are conducted in the safest manner possible; therefore, I will be alert to site health and safety conditions at all times.

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8.0 DAILY HEALTH AND SAFETY BRIEFING COMPLIANCE AGREEMENT

Topics covered during today's ( ) health and safety briefing:

I hereby agree to abide by the provisions of the SSHSP, issues discussed in today's health and safety briefing, and to aid the Site Health and Safety Officer or his representative in its implementation. I understand that it is in my best interest to see that site operations are conducted in the safest manner possible; therefore, I will be alert to site health and safety conditions at all times.

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APPENDIX B

Decontamination and Investigation-Derived Waste Management Plan

DECONTAMINATION AND INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

1.0 INTRODUCTION

In order to maintain sample integrity and minimize the spread of contamination between samples, well locations, and personnel, the decontamination of all equipment and management of investigation-derived wastes (IDW) will receive high priority. Equipment requiring decontamination will include hollow-stem augers, rods and split-barrel samplers, soil samplers, and associated bowls and implements. IDW requiring management includes auger cuttings and decontamination water from cleaning of auger and sampling equipment.

2.0 DECONTAMINATION

Prior to the collection of each sample, all sampling equipment that will come in physical contact with the matrix of interest will be thoroughly decontaminated. This will minimize potential cross-contamination of samples from different locations. Procedures for decontaminating the types of equipment and material anticipated to be used are described below.

2.1 Auger Equipment

All hollow-stem augers and rods will be decontaminated between borings at the decontamination pad. This equipment will be decontaminated using Liquinox detergent/potable water and distilled water rinse as determined by the site engineer/geologist. Decontaminated equipment will be stored on plastic sheeting, sawhorses, or on decontaminated auger racks.

All split-barrel soil samplers will be decontaminated prior to collection of each sample using the following procedure:

- Clean any soil residue off by scraping or brushing,
- Scrub in a Liquinox detergent and potable water wash using a brush,
- Rinse with potable water,
- Rinse with distilled water, and
- Store split-barrel samplers in plastic or aluminum foil when not in use. Samplers may be placed on plastic sheeting or a clean rack prior to use.

The water rinses may be accomplished by either pouring water directly on the equipment or by dispensing the water through all-polyethylene garden sprayers. All wastewater from cleaning of equipment will be containerized in DOT 17E, closed-top 55-gallon drums.

As a further protection against sample cross-contamination, the soil samplers will ensure that their gloves are clean prior to handling each sample. If non-disposable type gloves are worn, they will be cleaned in a manner identical to the sampling equipment. If disposable gloves are worn, they shall be changed prior to handling each new sample.

2.2 Sampling Equipment Decontamination

All other hand tools, bowls, containers etc. used during soil and sediment sampling will be decontaminated according to the following procedure after each use:

- Scrape or brush off all excess soil or contamination,
- Scrub in Liquinox detergent and potable water wash using a brush,
- Rinse thoroughly with potable water to remove detergent,
- Rinse thoroughly with distilled water, and
- Place item on plastic sheeting until use or store in clean plastic bag.

3.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

Several waste streams will be produced during this investigation. These wastes include soil cuttings, personal protective equipment (PPE), and decontamination wastewater. In order to protect human health and the environment, these wastes will be considered hazardous and managed as such until analysis of the waste proves otherwise. To minimize waste generation, the following guidelines will be followed:

- Removal of as much soil and other contamination from sampling equipment as possible before washing to minimize the quantity of wastewater generated.
- Avoid excessive travel through areas of known contamination to reduce the need for personal and/or vehicle decontamination.
- Avoid excessive well development or purging of monitoring wells.

3.1 Auger Cuttings and Soil Management

Hollow-stem augers or hand augers will be utilized for all soil borings and well installations and will produce a quantity of cuttings. Cuttings from each boring will be placed on surface on top of double-lined 6 mil or greater polyethylene plastic and staged at each of the soil boring and well location. All cuttings from the soil borings will be consolidated in one area or container for sampling and disposal. An adhesive backed label will be used to identify cuttings with the following information: soil boring number, contents of the container, and accumulation start date.

3.2 Decontamination Wastewater

The cleaning of auger equipment and sampling equipment will generate quantities of decontamination water. Decontamination stations will be set up such that all water will be containerized but allowed to evaporate while work is ongoing at the each site. All remaining wastewater will be containerized in DOT 17E, closed-top 55-gallon drums. An adhesive backed label will be used to label the drums with the following information: drum contents, accumulation start date, and monitoring well identification number.

3.4 Storage, Testing and Disposal of Wastes

Drums containing cuttings and decontamination water will be staged close to the work area. Drums from multiple sites may be gathered and staged at one site to minimize storage locations.

In order to determine the proper handling, storage and disposal requirements for IDW, a RCRA hazardous waste determination must be made. RCRA regulations define hazardous waste as possessing characteristic for ignitability, corrosivity, reactivity, or toxicity; or listed under 40 CFR Part 261.

The IDW generated during this investigation will be composed largely of soil cuttings and decontamination wastewater, and is not ignitable, corrosive, or reactive. However, the IDW may contain constituents that exhibit constituent concentrations exceeding toxicity characteristic (TC) levels.

If analytical results indicate auger wastes constituents in excess of EPA Land Disposal Standards, the WSMR WS-ES TI will be notified to arrange for proper disposal through the WSMR RCRA permitted Hazardous Waste Storage Facility (HWSF). If analytical results indicate detected constituents in concentrations below EPA Land Disposal Standards, the wastes will be disposed as non-hazardous at the project site.

A letter report will be submitted to the WS-ES TI outlining the analytical results of wastes generated during field investigation activities. Characterized wastes include auger cuttings, well development and purge water, and wastewater generated during decontamination activities. The total quantity of materials will be presented along with recommendations for proper disposal. Following disposal, records such as trip reports and manifests will be prepared and submitted to the WS-ES TI for documentation.

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APPENDIX C

Vegetation and Wildlife Lists for the
White Sands Missile Range Main Post Area

VEGETATION AND WILDLIFE LISTS FOR THE WHITE SANDS MISSILE RANGE MAIN POST AREA

Vegetation

Atriplex canescens-Fourwing Saltbush
Chilopsis linearis-Desert Willow
Gutierrezia sarothrae-Broom Snakeweed
Larrea tridentata - Creosotebush
Muhlenbergia porteri - Bush Muhly
Opuntia imbricata - Tree Cholla
Opuntia phaeacantha - Engelman's Prickly Pear
Opuntia violaceae - Purple Prickly Pear
Prosopis glandulosa-Honey Mesquite
Sporobolus ariodies - Alkali Sacatone
Sporobolus contractus - Spike Dropseed
Sporobolus cryptandrus - Mesa Dropseed
Sporobolus flexuosus-Sand Dropseed
Yucca elata - Soaptree Yucca

Avians

Amphispiza bilineata-Black-throated Sparrow
Buteo jamaicensis-Red-tailed Hawk
Buteo swainsoni-Swainson's Hawk
Callipepla squamata-Scaled Quail
Carpodacus mexicanus-House Finch
Corvus cryptoleucus – Chihuahuan raven
Falco sparverius-American Kestrel
Geococcyx californianus-Greater Roadrunner
Lanius ludovicianus - Loggerhead Shrike
Mimus polyglottos-Mockingbird
Sayornis saya-Say's Phoebe
Zenaida asiatica-White-winged Dove
Zenaida macroura-Mourning Dove
Zonotrichia leucophrys-White Crowned Sparrow

Invertebrates

Acrididae – Grasshopper (2 species)
Anthophoridae - Carpenter Bee
Ceribicidae – Longhorn Beetle
Coccinelidae - Lady Beetle
Formicidae - Red, Black, and Harvester Ants (3 species)
Halictidae - Sweat Bee
Lycosidae - Wolf Spider
Mantidae - Preying Mantis
Pieridae - Moth

Invertebrates (cont.)
Simuliidae - Gnats
Tenebrionidae - Tenebrionid Beetle
Termitidae – Termite

Mammals
Canis latrans-Coyote
Lepus californicus - Black-tailed Jackrabbit
Odocoileus hemionus-Mule Deer
Oryx gazella - Oryx
Sylvilagus audubonii-Desert Cottontail
Thomomys botae-Gopher

Reptiles
Cnemidophorus tigris – Western Whiptail
Crotalus atrox-Western Diamondback Rattlesnake
Gambelia wislizinii - Leopard Lizard
Masticophis flagellum - Coachwhip
Pituophis melanoleucas-Gopher Snake
Uta stansburiana-Side-blotched Lizard

ATTACHMENT A

SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT
SCOPING ASSESSMENT
SITE ASSESSMENT CHECKLIST

INTRODUCTION

This checklist has been developed as a tool for gathering information about the facility property and surrounding areas, as part of the scoping assessment. Specifically, the checklist assists in the compilation of information on the physical and biological aspects of the site including the site environmental setting, usage of the site, releases at the site, contaminant fate and transport mechanisms, and the area's habitats, receptors, and exposure pathways. The completed checklist can then be used to construct the preliminary conceptual site exposure model (PCSEM) for the site. In addition, the checklist and PCSEM will serve as the basis for the scoping assessment report. Section III of this document provides further information on using the completed checklist to develop the PCSEM.

In general, the checklist is designed for applicability to all sites, however, there may be unusual circumstances which require professional judgment in order to determine the need for further ecological evaluation (*e.g.,* cave-dwelling receptors). In addition, some of the questions in the checklist may not be relevant to all sites. Some facilities may have large amounts of data available regarding contaminant concentrations and hydrogeologic conditions at the site, while other may have only limited data. In either case, the questions on the checklist should be addressed as completely as possible with the information available.

Habitats and receptors, which may be present at the site, can be identified by direct or indirect[1] observations and by contacting local and regional natural resource agencies. Habitat types may be determined by reviewing land use and land cover maps (LULC), which are available via the Internet at http://www.nationalatlas.gov/mapit.html. With regard to receptors, it should be noted that receptors are often present at a site even when they are not observed. Therefore, for the purposes of this checklist, it should be assumed that receptors are present if viable habitat is present. The presence of receptors should be confirmed by contacting one or several of the organizations listed below.

Sources of general information available for the identification of ecological receptors and habitats include:

- U.S. Fish and Wildlife Service (http://www.fws.gov)
- Biota Information System of New Mexico (BISON-M) maintained by the New Mexico Department of Game and Fish (NMGF) (http://151.199.74.229/states/nm.htm)
- U.S. Forest Service (USFS) (http://www.fs.fed.us/)
- New Mexico Forestry Division (NMFD) of the Energy, Minerals and Natural Resources Department (http://www.emnrd.state.nm.us/forestry/index.htm)

1 Examples of indirect observations that indicate the presence of receptors include: tracks, feathers, burrows, scat

- U.S. Bureau of Land Management (USBLM) (http://www.blm.gov/nhp/index.htm) or (http://www.nm.blm.gov/www/new_home_2.html)
- United States Geological Service (USGS) (http://www.usgs.gov)
- National Wetland Inventory Maps (http://wetlands.fws.gov)
- National Audubon Society (http://www.audobon.com)
- National Biological Information Infrastructure (http://biology.usgs.gov)
- Sierra Club (http://www.sierraclub.org)
- National Geographic Society (http://www.nationalgeographic.com)
- New Mexico Natural Heritage Program (http://nmnhp.unm.edu/)
- State and National Parks System
- Local universities
- Tribal organizations

INSTRUCTIONS FOR COMPLETING THE CHECKLIST

The checklist consists of four sections: Site Location, Site Characterization, Habitat Evaluation, and Exposure Pathway Evaluation. Answers to the checklist should reflect existing conditions and should not consider future remedial actions at the site. Completion of the checklist should provide sufficient information for the preparation of a PCSEM and scoping report and allow for the identification of any data gaps.

Section I - Site Location, provides general site information, which identifies the facility being evaluated, and gives specific location information. Site maps and diagrams, which should be attached to the completed checklist, are an important part of this section. The following elements should be clearly illustrated: 1) the location and boundaries of the site relative to the surrounding area, 2) any buildings, structures or important features of the facility or site, and 3) all ecological areas or habitats identified during completion of the checklist. It is possible that several maps will be needed to clearly and adequately illustrate the required elements. Although topographical information should be illustrated on at least one map, it is not required for every map. Simplified diagrams (preferably to scale) of the site and surrounding areas will usually suffice.

Section II - Site Characterization, is intended to provide additional temporal and contextual information about the site, which may have an impact on determining whether a certain area should be characterized as ecologically viable habitat or contains receptors. Answers to the questions in Section II will help the reviewer develop a broader and more complete evaluation of the ecological aspects of a site.

Section III - Habitat Evaluation, provides information regarding the physical and biological characteristics of the different habitat types present at or in the locality of the site. Aquatic features such as lakes, ponds, streams, arroyos and ephemeral waters can be identified by reviewing aerial photographs, LULC and topographic maps and during site reconnaissance visits. In New Mexico, there are several well-defined terrestrial communities, which occur naturally. Typical communities include wetlands, forest (e.g., mixed conifer,

ponderosa pine and pinyon juniper), scrub/shrub, grassland, and desert. Specific types of vegetation characterize each of these communities and can be used to identify them. Field guides are often useful for identifying vegetation types. A number of sites may be in areas that have been disturbed by human activities and may no longer match any of the naturally occurring communities typical of the southwest. Particularly at heavily used areas at facilities, the two most common of these areas are usually described as "weed fields" and "lawn grass". Vegetation at "weed fields" should be examined to determine whether the weeds consist primarily of species native to the southwest or introduced species such as Kochia. Fields of native weeds and lawn grass are best evaluated using the short grass prairie habitat guides.

The applicable portions of Section III of the checklist should be completed for each individual habitat identified. For example, the questions in Section III.A of the checklist should be answered for each wetland area identified at or in the locality of the site and the individual areas must be identified on a map or maps.

Section IV- Exposure Pathway Evaluation, is used to determine if contaminants at the site have the potential to impact habitat identified in Section III. An exposure pathway is the course a chemical or physical agent takes from a source to an exposed organism. Each exposure pathway includes a source (or release from a source), an environmental transport mechanism, an exposure point, and an exposure route. A complete exposure pathway is one in which each of these components, as well as a receptor to be exposed, is present. Essentially, this section addresses the fate and transport of contaminants that are known or suspected to have been released at the site. In most cases, without a complete exposure pathway between contaminants and receptors, additional ecological evaluation is not warranted.

Potential transport pathways addressed in this checklist include migration of contaminants via air dispersion, leaching into groundwater, soil erosion/runoff, groundwater discharge to surface water, and irradiation. Due to New Mexico's semi-arid climate, vegetation is generally sparse. The sparse vegetation, combined with the intense nature of summer storms in New Mexico, results in soil erosion that occurs sporadically over a very brief time frame. Soil erosion may be of particular concern for sites located in steeply sloped areas. Several questions within Section IV of this checklist have been developed to aid in the identification of those sites where soil erosion/runoff would be an important transport mechanism.

USING THE CHECKLIST TO DEVELOP THE PRELIMINARY CONCEPTUAL SITE EXPOSURE MODEL

The completed Site Assessment Checklist can be used to construct the PCSEM. An example PCSEM diagram is presented in Figure 1. The CSM illustrates actual and potential contaminant migration and exposure pathways to associated receptors. The components of a complete exposure pathway are simplified and grouped into three main categories: sources, release mechanisms, and potential receptors. As a contaminant migrates and/or is transformed in the environment, sources and release mechanisms may expand into primary, secondary, and tertiary levels. For example, Figure 1 illustrates releases from inactive

lagoons (primary sources) through spills (primary release mechanism), which migrate to surface and subsurface soils (secondary sources), which are then leached (secondary release mechanism) to groundwater (tertiary source). Similarly, exposures of various trophic levels to the contaminant(s) and consequent exposures via the food chain may lead to multiple groups of receptors. For example, Figure 1 illustrates groups of both aquatic and terrestrial receptors which may be exposed and subsequently serve as tertiary release mechanisms to receptors which prey on them.

Although completing the checklist will not provide the user with a readymade PCSEM, a majority of the components of the PCSEM can be found in the answers to the checklist. It is then up to the user to put the pieces together into a comprehensive whole. The answers from Section II of the checklist, Site Characterization, can be used to identify sources of releases. The answers to Section IV, Exposure Pathway Evaluation, will assist users in tracing the migration pathways of releases in the environment, thus helping to identify release mechanisms and sources. The results of Section III, Habitat Evaluation, can be used to both identify secondary and tertiary sources and to identify the types of receptors which may be exposed. Appendix B of the NMED's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Assessment* also contains sample food webs which may be used to develop the PCSEM.

Once all of the components have been identified, one can begin tracing the steps between the primary releases and the potential receptors. For each potential receptor, the user should consider all possible exposure points (e.g., prey items, direct contact with contaminated soil or water, etc.) then begin eliminating pathways, which are not expected to result in exposure to the contaminant at the site. Gradually, the links between the releases and receptors can be filled in, resulting in potential complete exposure pathways.

For further guidance on constructing a PCSEM, consult the NMED's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Assessment* (2000), and EPA's Office of Solid Waste and Emergency *Response's Soil Screening Guidance: User's Guide* (1996).

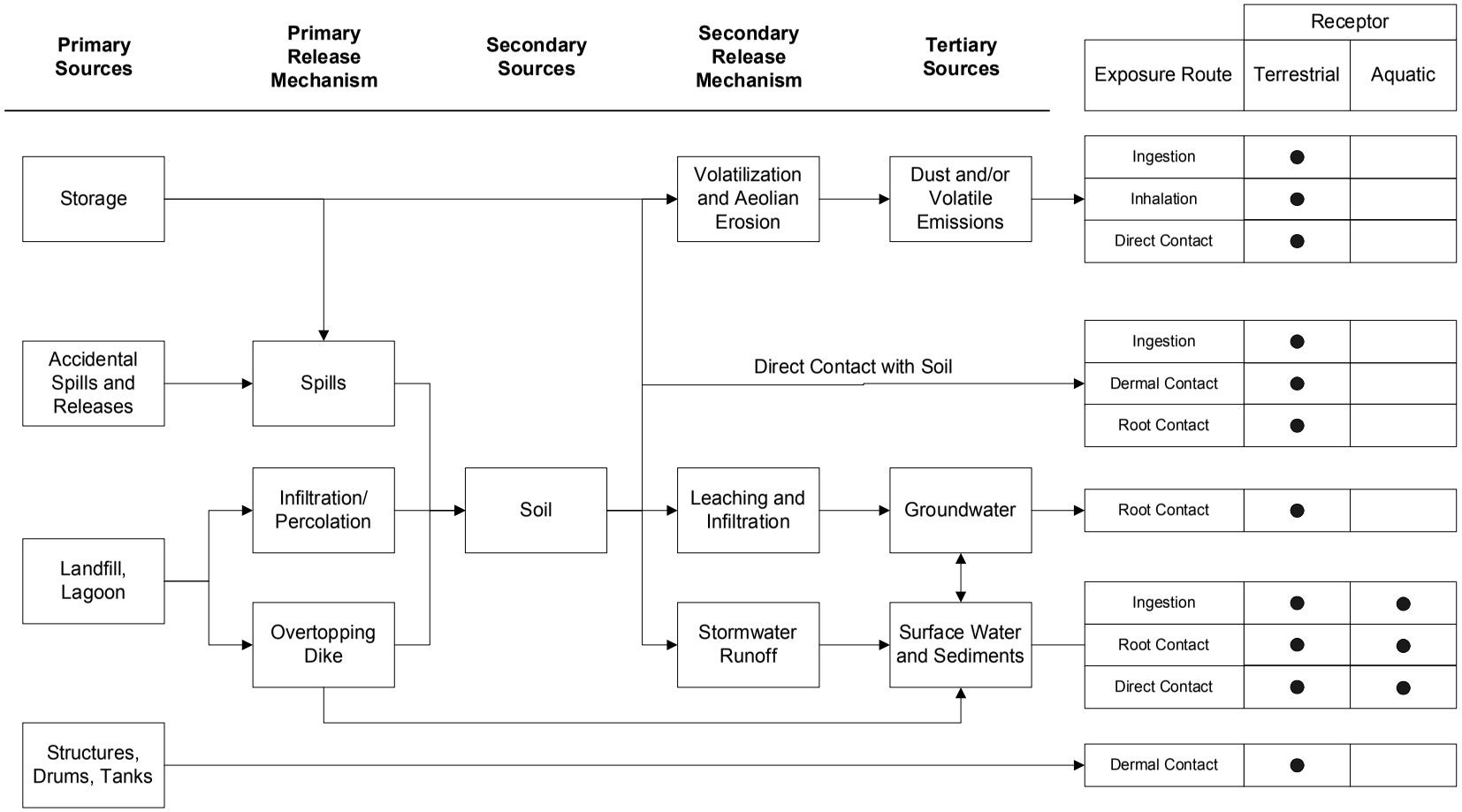

Figure 1. Example Preliminary Conceptual Site Exposure Model Diagram

NEW MEXICO ENVIRONMENT DEPARTMENT
SITE ASSESSMENT CHECKLIST

I. SITE LOCATION

1. Site
   Name:_____
   US EPA I.D.
   Number:_____
   Location:_____
   County:_____
   City:_____State:_____

2. Latitude:_____Longitude:_____

3. Attach site maps, including a topographical map, a diagram which illustrates the layout of the facility (e.g., site boundaries, structures, etc.), and maps showing all habitat areas identified in Section III of the checklist. Also, include maps which illustrate known release areas, sampling locations, and any other important features, if available.

II. SITE CHARACTERIZATION

1. Indicate the approximate area of the site (i.e., acres or sq. ft)
   _____

2. Provide an approximate breakdown of the land uses on the site:

_____% Heavy Industrial	_____% Light Industrial	_____% Urban
_____% Residential	_____% Rural	_____% Agricultural[b]
_____% Recreational[a]	_____% Undisturbed	_____% Other[c]

[a]For recreational areas, please describe the usage of the area (e.g., park, playing field, etc.):
_____

[b]For agricultural areas, please list the crops and/or livestock which are present:
_____

[c]For areas designated as "other", please describe the usage of the area:
_____

3. Provide an approximate breakdown of the land uses in the area surrounding the site. Indicate the radius (in miles) of the area described: _____

_____% Heavy Industrial	_____% Light Industrial	_____% Urban
_____% Residential	_____% Rural	_____% Agricultural[b]
_____% Recreational[a]	_____% Undisturbed	_____% Other [c]

[a]For recreational areas, please describe the usage of the area (e.g., park, playing field, golf course, etc.):
_____

[b]For agricultural areas, please list the crops and/or livestock which are present:
_____

[c]For areas designated as "other", please describe the usage of the area:
_____
_____

4. Describe reasonable and likely future land and/or water use(s) at the site.
_____
_____
_____
_____
_____
_____

5. Describe the historical uses of the site. Include information on chemical releases that may have occurred as a result of previous land uses. For each chemical release, provide information on the form of the chemical released (i.e., solid, liquid, vapor) and the known or suspected causes or mechanism of the release (i.e., spills, leaks, material disposal, dumping, explosion, etc.).
_____
_____
_____
_____
_____

6. If any movement of soil has taken place at the site, describe the degree of the disturbance. Indicate the likely source of any disturbances (e.g., erosion, agricultural, mining, industrial activities, removals, etc.) and estimate when these events occurred.
_____
_____
_____

7. Describe the current uses of the site. Include information on recent (previous 5 years) disturbances or chemical releases that have occurred. For each chemical

release, provide information on the form of the chemical released and the causes or mechanism of the release.

_____
_____
_____
_____
_____

8. Identify the location or suspected location of chemical releases at the site. Provide an estimate of the distance between these locations and the areas identified in Section III.

_____
_____
_____
_____
_____

9. Identify the suspected contaminants of concern (COCs) at the site. If known, include the maximum contaminant levels. Please indicate the source of data cited (e.g., RFI, confirmatory sampling, etc.).

_____
_____
_____
_____
_____
_____
_____

10. Identify the media (e.g., soil (surface or subsurface), surface water, air, groundwater) which are known or suspected to contain COCs. _____
_____

11. Indicate the approximate depth to groundwater (in feet below ground surface [(bgs)].

_____

12. Indicate the direction of groundwater flow (e.g., north, southeast, etc.)

_____

III. HABITAT EVALUATION

III.A Wetland Habitats

Are any wetland[2] areas such as marshes or swamps on or adjacent to the site?

☐ Yes ☐ No

If yes, indicate the wetland area on the attached site map and answer the following questions regarding the wetland area. If more than one wetland area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wetland area. Distinguish between wetland areas by using names or other designations (such as location), and clearly identify each area on the site map. Also, obtain and attach a National Wetlands Inventory Map (or maps) to illustrate each wetland area.

Identify the sources of the observations and information (e.g., National Wetland Inventory, Federal or State Agency, USGS topographic maps) used to make the determination that wetland areas are or are not present.

_____

_____

_____

_____

If no wetland areas are present, proceed to Section III.B.

2Wetlands are defined in 40 CFR §232.2 as " Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Examples of typical wetlands plants include: cattails, cordgrass, willows and cypress trees. National wetland inventory maps may be available at http:\\nwi.fws.gov. Additional information on wetland delineation criteria is also available from the Army Corps of Engineers.

Wetland Area Questions

☐ Onsite ☐ Offsite

Name or
Designation:_____

1. Indicate the approximate area of the wetland (acres or ft^2)_____

2. Identify the type(s) of vegetation present in the wetland.

   - ❑ Submergent (i.e., underwater) vegetation
   - ❑ Emergent (i.e., rooted in the water, but rising above it) vegetation
   - ❑ Floating vegetation
   - ❑ Scrub/shrub
   - ❑ Wooded
   - ❑ Other (Please describe):_____

3. Estimate the vegetation density of the wetland area.

   - ❑ Dense (i.e., greater than 75% vegetation)
   - ❑ Moderate (i.e., 25% to 75% vegetation)
   - ❑ Sparse (i.e., less than 25% vegetation)

4. Is standing water present? ☐ Yes ☐ No

   If yes, is the water primarily: ☐ Fresh or ☐ Brackish
   Indicate the approximate area of the standing water (ft^2): _____
   Indicate the approximate depth of the standing water, if known (ft. or in.)_____

5. If known, indicate the source of the water in the wetland.

   - ❑ Stream/River/Creek/Lake/Pond
   - ❑ Flooding
   - ❑ Groundwater
   - ❑ Surface runoff

6. Is there a discharge from the facility to the wetland? ☐ Yes ☐ No

   If yes, please
   describe:_____
   _____
   _____
   _____
   _____

Wetland Area Questions (Continued)

7. Is there a discharge from the wetland? ☐ Yes ☐ No
   If yes, indicate the type of aquatic feature the wetland discharges into:

   - ❑ Surface stream/River (Name:_____)
   - ❑ Lake/Pond (Name:_____)
   - ❑ Groundwater
   - ❑ Not sure

8. Does the area show evidence of flooding? ☐ Yes ☐ No
   If yes, indicate which of the following are present (mark all that apply):

   - ❑ Standing water
   - ❑ Water-saturated soils
   - ❑ Water marks
   - ❑ Buttressing
   - ❑ Debris lines
   - ❑ Mud cracks
   - ❑ Other (Please describe):_____

9. Animals observed in the wetland area or suspected to be present based on indirect evidence or file material:

   - ❑ Birds
   - ❑ Fish
   - ❑ Mammals
   - ❑ Reptiles (e.g., snakes, turtles)
   - ❑ Amphibians (e.g., frogs, salamanders)
   - ❑ Sediment-dwelling invertebrates (e.g., mussels, crayfish, insect nymphs)

   Specify species, if known:
   _____
   _____
   _____
   _____

III.B Aquatic Habitats

III.B.1 Non-Flowing Aquatic Features

Are any non-flowing aquatic features (such as ponds or lakes) located at or adjacent to the site?

☐ Yes ☐ No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the non-flowing aquatic features. If more than one non-flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.B.2.

Non-Flowing Aquatic Feature Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Indicate the type of aquatic feature present:

   - ❑ Natural (e.g., pond or lake)
   - ❑ Man-made (e.g., impoundment, lagoon, canal, etc.)

2. Estimate the approximate size of the water body (in acres or sq. ft.)_____

3. If known, indicate the depth of the water body (in ft. or in.)._____

Non-Flowing Aquatic Feature Questions (Continued)

4. Indicate the general composition of the bottom substrate. Mark all sources that apply from the following list.

☐ Bedrock	☐ Sand	☐ Concrete
☐ Boulder (>10 in.)	☐ Silt	☐ Debris
☐ Cobble (2.5 - 10 in.)	☐ Clay	☐ Detritus
☐ Gravel (0.1 - 2.5 in.)	☐ Muck (fine/black)	

☐ Other (please specify):_____

5. Indicate the source(s) of the water in the aquatic feature. Mark all sources that apply from the following list.

- ❑ River/Stream/Creek
- ❑ Groundwater
- ❑ Industrial Discharge
- ❑ Surface Runoff
- ❑ Other (please specify):_____

6. Is there a discharge from the facility to the aquatic feature? ☐ Yes ☐ No
   If yes, describe the origin of each discharge and its migration path:
   _____
   _____
   _____
   _____

7. Does the aquatic feature discharge to the surrounding environment? ☐ Yes ☐ No
   If yes, indicate the features from the following list into which the aquatic feature discharges, and indicate whether the discharge occurs onsite or offsite:

❑ River/Stream/Creek	☐ onsite	☐ offsite
❑ Groundwater	☐ onsite	☐ offsite
❑ Wetland	☐ onsite	☐ offsite
❑ Impoundment	☐ onsite	☐ offsite

❑ Other (please describe)_____

Non-Flowing Aquatic Feature Questions (Continued)

8. Animals observed in the vicinity of the aquatic feature or suspected to be present based on indirect evidence or file material:

- ❑ Birds
- ❑ Fish
- ❑ Mammals
- ❑ Reptiles (e.g., snakes, turtles)
- ❑ Amphibians (e.g., frogs, salamanders)
- ❑ Sediment-dwelling invertebrates (e.g., mussels, crayfish, insect nymphs)

Specify species, if known:

_____

_____

_____

_____

III.B.2 Flowing Aquatic Features

Are any flowing aquatic features (such as streams or rivers) located at or adjacent to the site?

☐ Yes ☐ No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the flowing aquatic features. If more than one flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations, and clearly identify each area on the site map

If no, proceed to Section III.C.

Flowing Aquatic Feature Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Indicate the type of flowing aquatic feature present.

   - ❑ River
   - ❑ Stream
   - ❑ Creek
   - ❑ Brook
   - ❑ Dry wash
   - ❑ Arroyo
   - ❑ Intermittent stream
   - ❑ Artificially created (ditch, etc.)
   - ❑ Other (specify)
   - ❑

2. Indicate the general composition of the bottom substrate.

   ☐ Bedrock ☐ Sand ☐ Concrete

   ☐ Boulder (>10 in.) ☐ Silt ☐ Debris

   ☐ Cobble (2.5 - 10 in.) ☐ Clay ☐ Detritus

   ☐ Gravel (0.1 - 2.5 in.) ☐ Muck (fine/black)

   ☐ Other (please specify):_____

3. Describe the condition of the bank (e.g., height, slope, extent of vegetative cover) of the aquatic feature.

   _____
   _____
   _____
   _____

4. Is there a discharge from the facility to the aquatic feature? ☐ Yes ☐ No
   If yes, describe the origin of each discharge and its migration path:

   _____
   _____
   _____
   _____

5. Indicate the discharge point of the water body. Specify name, if known.

   _____
   _____
   _____

Flowing Aquatic Feature Questions (Continued)

6. If the flowing aquatic feature is a dry wash or arroyo, answer the following questions.
   - ❑ Check here if feature is not a dry wash or arroyo

   If known, specify the average number of days in a year in which flowing water is present in the feature: _____

   Is standing water or mud present? Check all that apply.
   - ❑ Standing water
   - ❑ Mud
   - ❑ Neither standing water or mud

   Does the area show evidence of recent flow (e.g., flood debris clinging to vegetation)?
   - ❑ Yes
   - ❑ No
   - ❑ Not sure
7. Animals observed in the vicinity of the aquatic feature or suspected to be present based on indirect evidence or file material:

   - ❑ Birds
   - ❑ Fish
   - ❑ Mammals
   - ❑ Reptiles (e.g., snakes, turtles)
   - ❑ Amphibians (e.g., frogs, salamanders)
   - ❑ Sediment-dwelling invertebrates (e.g., mussels, crayfish, insect nymphs)

   Specify species, if known:

   _____
   _____
   _____
   _____

III.C Terrestrial Habitats

III.C.1 Wooded

Are any wooded areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the wooded area on the attached site map and answer the following questions. If more than one wooded area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wooded area. Distinguish between wooded areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.2.

Wooded Area Questions

☐ On-site ☐ Off-site

Name or Designation:_____

1. Estimate the approximate size of the wooded area (in acres or sq. ft.)_____

2. Indicate the dominant type of vegetation in the wooded area.

   - ❑ Evergreen
   - ❑ Deciduous
   - ❑ Mixed

   Dominant plant species, if known:_____

3. Estimate the vegetation density of the wooded area.

   - ❑ Dense (i.e., greater than 75% vegetation)
   - ❑ Moderate (i.e., 25% to 75% vegetation)
   - ❑ Sparse (i.e., less than 25% vegetation)

4. Indicate the predominant size of the trees at the site. Use diameter at chest height.

   - ❑ 0-6 inches
   - ❑ 6-12 inches
   - ❑ >12 inches
   - ❑ No single size range is predominant

5. Animals observed in the wooded area or suspected to be present based on indirect evidence or file material:

   - ❑ Birds
   - ❑ Mammals
   - ❑ Reptiles (e.g., snakes, lizards)
   - ❑ Amphibians (e.g., toads, salamanders)

   Specify species, if known:
   _____
   _____
   _____
   _____

III.C.2 Shrub/Scrub

Are any shrub/scrub areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the shrub/scrub area on the attached site map and answer the following questions. If more than one shrub/scrub area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual shrub/scrub area. Distinguish between shrub/scrub areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.3.

Shrub/Scrub Area Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Estimate the approximate size of the shrub/scrub area (in acres or sq. ft.)._____

2. Indicate the dominant type of shrub/scrub vegetation present, if known.

_____
_____
_____
_____

3. Estimate the vegetation density of the shrub/scrub area.

- ❑ Dense (i.e., greater than 75% vegetation)
- ❑ Moderate (i.e., 25% to 75% vegetation)
- ❑ Sparse (i.e., less than 25% vegetation)

4. Indicate the approximate average height of the scrub/shrub vegetation.

- ❑ 0-2 feet
- ❑ 2-5 feet
- ❑ >5 feet

5. Animals observed in the shrub/scrub area or suspected to be present based on indirect evidence or file material:
   - ❑ Birds
   - ❑ Mammals
   - ❑ Reptiles (e.g., snakes, lizards)
   - ❑ Amphibians (e.g., toads, salamanders)

   Specify species, if known:

_____
_____
_____
_____

III.C.3 Grassland

Are any grassland areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the grassland area on the attached site map and answer the following questions. If more than one grassland area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual grassland area. Distinguish between grassland areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.4.

Grassland Area Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Estimate the approximate size of the grassland area (in acres or sq. ft.)._____

2. Indicate the dominant plant type, if known.
_____
_____
_____
_____

3. Estimate the vegetation density of the grassland area.

   - ❑ Dense (i.e., greater than 75% vegetation)
   - ❑ Moderate (i.e., 25% to 75% vegetation)
   - ❑ Sparse (i.e., less than 25% vegetation)

4. Indicate the approximate average height of the dominant plant type (in ft. or in.)_

5. Animals observed in the grassland area or suspected to be present based on indirect evidence or file material:

   - ❑ Birds
   - ❑ Mammals
   - ❑ Reptiles (e.g., snakes, lizards)
   - ❑ Amphibians (e.g., toads, salamanders)

   Specify species, if known:

III.C.4 Desert

Are any desert areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the desert area on the attached site map and answer the following questions. If more than one desert area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual desert area. Distinguish between desert areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.5.

Desert Area Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Estimate the approximate size of the desert area (in acres or sq. ft.)._____

2. Describe the desert area (e.g., presence or absence of vegetation, vegetation types, presence/size of rocks, sand, etc.)

_____
_____
_____
_____
_____
_____
_____
_____
_____

3. Animals observed in the desert area or suspected to be present based on indirect evidence or file material:

- ❑ Birds
- ❑ Mammals
- ❑ Reptiles (e.g., snakes, lizards)
- ❑ Amphibians (e.g., toads, salamanders)

Specify species, if known:

_____

III.C.5 Other

1. Are there any other terrestrial communities or habitats on or adjacent to the site which were not previously described?

   ☐ Yes ☐ No

   If yes, indicate the "other" area(s) on the attached site map and describe the area(s) below. Distinguish between onsite and offsite areas. If no, proceed to Section III.D.

III.D Sensitive Environments and Receptors

1. Do any other potentially sensitive environmental areas[3] exist adjacent to or within 0.5 miles of the site? If yes, list these areas and provide the source(s) of information used to identify sensitive areas. *Do not answer "no" without confirmation from the U.S. Fish and Wildlife Service and appropriate State of New Mexico division.*

3 Areas that provide unique and often protected habitat for wildlife species. These areas are typically used during critical life stages such as breeding, hatching, rearing of young and overwintering. Refer to **Table 1** at the end of this document for examples of sensitive environments.

2. Are any areas on or near (i.e., within 0.5 miles) the site which are owned or used by local tribes? If yes, describe. *Contact the Tribal Liason in the Office of the Secretary (505)827-2855 to obtain this information.*

_____
_____
_____
_____
_____

4. Does the site serve or potentially serve as a habitat, foraging area, or refuge by rare, threatened, endangered, candidate and/or proposed species (plants or animals), or any otherwise protected species? If yes, identify species. *This information should be obtained from the U.S. Fish and Wildlife Service and appropriate State of New Mexico division.*

_____
_____
_____
_____
_____
_____

5. Is the site potentially used as a breeding, roosting or feeding area by migratory bird species? If yes, identify which species.

_____
_____
_____
_____
_____

6. Is the site used by any ecologically[4], recreationally, or commercially important

_____

4 Ecologically important species include populations of species which provide a critical (i.e., not replaceable) food resource for higher organisms and whose function as such would not be replaced by more tolerant species; or perform a critical ecological function (such as organic matter decomposition) and whose functions will not be replaced by other species. Ecologically important species include pest and opportunistic species that populate an area <u>if they serve as a food source for other species</u>, but do <u>not</u> include domesticated animals (e.g., pets and livestock) or plants/animals whose existence is maintained by continuous human interventions (e.g., fish hatcheries, agricultural crops, etc.,)

species? If yes, explain.

_____
_____
_____
_____
_____

IV. EXPOSURE PATHWAY EVALUATION

1. Do existing data provide sufficient information on the nature, rate, and extent of contamination at the site?

   - ❑ Yes
   - ❑ No
   - ❑ Uncertain

   Please provide an explanation for your answer:_____
   _____
   _____
   _____
   _____

2. Do existing data provide sufficient information on the nature, rate, and extent of contamination in offsite affected areas?

   - ❑ Yes
   - ❑ No
   - ❑ Uncertain
   - ❑ No offsite contamination

   Please provide an explanation for your answer:_____
   _____
   _____
   _____
   _____

3. Do existing data address potential migration pathways of contaminants at the site?

   - ❑ Yes
   - ❑ No
   - ❑ Uncertain

   Please provide an explanation for your answer:_____
   _____
   _____
   _____
   _____

4. Do existing data address potential migration pathways of contaminants in offsite affected areas?

- ❑ Yes
- ❑ No
- ❑ Uncertain
- ❑ No offsite contamination

Please provide an explanation for your answer:_____

_____

_____

_____

_____

5. Are there visible indications of stressed habitats or receptors on or near (i.e., within 0.5 miles) the site that may be the result of a chemical release? If yes, explain. Attach photographs if available.

_____

_____

_____

_____

_____

_____

6. Is the location of the contamination such that receptors might be reasonably expected to come into contact with it? For soil, this means contamination in the soil 0 to 5 feet below ground surface (bgs). If yes, explain.

_____

_____

_____

_____

_____

_____

_____

7. Are receptors located in or using habitats where chemicals exist in air, soil, sediment or surface water? If yes, explain.

_____

_____

_____

_____

_____

8. Could chemicals reach receptors via groundwater? Can chemicals leach or dissolve to groundwater? Are chemicals mobile in groundwater? Does groundwater discharge into receptor habitats? If yes, explain.

_____
_____
_____
_____
_____
_____
_____

9. Could chemicals reach receptors through runoff or erosion? Answer the following questions:

What is the approximate distance from the contaminated area to the nearest watercourse or arroyo?

- ❑ 0 feet (i.e., contamination has reached a watercourse or arroyo)
- ❑ 1-10 feet
- ❑ 11-20 feet
- ❑ 21-50 feet
- ❑ 51-100 feet
- ❑ 101-200 feet
- ❑ > 200 feet
- ❑ > 500 feet
- ❑ > 1000 feet

What is the slope of the ground in the contaminated area?

- ❑ 0-10%
- ❑ 10-30%
- ❑ > 30%

What is the approximate amount of ground and canopy vegetative cover in the contaminated area?

- ❑ < 25%
- ❑ 25-75%
- ❑ > 75%

Is there visible evidence of erosion (e.g., a rill or gully) in or near the contaminated area?

- ❑ Yes
- ❑ No
- ❑ Do not know

Do any structures, pavement, or natural drainage features direct run-on flow (i.e., surface flows originating upstream or uphill from the area of concern) into the contaminated area?

- ❑ Yes
- ❑ No
- ❑ Do not know

10. Could chemicals reach receptors through the dispersion of contaminants in air (e.g., volatilization, vapors, fugitive dust)? If yes, explain.

_____
_____
_____
_____
_____
_____

11. Could chemicals reach receptors through migration of non-aqueous phase liquids (NAPLs)? Is a NAPL present at the site that might be migrating towards receptors or habitats? Could NAPL discharge contact receptors or their habitat?

_____
_____
_____
_____
_____
_____
_____

12. Could receptors be impacted by external irradiation at the site? Are gamma emitting radionuclides present at the site? Is the radionuclide contamination buried or at the surface?

_____
_____
_____
_____
_____
_____
_____

PHOTOGRAPHIC DOCUMENTATION

During the site visit(s), photographs should be taken to document the current conditions at the site and to support the information entered in the checklist. For example, photographs may be used to document the following:

- The nature, quality, and distribution of vegetation at the site
- Receptors or evidence of receptors
- Potentially important ecological features, such as ponds and drainage ditches
- Potential exposure pathways
- Any evidence of contamination or impact

The following space may be used to record photo subjects.

SUMMARY OF OBSERVATIONS AND SITE SETTING

Include information on significant source areas and migration pathways that are likely to constitute complete exposure pathways.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Checklist Completed by_____

Affiliation_____

Author Assisted by_____

Date_____

TABLE 1
EXAMPLES OF SENSITIVE ENVIRONMENTS

National Parks and National Monuments

Designated or Administratively Proposed Federal Wilderness Areas

National Preserves

National or State Wildlife Refuges

National Lakeshore Recreational Areas

Federal land designated for protection of natural ecosystems

State land designated for wildlife or game management

State designated Natural Areas

Federal or state designated Scenic or Wild River

All areas that provide or could potentially provide critical habitat[1] for state and federally listed Threatened or Endangered Species, those species that are currently petitioned for listing, and species designated by other agencies as sensitive or species of concern

All areas that provide or could potentially provide habitat for state protected species as defined in the Wildlife Code, Chapter 17 of the New Mexico Statutes

All areas that provide or could potentially provide habitat for migratory birds as protected by the Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)

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1 Critical habitats are defined by the Endangered Species Act (50 CFR §424.02(d)) as:

> 1) Specific areas within the geographical area currently occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (ii) that may require special management considerations or protection, and 2) Specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary [of Interior] that such areas are essential for the conservation of the species.

All areas that provide or could potentially provide habitat for bald eagles and golden eagles as protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)

All areas that provide or could potentially provide habitat for song birds as protected by the State of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-13)

All areas that provide or could potentially provide habitat for hawks, vultures and owls as protected by the State of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-14)

All areas that provide or could potentially provide habitat for horned toads and Bullfrogs as protected by the State of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-15 and 16, resp.)

All perennial waters (e.g., rivers, lakes, playas, sloughs, ponds, etc)

All ephemeral drainage (e.g., arroyos, puddles/pools, intermittent streams, etc) that provide significant wildlife habitat or that could potentially transport contaminants off site to areas that provide wildlife habitat

All riparian habitats

All perennial and ephemeral wetlands (not limited to jurisdictional wetlands)

All areas that are potentially important breeding, staging, and overwintering habitats as well as other habitats important for the survival of animals during critical periods of their life cycle.

ATTACHMENT B

ECOLOGICAL SITE EXCLUSION CRITERIA CHECKLIST AND DECISION TREE

1. NEW MEXICO ECOLOGICAL EXCLUSION CRITERIA CHECKLIST

The following questions are designed to be used in conjunction with the Ecological Exclusion Criteria Decision Tree (Figure 1). After answering each question, refer to the Decision Tree to determine the appropriate next step. In some cases, questions will be omitted as the user is directed to another section as indicated by the flow diagram in the Decision Tree. For example, if the user answers "yes" to Question 1 of Section I, he or she is directed to proceed to Section II.

I. Habitat

In the following questions, "affected property" refers to all property on which a release has occurred or is believed to have occurred, including off-site areas where contamination may have occurred or migrated.

1. Are any of the below-listed sensitive environments at, adjacent to, or in the locality1 of the affected property?

    - National Park or National Monument
    - Designated or administratively proposed Federal Wilderness Area
    - National Preserve
    - National or State Wildlife Refuge
    - Federal or State land designated for wildlife or game management
    - State designated Natural Areas
    - All areas that are owned or used by local tribes
    - All areas that are potentially important breeding, staging, and overwintering habitats as well as other habitats important for the survival of animals during critical periods of their life cycle
    - All areas that provide or could potentially provide habitat for state and federally listed Threatened or Endangered Species, those species that are currently petitioned for listing, and species designated by other agencies as sensitive or species of concern
    - All areas that provide or could potentially provide habitat for state protected species as defined in the Wildlife Code, Chapter 17 of the New Mexico Statutes
    - All areas that provide or could potentially provide habitat for migratory birds as protected by the Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)

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1 *Locality* of the site refers to any area where an ecological receptor is likely to contact site-related chemicals. The locality of the site considers the likelihood of contamination migrating over time and places the site in the context of its general surrounding. Therefore, the locality is typically larger than the site and the areas adjacent to the site.

- All areas that provide or could potentially provide habitat for bald eagles and golden eagles as protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)
- All areas that provide or could potentially provide habitat for song birds as protected by the state of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-13)
- All areas that provide or could potentially provide habitat for hawks, vultures and owls as protected by the state of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-14)
- All areas that provide or could potentially provide habitat for horned toads and bullfrogs as protected by the state of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-15 and 16, respectively)

2. Does the affected property contain land areas which were not listed in Question 1, but could be considered viable ecological habitat? The following are examples (but not a complete listing) of viable ecological habitats:

   - Wooded areas
   - Shrub/scrub vegetated areas
   - Open fields (prairie)
   - Other grassy areas
   - Desert areas
   - Any other areas which support wildlife and/or vegetation, excluding areas which support only opportunistic species (such as house mice, Norway rats, pigeons, etc.) that do not serve as prey to species in adjacent habitats.

   The following features are <u>not</u> considered ecologically viable:

   - Pavement
   - Buildings
   - Paved areas of roadways
   - Paved/concrete equipment storage pads
   - Paved manufacturing or process areas
   - Other non-natural surface cover or structure

3. Does the affected property contain any perennial or ephemeral aquatic features which were not listed in Question 1?

II. Receptors

1. Is any part of the affected property used for habitat, foraging area, or refuge by any rare, threatened, or endangered species (plant *or* animal), or otherwise protected species (e.g., raptors, migratory birds)?

2. Is any part of the affected property used for habitat, foraging area, or refuge by any species used as a recreational (e.g., game animals) and/or commercial resource?

3. Is any part of the affected property used for habitat, foraging area, or refuge by any plant or animal species? This includes plants considered "weeds" and opportunistic insect and animal species (such as cockroaches and rats) if they are used as a food source for other species in the area.

III. Exposure Pathways

1. Could receptors be impacted by contaminants via direct contact?

   Is a receptor located in or using an area where it could contact contaminated air, soil3, or surface water?

For Questions 2 and 3, note that one must answer "yes" to all three bullets in order to be directed to the "exclusion denied" box of the decision tree. This is because answering "no" to one of the questions in the bullet list indicates that a complete exposure pathway is not present. For example, in Question 2, if the chemical cannot leach or dissolve to groundwater (bullet 1), there is no chance of ecological receptors being exposed to the chemical through contact with contaminated groundwater. Similarly, the responses to the questions in Question 4 determine whether a complete pathway exists for exposure to NAPL.

2. Could receptors contact contaminants via groundwater?
   - Can the chemical leach or dissolve to groundwater4?
   - Can groundwater mobilize the chemical?
   - Could (does) contaminated groundwater discharge into known or potential receptor habitats?

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3 For soil, this means contamination less than 5 feet below ground surface (bgs).

4 Information on the environmental fate of specific chemicals can be found on the Internet at *http://www.epa.gov/opptintr/chemfact/* or at a local library in published copies of the *Hazardous Substances Data Bank*.

3. Could receptors contact contaminants via runoff (i.e., surface water and/or suspended sediment) or erosion by water or wind?
    - Are chemicals present in surface soils?
    - Can the chemical be leached from or eroded with surface soils?
    - Is there a receptor habitat located downgradient of the leached/eroded surface soil?

4. Could receptors contact contaminants via migration of non-aqueous phase liquids (NAPL)?
    - Is NAPL present at the site?
    - Is NAPL migrating toward potential receptors or habitats?
    - Could NAPL discharge impact receptors or habitats?

Figure 1 -Ecological Exclusion Criteria Decision Tree

(Refer to corresponding checklist for the full text of each question)

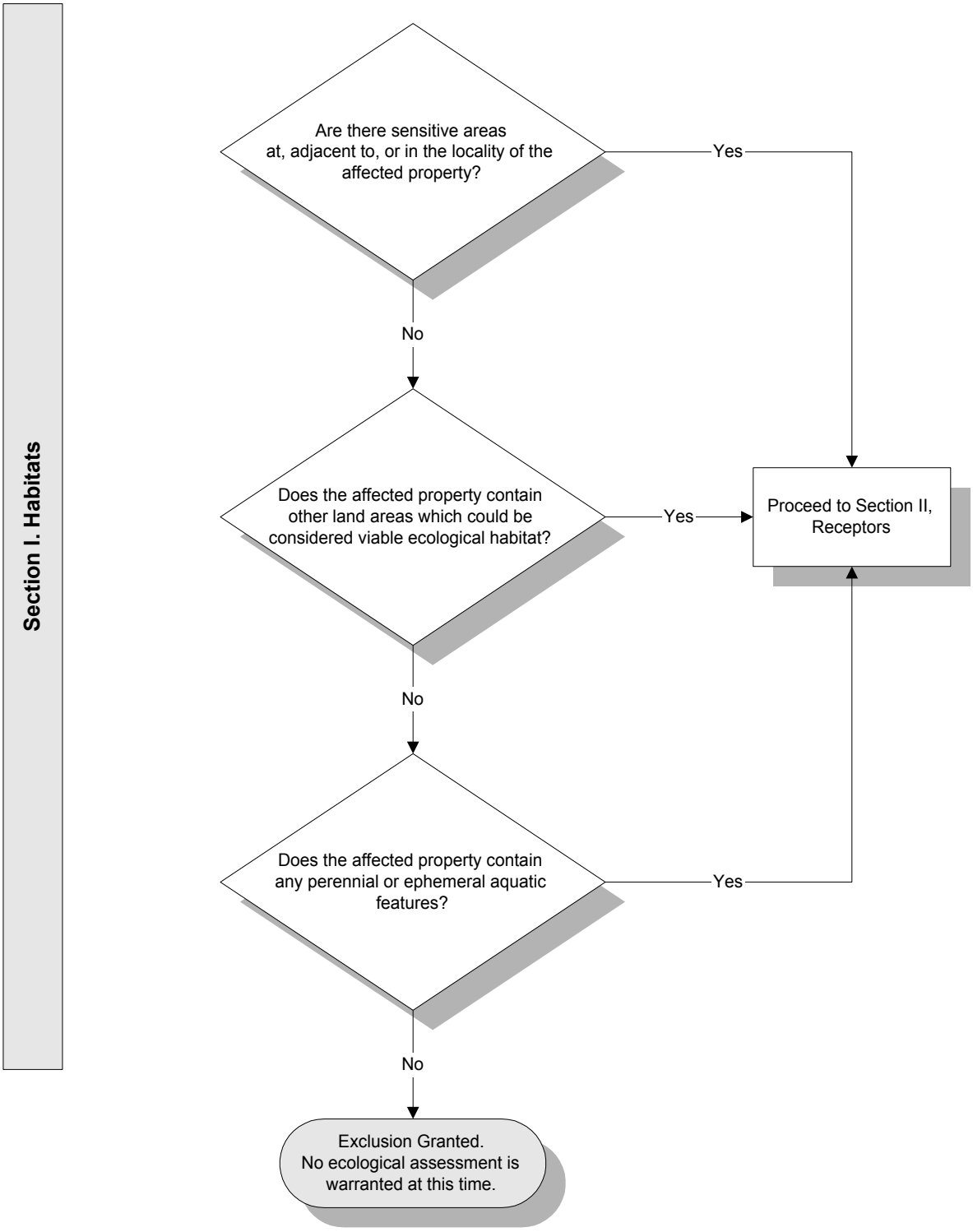

Figure 1 - Exclusion Criteria Decision Tree (continued)

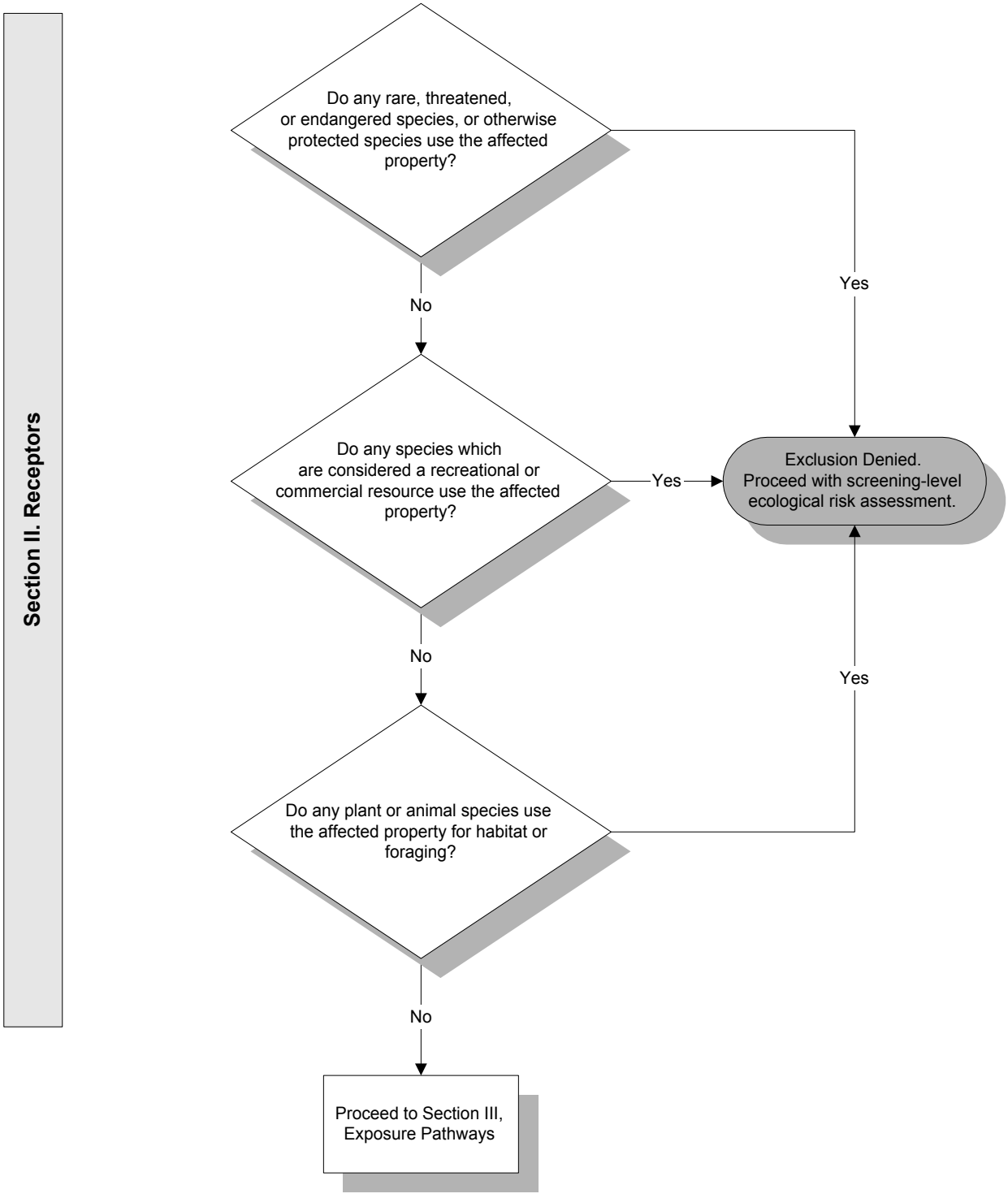

Figure 1 - Exclusion Criteria Decision Tree (continued)