DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY AIR DEFENSE ARTILLERY CENTER AND FORT BLISS
1733 PLEASONTON ROAD
FORT BLISS, TEXAS 79916-6816

ENTERED

25 November 1997

REPLY TO
ATTENTION OF

Directorate of Environment

Mr. Benito Garcia
Hazardous and Radioactive Materials Bureau
RCRA Technical Compliance Program
New Mexico Environment Department
2044-A Galisteo
Santa Fe, NM 87505

Dear Mr. Garcia:

Please find enclosed two copies of the Final Field Sampling and Analysis Plan for Subsurface Investigation of the Oxidation Lagoons (SWMU's 19, 25B, and 27B), Fort Bliss, Texas and New Mexico for your review. This work represents the second phase of RCRA Facility Investigation at these sites. The results of the first phase have been previously submitted for your review.

The goal of this second phase of investigation is to install a single monitor well at each of these sites in order to assess the potential for the vertical migration of contaminants from the lagoons to the regional aquifer. The Fort Bliss Directorate of Environment (DOE) is anticipating the start of field work in early December 1997.

If you have any questions or concerns please do not hesitate to call Mr. Kelly Blough, the Fort Bliss DOE technical point of contact. Mr. Blough can be reached at (915) 568-7979.

Sincerely,

David Felix

Mr. David Felix
Chief, Multimedia Compliance Div., DOE
Fort Bliss, Texas

cc. file

enc. (2)

FB 99-007

FIELD SAMPLING AND ANALYSIS PLAN
FOR SUBSURFACE INVESTIGATION OF OXIDATION LAGOONS
(SWMUs NO. 19, 25B, AND 27B)
FORT BLISS, TEXAS AND NEW MEXICO

Prepared for

Fort Bliss Directorate of Environment,

U.S. Army Corps of Engineers, Fort Worth, and

COMPA Industries, Inc.

November 12, 1997

TETRA TECH

135 MAIN STREET, SUITE 1800

SAN FRANCISCO, CALIFORNIA 94105

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1.0 INTRODUCTION

Tetra Tech EM Inc. (Tetra Tech) is subcontracted to COMPA Industries, Inc. (COMPA), to conduct work under Work Assignment No. D.O. 0027 from the U.S. Army Corps of Engineers (COE) under Contract No. DACA63-93-D-0036. Under this subcontract, Tetra Tech will conduct a subsurface investigation of oxidation lagoons at the McGregor Range (Solid Waste Management Unit [SWMU] 19), the Orogrande Range (SWMU 25B), and the Doña Ana Range (SWMU 27B) located at the Fort Bliss Military Reservation in New Mexico and Texas. This work plan is a supplement to the previously approved RCRA Facility Investigation (RFI) work plan (Thompson Professional Group, Inc. [Thompson] 1996). This supplement is consistent with the RFI work plan, and to avoid duplication, this supplement refers to the RFI work plan where more detailed information is presented. This work plan supplement presents the proposed technical approach for performing the deep subsurface site investigation at SWMUs 19, 25B, and 27B. The remainder of this section discusses project objectives, background, site geology and hydrogeology, and previous investigations. Section 2.0 describes the field program, and Section 3.0 covers the health and safety program. Chemical and geotechnical analytical programs are outlined in Sections 4.0 and 5.0. Sections 6.0 and 7.0 describe the quality assurance program and vadose zone modeling, and references are presented in Section 8.0.

1.1 OBJECTIVE

This work assignment has two primary objectives: (1) to evaluate the presence and concentration of contaminants in soil and groundwater at the three oxidation lagoons and (2) to determine the moisture content of subsurface soil and the hydrogeologic profile at each site to provide data for evaluating the potential for water and solutes to migrate downward. These objectives will be addressed by a program that includes the following tasks:

- Task 1 - Field investigation
- Task 2 - Chemical and geotechnical laboratory analysis
- Task 3 - Vadose zone modeling

This work plan presents the approach to be taken to complete these tasks.

1.2 BACKGROUND

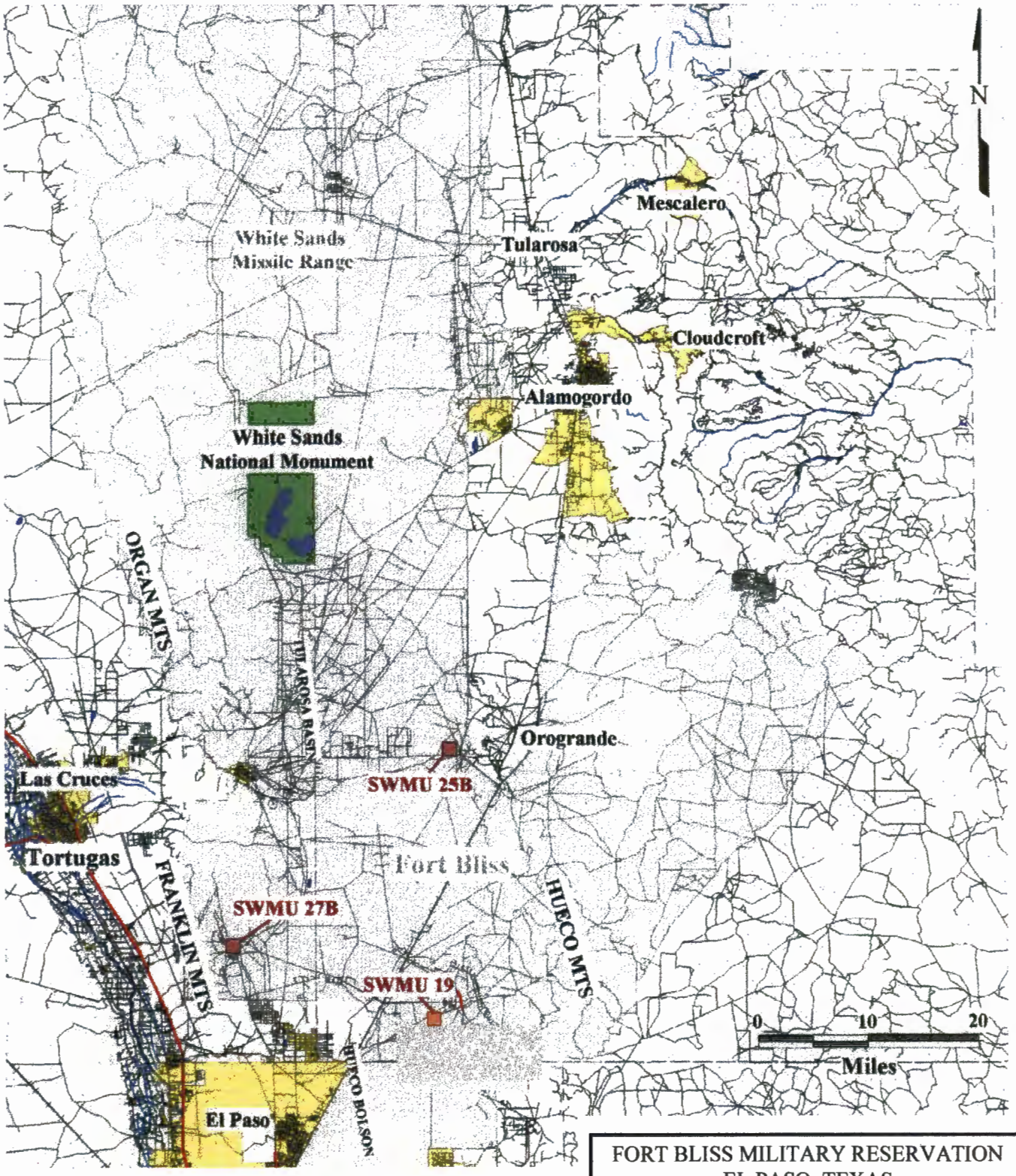
The Fort Bliss Military Reservation occupies about 1.2 million acres of land in New Mexico and Texas near El Paso, Texas. A site location map is presented in Figure 1. Several training camps located throughout the reservation function as training support centers for the U.S. Army. The training camps consist of logistical support and training structures, housing and maintenance facilities, and other support areas. SWMUs 19, 25B, and 27B were constructed at the training camps as disposal units for sanitary and liquid wastes generated by Army personnel and training camp related activities. The SWMUs consist of one oxidation lagoon at each training camp, as well as other associated units, such as Imhoff tanks and drying beds. The oxidation lagoons are active and currently receive wastewater from various sources.

Hazardous wastes are also reported to have been disposed of in the oxidation lagoons (Thompson 1996). Potential hazardous wastes generated at the training camps include solvents, battery acid, supertropical bleach, methanol, formaldehyde, xylenes, paint and paint thinner, and chromic acid rinse water. Trace amounts of these constituents could possibly end up in wastewater routed to the oxidation lagoons. Hazardous substances including bis(2-ethylhexyl)phthalate, pesticides, and heavy metals have been detected at SWMU 25B.

With the exception of general repairs to piping, no interim measures or corrective actions have been conducted at any of the SWMUs.

1.3 GEOLOGY AND HYDROGEOLOGY

SWMUs 19, 25B, and 27B are located within the Tularosa and Hueco Basins of the New Mexico Highlands section of the Basin and Range Province. These north-south oriented basins are situated between the Sacramento Mountains to the east and the San Andres-Organ-Franklin Mountains to the west. The mountains are granite-cored uplifts capped with Paleozoic age strata. The basin fill material consists of unconsolidated sedimentary sequences of alternating clay, sand, and gravel units of the Santa Fe Group; thicknesses of the basin fill sediments range from near 0 feet at the mountain fronts to more than 9,000 feet in the deeper portions of the basins. The surface topography of the basins is nearly level



FORT BLISS MILITARY RESERVATION
EL PASO, TEXAS

FIGURE 1
FORT BLISS RFI
SITE LOCATION MAP

Tetra Tech EM Inc.

SOURCE: MODIFIED FROM WESTON, 1997

to gently rolling and consists of shallow, ephemeral lake beds (playas), alluvial plains, and low sand dunes. No major streams or surface water bodies are present within the basins, except for some seasonal streams that drain the mountains located to the north. The regional groundwater surface is reported to be about 350 feet below ground surface (bgs). However, shallow, perched aquifers have been reported in some of these basins.

1.4 SUMMARY OF PREVIOUS INVESTIGATIONS

Several previous site investigations have been performed at various SWMUs at Fort Bliss. The following is a list of site investigation reports that have been submitted to the New Mexico Environmental Department (NMED) and the U.S. Environmental Protection Agency (EPA):

- U.S. Army Environmental Hygiene Agency. 1987 and 1989. Aberdeen Proving Ground, Maryland. Final Report, Evaluation of Solid Waste Management Units. Fort Bliss, Texas. August 3 to 7, 1987, and September 26 to 29, 1989.
- A.T. Kearney. 1989. RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report. March.
- Environmental Science & Engineering, Inc. (ESE). 1991. RCRA Facility Inspection Report. New Mexico Solid Waste Management Units, Fort Bliss, Volume 1. September.
- ESE. 1992. Draft Corrective Investigation Study Report for Solid Waste Management Unit 25B, Orogrande Oxidation Lagoon, Fort Bliss, El Paso, Texas.
- Earth Science Corporation. 1993. Environmental Compliance Assessment Report. April.

Most recently, Roy F. Weston, Inc. (Weston), conducted a RFI at the McGregor Range oxidation lagoon (SWMU 19), the Orogrande Range oxidation lagoon (SWMU 25B), the Doña Ana Range oxidation lagoon (SWMU 27B), and the Meyer Range oxidation lagoon (SWMU 76) (Weston 1997). The objective of the RFI was to determine if hazardous waste or hazardous constituents were released into the environment from any of the SWMUs. Weston collected surface soil/sediment, subsurface soil, surface water, wastewater, and groundwater samples at the SWMUs. Groundwater samples were collected from monitoring wells screened in the upper perched aquifer.

Based on data collected during the RFI, Weston concluded the following regarding the occurrence of groundwater and contamination of environmental media at the oxidation lagoons.

McGregor Range Oxidation Lagoon

- The McGregor Range lagoon is the largest of the three SWMUs included in this study and appears to be the most active based on current level of surface discharge.
- Perched groundwater at the McGregor Range Oxidation Lagoon occurs between 50 and 60 feet bgs.
- Constituents of concern were not reported in the collected groundwater samples.
- Constituents in surface water samples were below maximum contaminant levels (MCL).
- Volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCB), and heavy metals were detected in sediment samples above background concentrations.
- Constituents potentially attributable to the SWMUs were detected in surface soil samples downgradient of the overflow structures at the McGregor Range oxidation lagoon.
- VOCs, SVOCs, pesticides, and PCBs were detected in surface soil samples at the McGregor Range Oxidation Lagoon.

Doña Ana Range Oxidation Lagoon

- Groundwater was not encountered in any of the borings at the Doña Ana Range oxidation lagoon.
- Cadmium and lead levels were reported in the surface water sample at concentrations above MCLs.
- VOCs, pesticides, and metals were reported in several sediment samples above background concentrations but below EPA Region 3 criteria for industrial soil ingestion and soil to air transfer scenarios.

Orogrande Range Oxidation Lagoon

- Groundwater was not encountered in any of the borings at the Orogrande oxidation lagoon.
- Lead, acetone, and total petroleum hydrocarbons were reported in surface water samples at concentrations either above MCLs or above reporting limits.
- Total Kjeldahl nitrogen and pesticides were reported in sediment and soil samples above background levels but below EPA Region 3 criteria for industrial soil ingestion and soil to air transfer scenarios.

2.0 FIELD PROGRAM

The field program consists of drilling and sampling a single boring at each of the three oxidation lagoons at SWMUs 19, 25B and 27B. Sampling of soils and groundwater will be conducted in each hole from the ground surface down to the regional aquifer, which occurs about 350 feet bgs. The field program will consist of (1) utility clearance activities; (2) drilling, sampling, and monitoring well installation; (3) downhole geophysical logging; (4) well and site surveying; and (5) management of investigation derived waste (IDW). These five field tasks are described in the following sections.

2.1 UTILITY CLEARANCE ACTIVITIES

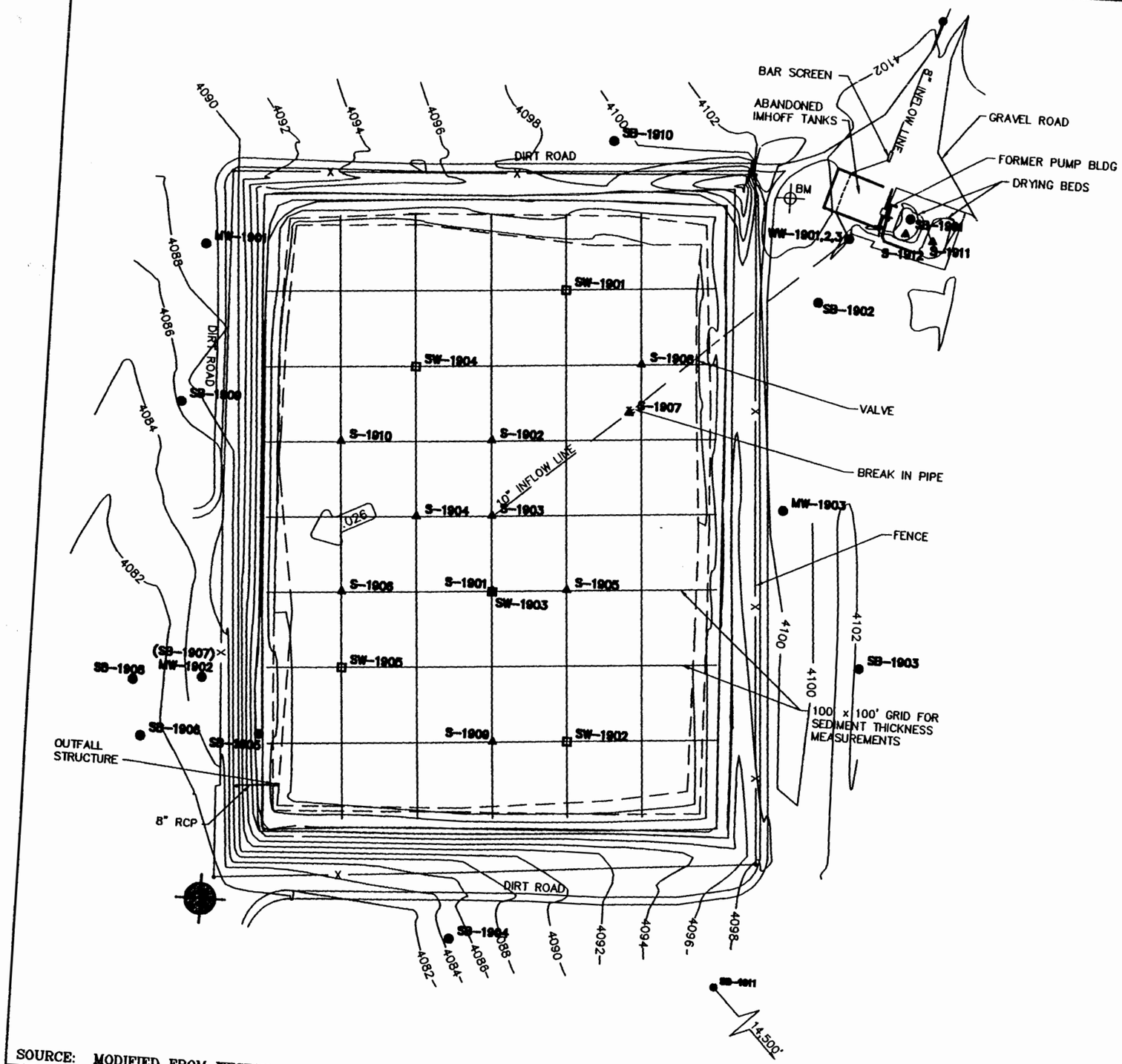
Before beginning drilling activities, all three boring locations will be cleared for buried utilities. Site clearance activities will consist of notifying Fort Bliss and public utility companies of intrusive work, obtaining digging and hot work permits from the Fort Bliss Department of Public Works, and screening the marked boring locations with standard electromagnetic line locator equipment. Site clearance and all other activities at the three sites will be coordinated with the Fort Bliss Directorate of Environment and Range Liaison Office.

2.2 DRILLING, SAMPLING, AND MONITORING WELL INSTALLATION

This section discusses the technical approach and procedures for (1) drilling, (2) sampling soil and groundwater, and (3) monitoring well installation and development.

2.2.1 Drilling Procedure

A single boring will be drilled at each of the three sites (SWMUs 19, 25B, and 27B). The borings will be completed 10 feet into the saturated zone of the regional aquifer. The regional aquifer water table is anticipated to occur at about 350 feet bgs. Drilling deeper than 350 feet bgs will be conducted only upon instruction from Fort Bliss Directorate of Environment. Boreholes will be located on the downgradient side of each oxidation lagoon and placement will be based on the gradient of the regional aquifer (U.S. Geological Survey 1991). Proposed boring locations are presented in Figures 2, 3, and 4. Soil borings will be completed using either an air percussion or reverse air rotary drill rig. The drilling method used will be either dual-wall reverse-circulation air percussion or air percussion with driven casing. Both



MONITORING WELL ID	TOC ELEV (FT MSL)	NG ELEV (FT MSL)	WATER ELEV (FT MSL)
MW-1901	4078.1	4075.02	4018.95
MW-1902	4071.77	4069.01	4014.21
MW-1903	4088.96	4085.28	4037.66

WATER LEVEL MEASUREMENTS COLLECTED ON 11 DEC, 1996

N

LEGEND

- SB# — SOIL BORING LOCATION
- MW# — MONITORING WELL LOCATION
- S# — SURFACE SOIL/SEDIMENT SAMPLE LOCATION
- SW# — SURFACE WATER SAMPLE LOCATION
- WW# — WASTEWATER SAMPLE LOCATION
- 4092 — TOPOGRAPHIC ELEVATION (FT. MSL)
- GROUNDWATER GRADIENT

NOTE: ALL SAMPLE LOCATIONS FROM WESTON RFI REPORT, 1997

PROPOSED DEEP MONITORING WELL LOCATION

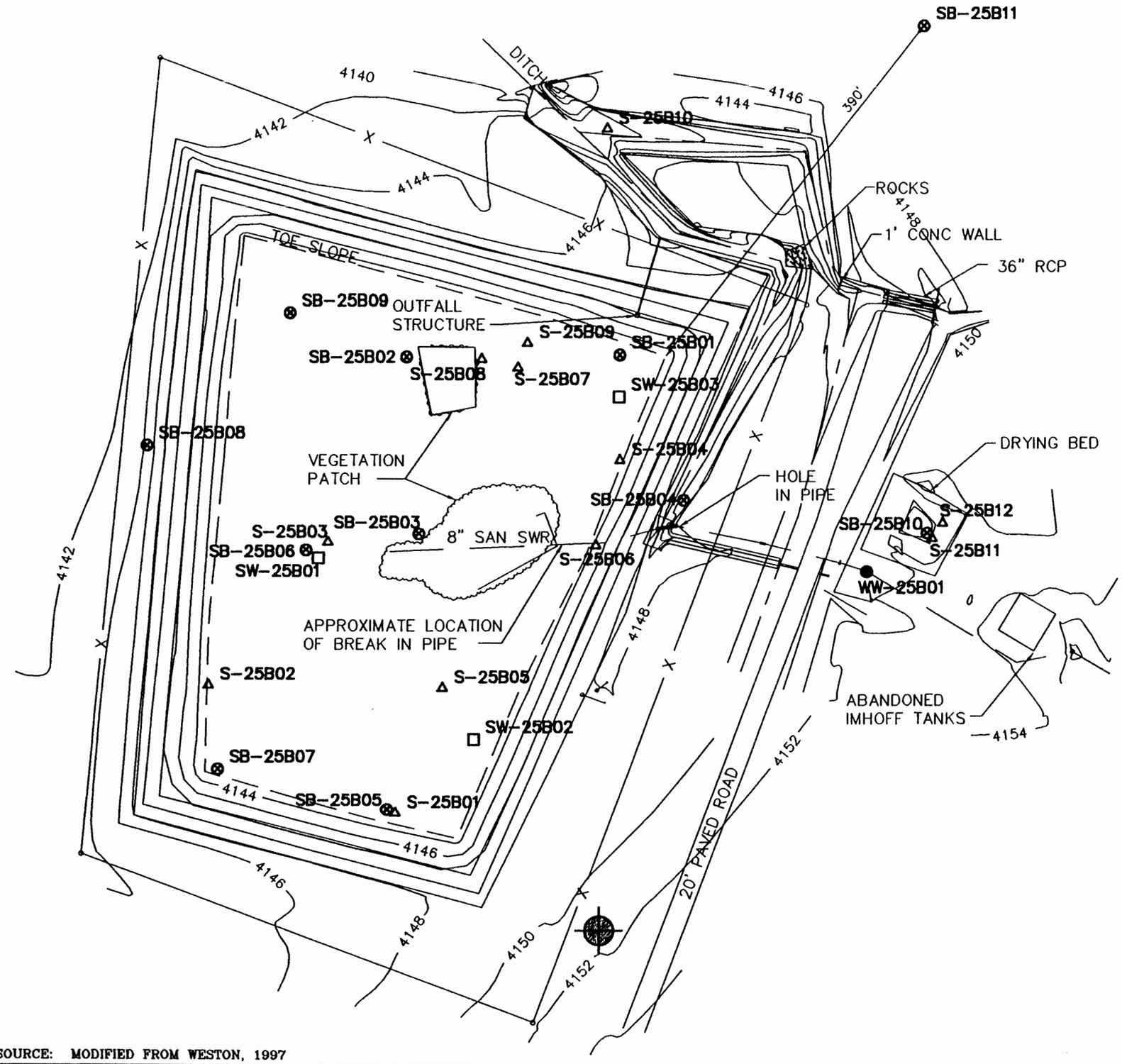
0 75 150
SCALE IN FEET

SOURCE: MODIFIED FROM WESTON, 1997

FORT BLISS MILITARY RESERVATION
EL PASO, TEXAS

FIGURE 2
FORT BLISS RFI
McGREGOR RANGE OXIDATION LAGOON
SWMU No. 19
SITE PLAN AND SAMPLE LOCATION MAP

Tetra Tech EM Inc.

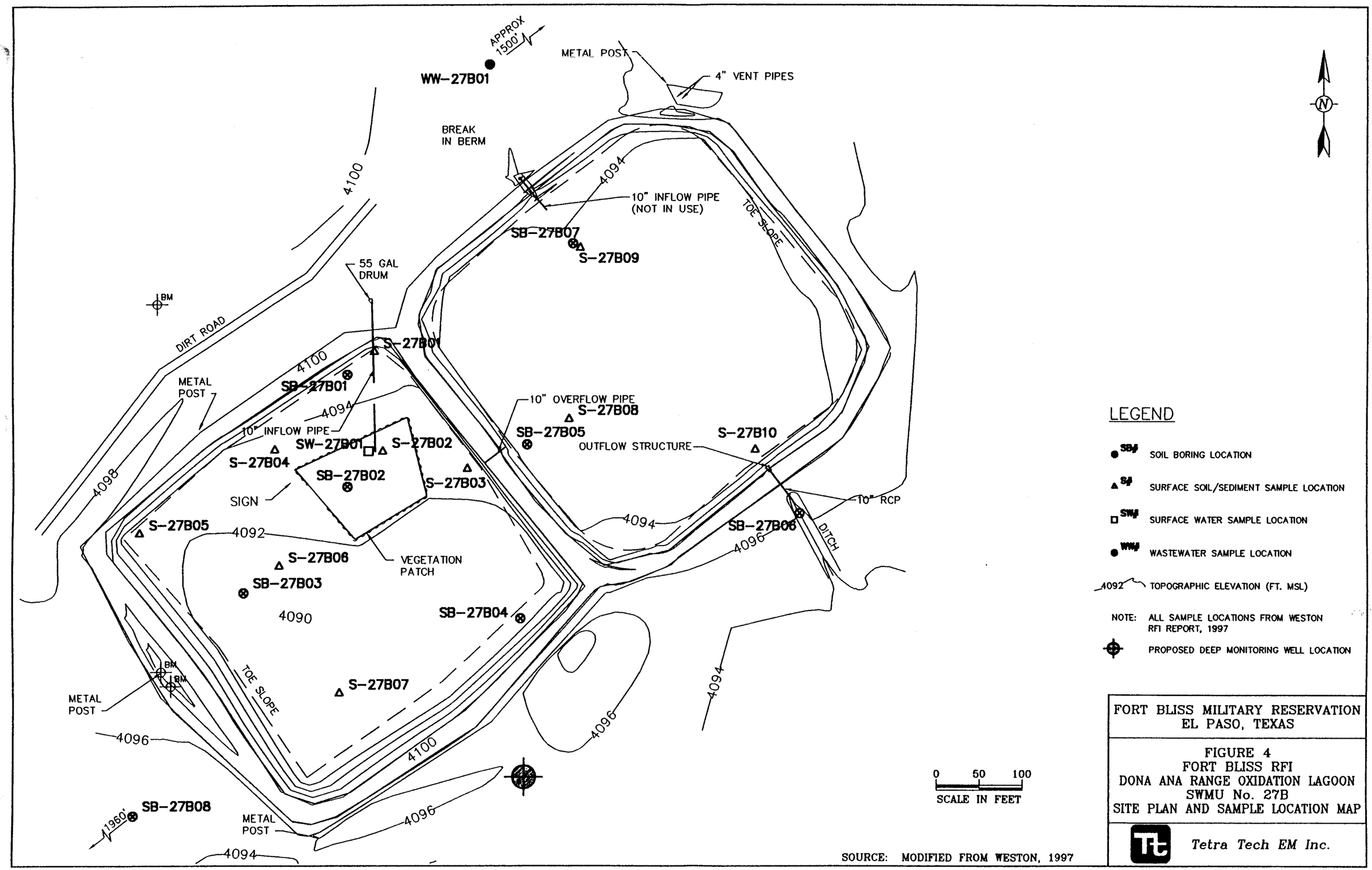


SOURCE: MODIFIED FROM WESTON, 1997

FORT BLISS MILITARY RESERVATION
EL PASO, TEXAS

FIGURE 3
FORT BLISS RFI
OROGRANDE RANGE OXIDATION LAGOON
SWMU No. 25B
SITE PLAN AND SAMPLE LOCATION MAP

Tetra Tech EM Inc.


APPROX 1500'
WW-27B01
METAL POST
4" VENT PIPES
BREAK IN BERM
4100
4094
10" INFLOW PIPE (NOT IN USE)
SB-27B07
S-27B09
TOE SLOPE
55 GAL DRUM
BM
DIRT ROAD
S-27B01
4100
SB-27B01
METAL POST
4094
10" INFLOW PIPE
SW-27B01
S-27B02
S-27B04
SB-27B02
S-27B03
SIGN
4098
S-27B05
4092
S-27B06
SB-27B03
VEGETATION PATCH
4090
SB-27B04
BM
BM
METAL POST
TOE SLOPE
S-27B07
4096
4100
SB-27B08
1960'
METAL POST
4096
4094
10" OVERFLOW PIPE
S-27B08
SB-27B05
OUTFLOW STRUCTURE
S-27B10
10" RCP
SB-27B06
4094
4096
DITCH
4096
4094
LEGEND
SOIL BORING LOCATION
SURFACE SOIL/SEDIMENT SAMPLE LOCATION
SURFACE WATER SAMPLE LOCATION
WASTEWATER SAMPLE LOCATION
4092 TOPOGRAPHIC ELEVATION (FT. MSL)
NOTE: ALL SAMPLE LOCATIONS FROM WESTON RFI REPORT, 1997
PROPOSED DEEP MONITORING WELL LOCATION
0 50 100
SCALE IN FEET
SOURCE: MODIFIED FROM WESTON, 1997
FORT BLISS MILITARY RESERVATION
EL PASO, TEXAS
FIGURE 4
FORT BLISS RFI
DONA ANA RANGE OXIDATION LAGOON
SWMU No. 27B
SITE PLAN AND SAMPLE LOCATION MAP
Tetra Tech EM Inc.

methods continuously advance the casing with the drill bit so that no annular space exists between the formation and the drill pipe, thus avoiding the creation of a vertical migration pathway and preventing any cross-contamination of water-bearing zones during drilling. The methods also allow the near instantaneous delivery of drill cuttings to the surface.

The first perched water-bearing zone encountered at each site will be cased off with surface casing; the surface casing will extend about 3 to 5 feet below the base of the perched zone to minimize the potential for cross-contamination. The casing will be grouted to the surface and allowed to cure for a minimum period of 24 hours. Surface casing will not be installed in any of the deeper perched water-bearing zones. The drilling methods selected provide an effective seal against vertical migration of contaminants and minimize the potential for cross-contamination.

2.2.2 Soil Boring Sampling and Logging

Drill cuttings will be collected from the cyclone sample collector, bagged, and logged at 5-foot intervals; however, because identifying moisture-containing zones is critical to this investigation, drill cuttings will be monitored continuously for the presence of any moisture that may indicate perched water-bearing zones. Down to the level of the first perched aquifer, drill cuttings will be bagged and logged at 2-foot intervals. The on-site geologist will describe the drill cuttings using the unified soil classification code (USCS) terminology and the appropriate Munsell color chart designations. The geologist will also note the moisture content as well as the presence of sedimentary structures and other petrologic characteristics.

2.2.3 Soil Sampling for Geotechnical Analysis

Geotechnical testing will be conducted on soil samples collected at the selected intervals indicated in Table 1. Geotechnical testing will include analysis from the following list of analytic methods:

- Saturated hydraulic conductivity (ASTM D5084)
- Volumetric moisture content (ASTM D2216)
- Porosity (calculated)
- Grain size distribution (ASTM D422, D1140)

TABLE 1
SOIL AND GROUNDWATER SAMPLING SCHEDULE
OXIDATION LAGOONS (SWMU NOS. 19, 25B, AND 27B), FORT BLISS

	Sampling Interval							
Sampling Target	**From (ft bgs)**	**To (ft bgs)**	**Water Samples**	**Shelby tube - Split spoon**	**Bulk Soil**	**Soil Geotech Samples**		**Soil Chem Samples**
	0	10						
	10	20						
	20	30		1		1	b	
	30	40			1	1	a	
	40	50						
Perched aquifer 1	50	60	1	2		1	c	1
Aquitard 1	60	70		2		1	b	1
	70	80						
	80	90						
	90	100		1			b	
	100	110			1	1	a	
	110	120						
	120	130		1			b	
	130	140			1	1	a	
	140	150						
Perched aquifer 2	150	160	1	2		1	c	1
Aquitard 2	160	170		2		1	b	1
	170	180						
	180	190		1		1	b	
	190	200			1	1	a	
	200	210						
	210	220		1		1	b	
	220	230			1	1	a	
	230	240						
	240	250		1		1	b	
	250	260						
	260	270						
	270	280						
	280	290			1	1	a	
	290	300		1		1	b	
	300	310						
	310	320			1	1	a	
	320	330						
Regional Aquifer	330	340	1	1		1	c	
Regional Aquifer	340	350	1	1	1	1	a	1
Total Per Site			**4**	**17**	**8**	**8a, 9 b, 3c**		**5**
Three Site Total			**12**	**51**	**24**	**24a, 27b, 9c**		**15**
QA/QC			**4[d]**					**2[e]**
Total			**16**					**17**

Notes:

a Bulk soil samples will be analyzed for grain size by sieve and hydrometer methods

b Shelby tube will be analyzed for grain size, porosity, moisture content, and vertical permeability

c Shelby tube will be analyzed for grain size, porosity, moisture content, horizontal and vertical permeability

d Quality assurance/quality control (QA/QC) water samples will include one duplicate, two equipment rinsate and one field source blank. An additional six trip blanks will be submitted for analysis of VOC only.

e QA/QC soil samples will consist of two split soil samples

Geotechnical tests for volumetric water content, saturated hydraulic conductivity, and porosity will be conducted on undisturbed samples. Samples analyzed for grain size distribution will include both undisturbed and disturbed (bagged drill cuttings) samples. In general, undisturbed soil samples will be taken at intervals averaging 30 feet.

Undisturbed soil samples collected for geotechnical analysis will be collected with Shelby (thin-walled) tubes and sealed for shipment to the laboratory within 48 hours. An increased number of samples will be collected in perched aquifer zones. Every effort will be made to collect two undisturbed samples in perched aquifer zones and another two in the underlying aquitard layer. The hydraulic conductivity of undisturbed soil samples from the perched aquifer layer will be tested in both the vertical and horizontal directions.

In the event of poor sample recovery using the Shelby tube sampler, geotechnical samples will be collected using a split-barrel sampler. If split-barrel samples are collected, the geotechnical analysis of undisturbed samples will be modified to consist of the following:

- Saturated hydraulic conductivity, repacked specimen (ASTM D5084)
- Grain size distribution (ASTM D422, D1140)

Undisturbed soil samples are obtained by lowering the Shelby tube sampler into the bottom of the borehole. The Shelby tube is attached to the drill rods and then pushed into the undisturbed formation.

2.2.4 Soil Sampling for Chemical Analysis

Soil samples will be collected for chemical analysis from each perched aquifer zone and the underlying aquitard, as indicated in Table 1. Samples for chemical analysis will be collected with a split-barrel sampler with stainless-steel liners. The soil sample is obtained by lowering a clean split-barrel sampler, attached to the drill rods, into the bottom of the borehole. The split-barrel sampler is then driven into the undisturbed formation with a 140-pound hammer dropped from a 30-inch height. After recovery of the sampler, the liners are monitored for organic vapors using a photoionization detector (PID) monitor and inspected for soil type and percentage recovery. Full sample liners, particularly those sample liners showing any indications of contamination, are selected for submission to the laboratory. Soil identified for sampling will be transferred into two pre-cleaned, 8-ounce, glass jars, and will be filled so that no

headspace remains. These samples are sealed and stored in a cooler at 4°C for shipping to the chemical laboratory.

2.2.5 Groundwater Sampling

Discrete groundwater samples will be collected from saturated water zones at each site using a Hydropunch™-type sampling device. Groundwater samples will be collected from each perched water-bearing zone and the regional aquifer. As a contingency against failure to collect a full water sample with the Hydropunch™, grab groundwater samples may be collected from the borehole using a clean stainless-steel or disposable bailer.

2.2.6 Monitoring Well Installation

Monitoring wells will be constructed to screen the top 10 feet of the saturated zone of the regional aquifer. Wells will be constructed of Schedule 80 polyvinyl chloride (PVC) casing and screen. The well screen will be 10 feet in length, continuous, and without blank sections of casing between sections of screen. The screen and casing will be constructed of flush-threaded, Schedule 80 PVC, minimum 2-inch internal diameter (ID) pipe. The well screen will be factory slotted at a width of 0.010 inch. The bottom of the screen will also be fitted with a 2-foot silt trap. The screen and casing will have no stencil marks and will be decontaminated at the point of manufacture and delivered to the site in sealed plastic tubes. No PVC glue will be used with the screen and casing. Stainless-steel centralizers will be placed at the top and bottom of the screen in the center of the boring; additional centralizers will be placed on the casing riser as necessary to maintain well alignment.

The filter pack material placed around the well screen will be selected to be compatible with the aquifer and the screen slot size. The filter pack material will be installed to extend a minimum of 2 feet above the top of the screen. A minimum 2-foot-thick seal of bentonite pellets will be placed above the filter pack and hydrated by placing water in the annulus, as needed, until hydration occurs. The remaining annulus will be filled with a bentonite-portland cement grout. The grout will be tremied into place to completely fill the annulus from the bentonite seal to the ground surface. The end of the tremie pipe will be within 5 feet of the bentonite seal. The placement of grout will virtually be uninterrupted, with minimal time needed between mixing batches of grout. About 24 hours after the annulus has been filled

with grout, the grout will be checked for settlement, and additional grout will be added to fill any depressions, if necessary.

Above-grade surface completions will be used for all three monitoring wells. For above-grade well completions, 8-inch-diameter steel protective casing will be installed, rising 3 feet above the ground surface and set 2 feet bgs. The protective casing will have a lockable, hingeless lid. A 4- by 4-foot-square concrete pad with a minimum thickness of 4 inches will be installed around the protective casing. The pad will be sloped to prevent water from collecting next to the casing. Four cement-filled, 3-inch-diameter steel bumper posts will be securely cemented in 2-foot bgs borings around each well. The bumper posts will be 3 feet above ground surface. The top of the well casing will be capped with a lockable, vented well cap.

2.2.7 Well Development

Initial well development will be performed as soon as feasible, but no sooner than 48 hours after the placement of the grout seal. Wells will be developed using air lift techniques or with a submersible pump. Well development will continue until a minimum of five well volumes has been removed; the purged groundwater is visually free of sediment; and the temperature, specific conductivity, and pH measurements have stabilized. Completion of well development will be determined by the field operations manager.

2.3 GEOPHYSICAL LOGGING

Downhole geophysical logging will be conducted in each of three completed monitoring wells. Each monitoring well will be geophysically logged for electromagnetic induction, neutron, natural gamma, and gamma gamma density.

2.4 WELL AND SITE SURVEYING

Each of the newly installed monitoring wells will be surveyed to establish the following:

- The location of the well
- The elevation above mean sea level (msl) of the ground surface at the base of the well

- The elevation above msl of a reference point at the top of the casing

Elevations and locations of wells will be surveyed with a horizontal (line) accuracy of 0.1 feet and a vertical (grade) accuracy of 0.01 feet. The survey coordinates will be referenced to a U.S. Geological Survey benchmark and reported in New Mexico State Plane and universal transverse mercator (UTM) zone 13, North American datum (NAD) 1983 coordinates. Permanent markers will be installed at each well indicating the elevation of the reference point and the well identification.

All surveying will be conducted by a New Mexico-registered professional land surveyor. The surveyor will provide Tetra Tech with a copy of the field notes and a site plan, showing the coordinates and elevations of the wells. Surveying will be conducted immediately following the well installation activities.

2.5 MANAGEMENT OF INVESTIGATION DERIVED WASTE

Any IDW generated during the subsurface investigation will be containerized at each site. Soil cuttings will be containerized in a single covered roll-off type box at each of the three sites. Decontamination fluids and well development water will be placed in New Mexico Department of Transportation (NM DOT) approved 55-gallon drums. All IDW will be characterized using the analytical results from soil and groundwater samples. IDW will be disposed of in an environmentally responsible manner and in accordance with all state and federal environmental regulations. All IDW will be disposed of by Tetra Tech.

2.6 DECONTAMINATION AND DISPOSAL PROCEDURES

All sampling equipment will be decontaminated in accordance with procedures described in the RFI work plan (Thompson 1996). The purpose of decontamination and cleaning procedures during drilling, well installation, and sampling tasks is to prevent contamination of the samples and cross-contamination between wells. All drill rods, drill bits, sampling equipment, and any other drilling equipment that may come in contact with soil or groundwater will be decontaminated in accordance with the following procedures:

- Wash thoroughly with laboratory grade detergent such as Liquinox and hot water, using a brush to remove any particulate matter or surface film; alternatively, equipment may also be cleaned with tap water using a steam cleaner.

- Wrap the equipment with aluminum foil, if appropriate, to prevent contamination if the equipment is going to be stored or transported.

These decontamination procedures will be implemented in the field between the collection of samples from separate sampling intervals within a borehole and before mobilization to a different borehole location.

3.0 SITE HEALTH AND SAFETY

All field activities will be conducted in accordance with the site specific health and safety plan (Tetra Tech 1997). Personal protection equipment (PPE) will be worn to protect field personnel from known or suspected physical hazards and potential airborne and water-borne contamination in accordance with 29 CFR 1910.95(I), 29 CFR 1910.120(g)(5), and 29 CFR 1910.132 through 1910.134. The selections of the level of personal protection to be used for work tasks have been based on (1) known or anticipated physical hazards; (2) concentrations of contaminants that may be encountered at the sites; and (3) the contaminant's chemical properties, toxicity, exposure routes, and contaminant matrices. Because sufficient information regarding site hazards is available and because minimal hazards are anticipated at the oxidation lagoons, all activities at this site will initially be performed with modified Level D protection (work clothes, gloves, Tyvek coveralls, eye protection, and steel-toed boots) with a contingency to upgrade to personnel protection Level C. Personnel protection Level C will consist modified Level D protection plus an air purifying respirator.

A PID will be used at each well to monitor the breathing zone for organic vapors. The PID will be calibrated prior to each field sampling event and will be checked for proper operation daily before purging and sampling activities begin. The upgrade to Level C personnel protection will be triggered when the PID registers more than 1 part per million of organic vapors in the breathing zone.

4.0 CHEMICAL ANALYSIS

Soil and groundwater samples will be collected for chemical analysis at the depth intervals indicated in Table 1. The samples will be analyzed by a COE-approved, off-site laboratory for the following parameters:

- VOCs (SW 846 EPA method 8260)
- SVOCs (SW 846 EPA method 8270A)
- Pesticides and PCBs (SW 846 EPA method 8080)
- RCRA metals (SW 846)

-	Arsenic	EPA method 7060
-	Barium	EPA method 6010
-	Cadmium	EPA method 6010
-	Chromium	EPA method 6010
-	Lead	EPA method 6010
-	Mercury	EPA method 7471
-	Selenium	EPA method 7740
-	Silver	EPA method 6010

Soil samples for chemical analysis will be collected using a split-barrel sampler. Discrete interval groundwater samples will be collected using a Hydropunch™-type water sampler; additional groundwater samples may also be collected from the borehole using a bailer. One groundwater sample will be collected from each of the three completed monitoring wells using a low-flow submersible pump provided by the Fort Bliss Directorate of the Environment.

5.0 SAMPLE CONTAINERIZATION, LABELING, PRESERVATION, PACKAGING, AND SHIPPING

This section discusses the following sample handling procedures: (1) collection, (2) preservation, (3) labeling, (4) packaging, and (5) shipping and chain of custody.

5.1. SAMPLE COLLECTION

All samples will be placed in appropriate containers to maintain sample integrity and chain of custody during delivery to the analytic laboratory. Appropriate sample containers, holding times, and preservation requirements for soil and water samples are summarized in Table 2.

5.2 SAMPLE PRESERVATION

Soil samples will be preserved by storing them in a chilled cooler at 4°C. Water samples analyzed for VOCs will be preserved with hydrochloric acid. Water samples analyzed for metals will be preserved with nitric acid. Acid-preserved water will have a pH value of 2 or less. Sample labels will indicate which preservative was used. In addition, samples will be placed in plastic bags and stored in coolers packed with cubed ice.

5.3 SAMPLE LABELING

Each sample container will be labeled immediately before or after sample collection. The sample labels will contain the following information:

- Tetra Tech project number
- Site name
- Sample identification number
- Sample matrix type (soil or water)
- Analysis requested
- Date and time of collection
- Preservatives used, if any
- Filtering, if applicable

TABLE 2

SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS FOR SOIL AND WATER SAMPLES, OXIDATION LAGOONS (SWMUs 19, 25B, AND 27B), FORT BLISS

Parameter	Matrix	Method	Container	Preservative	Holding Time
VOCs[1]	Soil	SW 846 EPA 8260	8-oz glass jar	cool, 4° C	14 days
SVOCs	Soil	SW 846 EPA 8270	8-oz glass jar	cool, 4° C	14 days
Pesticides-PCBs	Soil	SW 846 EPA 8280	8-oz glass jar	cool, 4° C	14 days
Metals	Soil	SW 846 EPA 6010/7000	8-oz glass jar	cool, 4° C	14 days
VOCs[1]	Water	SW 846 EPA 8260	2, 40-mL glass vials	HCl to pH <2, 4°C	14 days
SVOCs	Water	SW 846 EPA 8270	2-liter amber glass	cool, 4° C	7 days
Pesticides-PCBs	Water	SW 846 EPA 8280	2-liter amber glass	cool, 4° C	7 days
Metals	Water	SW 846 EPA 6010/7000	1-liter HDPE	HNO_3 to pH<2, 4°C	60 days (28 days for Hg)

Notes:

[1] VOC samples will contain no headspace
mL = Milliliters
HCl = Hydrochloric acid
HNO_3 = Nitric acid
HDPE = High-density polyethylene

5.4 SAMPLE PACKAGING

After labeling, each sample will be refrigerated or placed in a cooler containing ice to maintain the sample temperature at 4°C during storage and transportation.

5.5 SAMPLE SHIPPING AND CHAIN OF CUSTODY

Samples collected for chemical analysis will be shipped to the laboratory the day of sampling or the following day. Two custody seals will be placed on each cooler so that they must be broken to gain access to the cooler's contents. Custody seals will consist of security tape on which the date and initials of the sampler are written in indelible ink. Clear tape will be placed over the custody seals to protect them from accidental breakage.

Shipping coolers will contain bubble wrap and packing material to avoid disturbing the sample containers. Sufficient packing material will be used to prevent sample containers from making contact during shipment. Enough ice will be added to maintain the sample temperature at 4°C.

The chain-of-custody record will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. Samples will be sent to EA Laboratories for analysis. The mailing address and point of contact for the laboratory is as follows:

Mary Asper
Laboratory Project Manager
EA Laboratories
19 Loveton Circle
Sparks, Maryland 21152
(410) 771-4920

A split sample will be sent to the COE analytical laboratory as designated by COE. Tetra will confirm the shipping details for the split sample with the COE technical manager, Beverly Post, at phone number (817) 978-3221, extension 1646.

6.0 QUALITY ASSURANCE

Quality assurance and quality control (QA/QC) measures will be implemented to assist in obtaining accurate and representative environmental samples and to ensure that valid analytical data are collected. QA/QC samples will also be submitted for full chemical analysis. These samples will include the following:

- One field blank of each source of decontamination water
- One equipment rinsate blank from each nondisposable sampling device.
- One duplicate groundwater sample.
- Two duplicate soil samples.
- One trip blank (for VOC analysis only) for each cooler containing samples to be analyzed for VOCs.

One split sample will be collected for both soil and groundwater. The split sample will be submitted to the COE-designated analytical laboratory. A detailed discussion of all QA/QC procedures is provided in the RFI work plan (Thompson 1996).

7.0 VADOSE ZONE MODELING

Vadose zone modeling will be conducted to evaluate solute flow travel times between the surface and the regional aquifer. The steady-state numerical modeling will assume layer heterogeneity and continuously ponded conditions at the oxidation lagoons. Field and laboratory data will be used to define the vertical profile of the lithology, grain size, saturated hydraulic conductivity, and moisture content. Literature-based values will be used to augment field and laboratory data and will be used to derive the soil moisture retention curve and the hydraulic conductivity function with respect to soil moisture.

8.0 REFERENCES

Roy F. Weston, Inc. 1997. Final RCRA Facility Investigation Report for Fort Bliss, Texas. May.

Thompson Professional Group, Inc. 1996. RCRA Facility Investigation Work Plan for Nine Solid Waste Management Units, Fort Bliss, Texas. 2 volumes. July.

Tetra Tech. 1997. Subsurface Investigation of the New Mexico Oxidation Lagoons, Site Specific Health and Safety Plan. November.

U.S. Geological Survey. 1991. Geohydrology and Potential Effects of Development of Freshwater Resources in the Northern Part of the Hueco Bolson, Doña Ana and Otero Counties, New Mexico, and El Paso County, Texas. Water Resources Investigations Report 91-4082.