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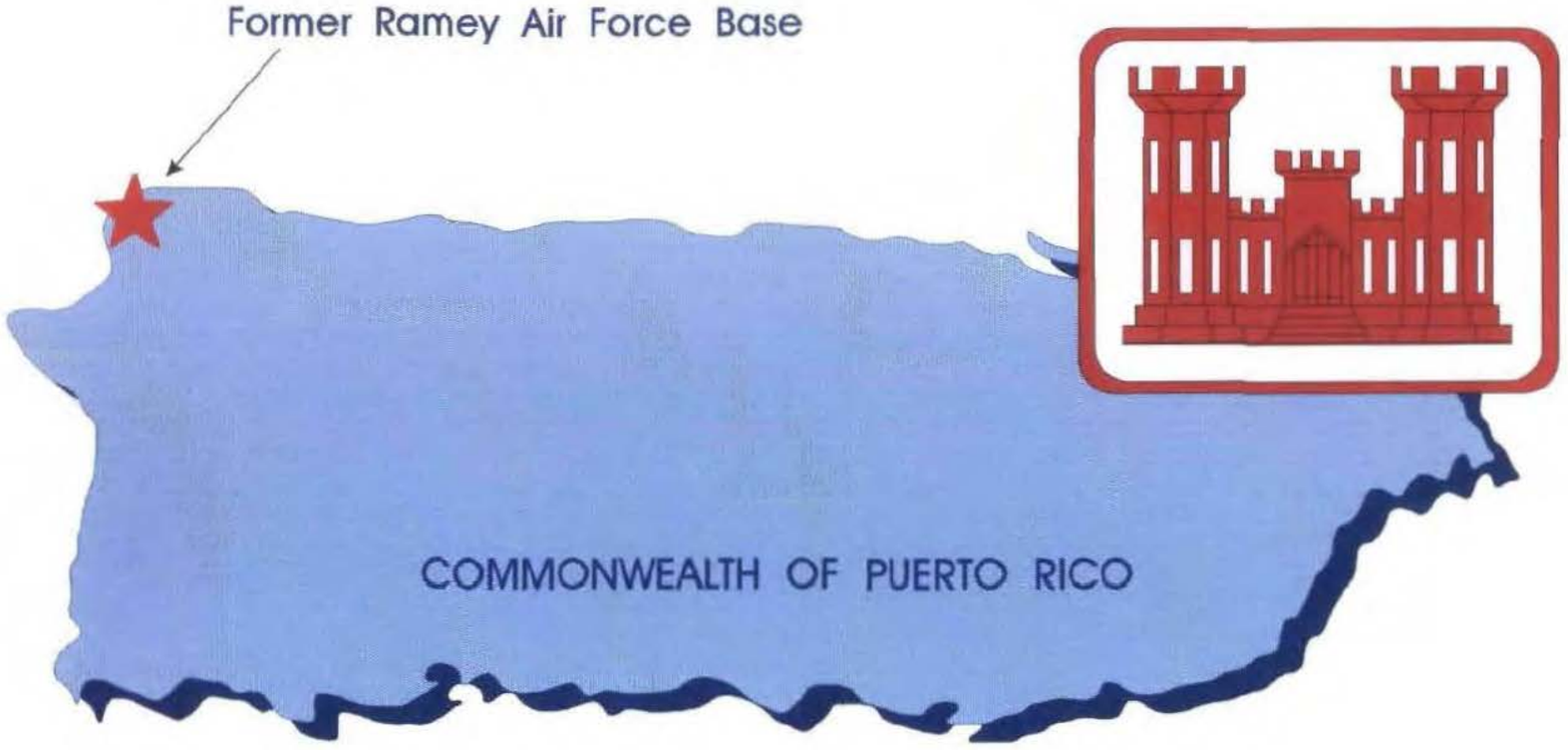
SITE INVESTIGATION WORK PLAN FOR LANDFILL AREAS 1 AND 2, FORMER RAMEY AIR FORCE BASE, AGUADILLA, PUERTO RICO

FINAL - VOLUME 1

February 1997



Prepared for:

Savannah District,
United States Army Corps of Engineers

ecology and environment, inc.
International Specialists in the Environment

VN3900_P0032

FINAL

SITE INVESTIGATION WORK PLAN FOR LANDFILL AREAS 1 AND 2, FORMER RAMEY AIR FORCE BASE, AGUADILLA, PUERTO RICO

Contract No. DACA21-93-D-0034
Delivery Order No. 0021

February 1997

Prepared for:

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PUERTO RICO PROFESSIONAL ENGINEER CERTIFICATION

I hereby affix my seal to the Work Plan for the Completion of a Site Investigation at Landfill Areas 1 and 2, Former Ramey Air Force Base, Aguadilla, Puerto Rico, in accordance with the laws and regulations of the Commonwealth of Puerto Rico.

Luis A. Morales, P.E.

17 JAN 1997
Date

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LIST OF ACRONYMS

AFB	Air Force Base
ASC	Analytical Services Center
AST	aboveground storage tank
BGS	below ground surface
BNA	base neutral/acid extractable organic compound
CAP	Corrective Action Plan
CDAP	Chemical Data Acquisition Plan
CSA	chemical safety audit
DMP	Data Management Plan
EPA	U.S. Environmental Protection Agency
EQB	Puerto Rico Environmental Quality Board
E & E	Ecology and Environment, Inc.
GDAP	Geologic Data Acquisition Plan
IDW	investigation-derived wastes
NGVD	National Geodetic Vertical Datum
OSWER	Office of Solid Waste and Emergency Response
OVA	Organic Vapor Analyzer
PCB	polychlorinated biphenyl
PMP	Project Management Plan
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control

List of Acronyms (Cont.)

RCRA	Resource Conservation and Recovery Act
SCDAP	Site-Specific Chemical Data Acquisition Plan
SSHP	Site-Specific Safety and Health Plan
TAL	target analyte list
TCLP	Toxicity Characteristic Leaching Procedure
TOC	top of casing
TOIC	top of inner casing
TOV	total organic vapor
TPH	total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
VOC	volatile organic compound

1. INTRODUCTION

This work plan outlines proposed procedures and methodologies to be used in conducting a site investigation (SI) of Landfill Areas 1 and 2 at the former Ramey Air Force Base (AFB) in Aguadilla, Puerto Rico. This work plan was prepared by Ecology and Environment, Inc., (E & E) for the Department of the Army, Savannah District, United States Army Corps of Engineers (USACE), under Contract Number (No.) DACA21-93-D-0034. This work plan was developed based on the initial USACE scope of services and a site meeting conducted on April 15, 16, and 17, 1996, between USACE and E & E.

The purpose of the site investigation at the Landfill Areas is to identify the presence or absence of any groundwater or soil contamination at either site which is attributable to former DOD activities at the former Ramey AFB. E & E will confirm the presence or absence of soil, sediment, surface water, and groundwater contamination associated with each landfill. During investigation activities, E & E will make all reasonable efforts to interview persons knowledgeable about former site activities to confirm the presence or absence of materials directly attributable to past DOD activities. The site investigation will be conducted in accordance with all applicable USACE, federal, Commonwealth of Puerto Rico, and local regulations and guidelines.

2. WORK PLAN SUPPORT DOCUMENTS

In addition to this work plan, several administrative documents, which contain detailed information, have been generated and will be used as guidance documents throughout these investigations. These documents are submitted and referenced in this work plan, as appropriate. The following subsections summarize the type of information contained in these plans.

2.1 PROJECT MANAGEMENT PLAN

E & E has prepared a Project Management Plan (PMP) that presents E & E technical and managerial approaches to this investigation and the personnel involved in managing this project, including support personnel and subcontractors who will be involved throughout each phase of work. The project management process includes preparation of monthly project status reports; coordination of schedules, mobilizations, and other project incidentals with USACE; management of project staff; coordination with the E & E support groups (e.g., publications, laboratory); and ongoing project review by E & E technical managers and directors. These project management steps are described in detail in the PMP.

2.2 SITE-SPECIFIC SAFETY AND HEALTH PLAN

E & E has prepared a Site-Specific Safety and Health Plan (SSHP) for this project. The SSHP includes information regarding the toxicological properties of potential contaminants and other health hazards potentially associated with this site and emergency action information. The SSHP addresses personal protection issues related to investigations of contaminated sites and will be followed by all personnel participating in the site investigation activities.

2.3 GEOLOGIC DATA ACQUISITION PLAN

E & E has prepared a Geologic Data Acquisition Plan (GDAP) that outlines E & E's standardized procedures for performing geologic field activities for this project. The GDAP presents detailed procedures for field quality assurance (QA) and quality control (QC), geophysical surveys, drilling methods, soil boring/monitoring well installation, determination of groundwater flow direction, geotechnical sampling, surveying, decontamination, and handling of investigation-derived wastes (IDW).

E & E will implement procedures detailed in the GDAP to ensure that high-quality data are collected to support site characterization, analysis, and recommendations. These procedures are consistent with the requirements of USACE, the U.S. Environmental Protection Agency (EPA), the Commonwealth of Puerto Rico, and the data quality objectives of this work plan.

2.4 CHEMICAL DATA ACQUISITION PLAN

E & E has prepared a Chemical Data Acquisition Plan (CDAP; now referred to as a Sampling and Analysis Plan or SAP) that presents the organization, objectives, policies, activities, and specific QA and QC procedures that will be employed by E & E to ensure that all technical data generated during the performance of the site investigation are accurate, representative, and ultimately capable of withstanding judicial scrutiny. The CDAP complies with USACE requirements (including *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3, and Table I-1 of that document, dated 30 June 1995) and EPA's *Engineering Compliance Branch Standard Operating Procedures and Quality Assurance Manual* (EPA 1991a).

2.5 DATA MANAGEMENT PLAN

E & E has prepared a Data Management Plan (DMP) that describes the methods, techniques, and procedures that will be used to ensure that all data produced during the project will be accurately gathered, recorded, maintained, and reported. Data presented in reports will be in the following forms: listed, sorted, tabulated, graphed, charted, or any combination thereof. Figures and charts will be used to clearly highlight the relationships of the data at the site.

3. SITE BACKGROUND AND SETTING

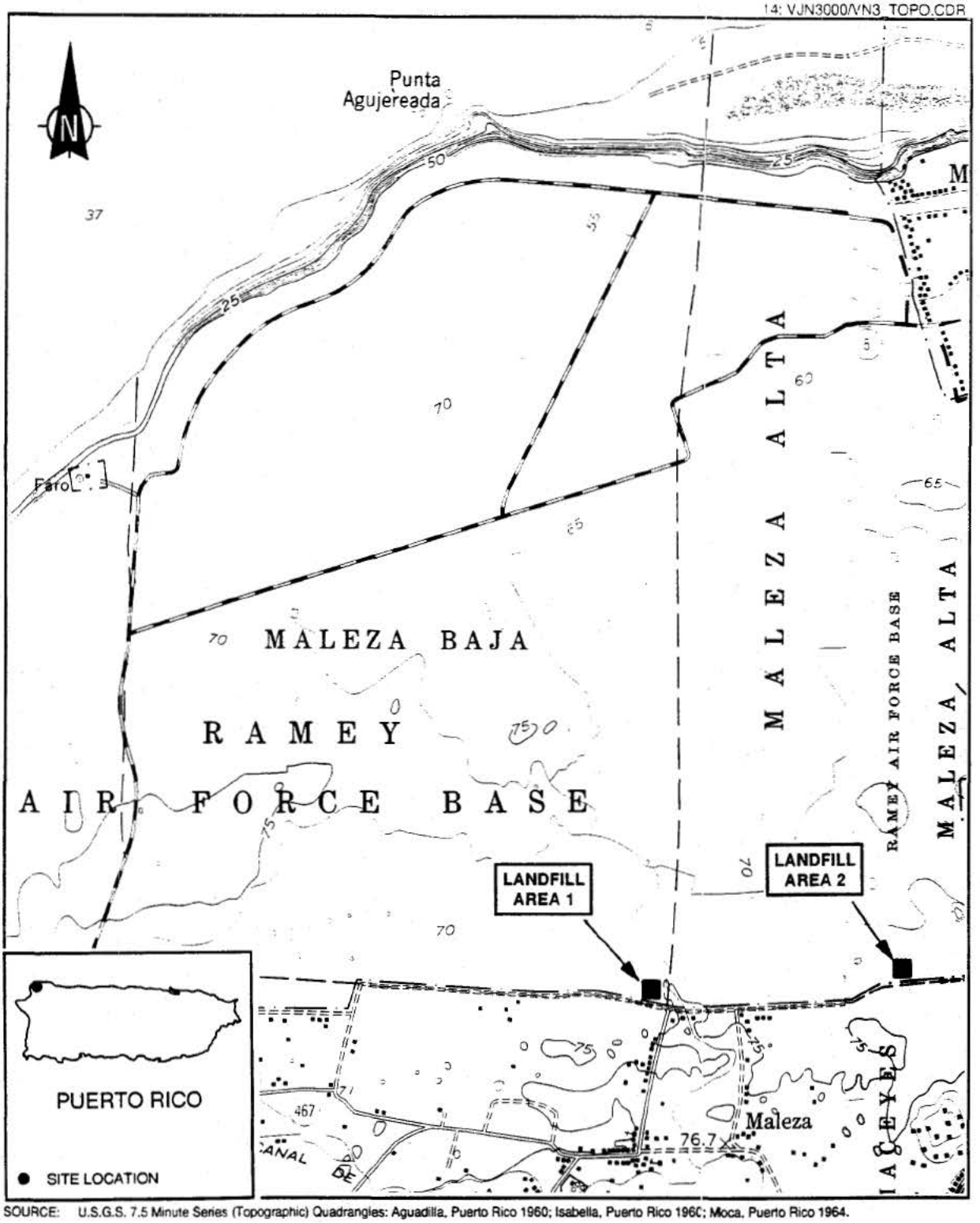
3.1 DESCRIPTION

3.1.1 Former Ramey Air Force Base

The former Ramey Air Force Base occupied approximately 4,357 acres north of the city of Aguadilla, on the extreme northwestern tip of the island of Puerto Rico (see Figure 3-1). The U.S. government acquired the property between 1939 and 1963 and utilized the site as a fully operational Air Force base until its deactivation in 1973 (see Figure 3-2). On March 1, 1974, ownership of most of the property was transferred to the Puerto Rican Industrial Development Company. Since March 1974, numerous land parcel transfers have occurred between U.S. government agencies, the U.S. government and private companies, and the U.S. government and local government agencies. This area is now operated by the Puerto Rican Port Authority as a municipal airport and industrial park, except for approximately 125 acres that are still utilized by the U.S. government as a U.S. Coast Guard installation (USACE 1992).

3.1.2 Landfill Area 1

Landfill Area 1 is located adjacent to, and south of, the airfield runway (see Figure 3-3). Area 1 is approximately 18 acres in area (USACE, 1996). Site features include a large (approximately five acres) sinkhole up to 25 feet deep, a fossilized coral reef forming a 30-foot high, 3-acre hill, and a broad, fenced area of heavy undergrowth, high grass, and trees. The hill is situated in the northern portion of the site. The site generally slopes at approximately 5° to the west, toward the sinkhole. Surface drainage of the site is into the sinkhole. Topographic relief at the site is approximately 100 feet. The site is reportedly used to graze cattle. Evidence that the site was used as a landfill includes abundant construction



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Aguadilla, Puerto Rico 1960; Isabella, Puerto Rico 1960; Moca, Puerto Rico 1964.

SCALE

0 .5 1 MILE

0 1000 2000 3000 4000 5000 FEET

Figure 3-1 LOCATION MAP -- LANDFILL AREAS 1 AND 2 AT THE FORMER RAMEY AIR FORCE BASE, AGUADILLA, PUERTO RICO

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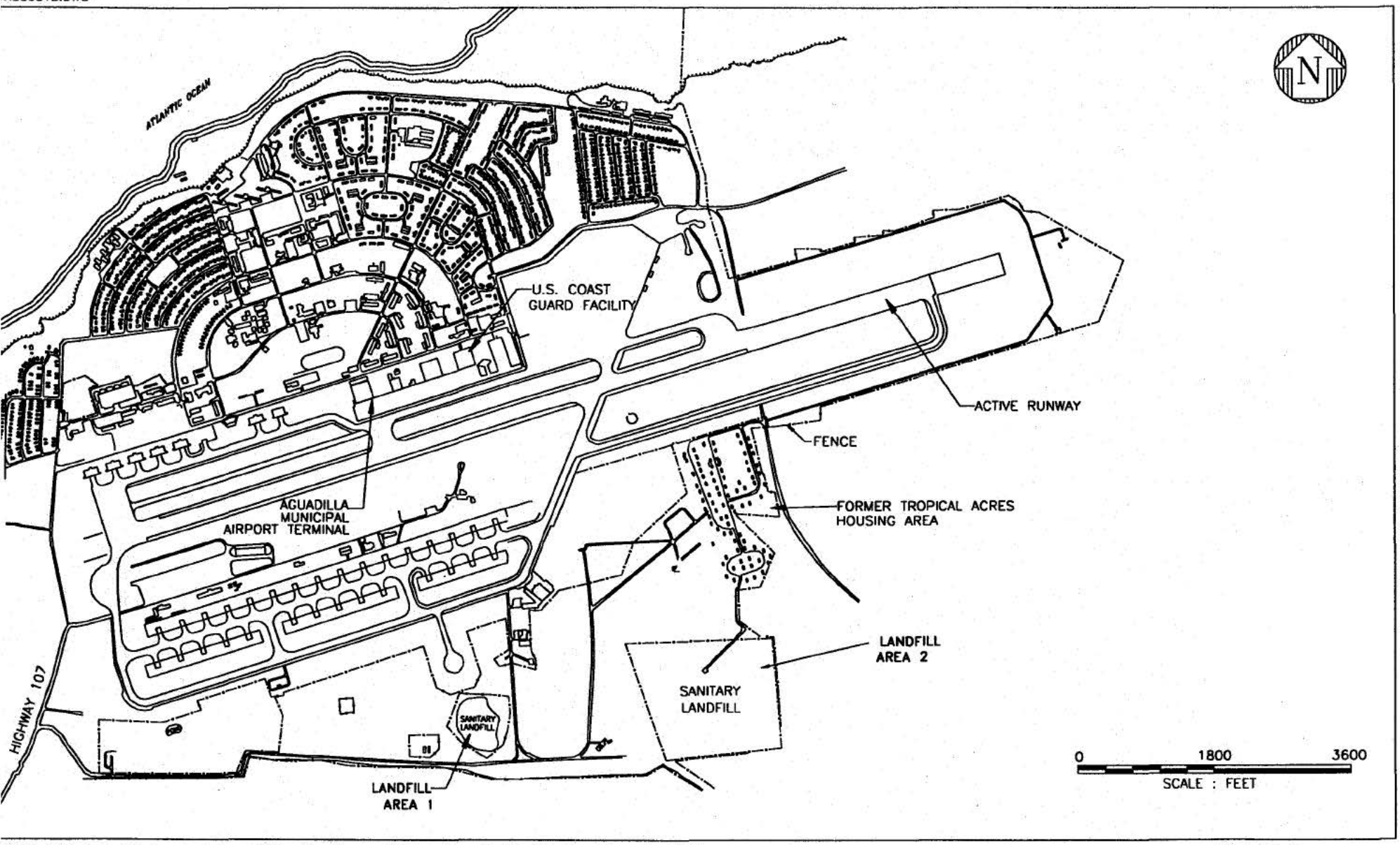

)URCE: Ecology and Environment, Inc., 1996., after Ramey Air Force Base Master Plan Map, November 1966.

Figure 3–2
HISTORICAL SITE VICINITY MAP
LANDFILL AREAS 1 and 2
AT THE FORMER
RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

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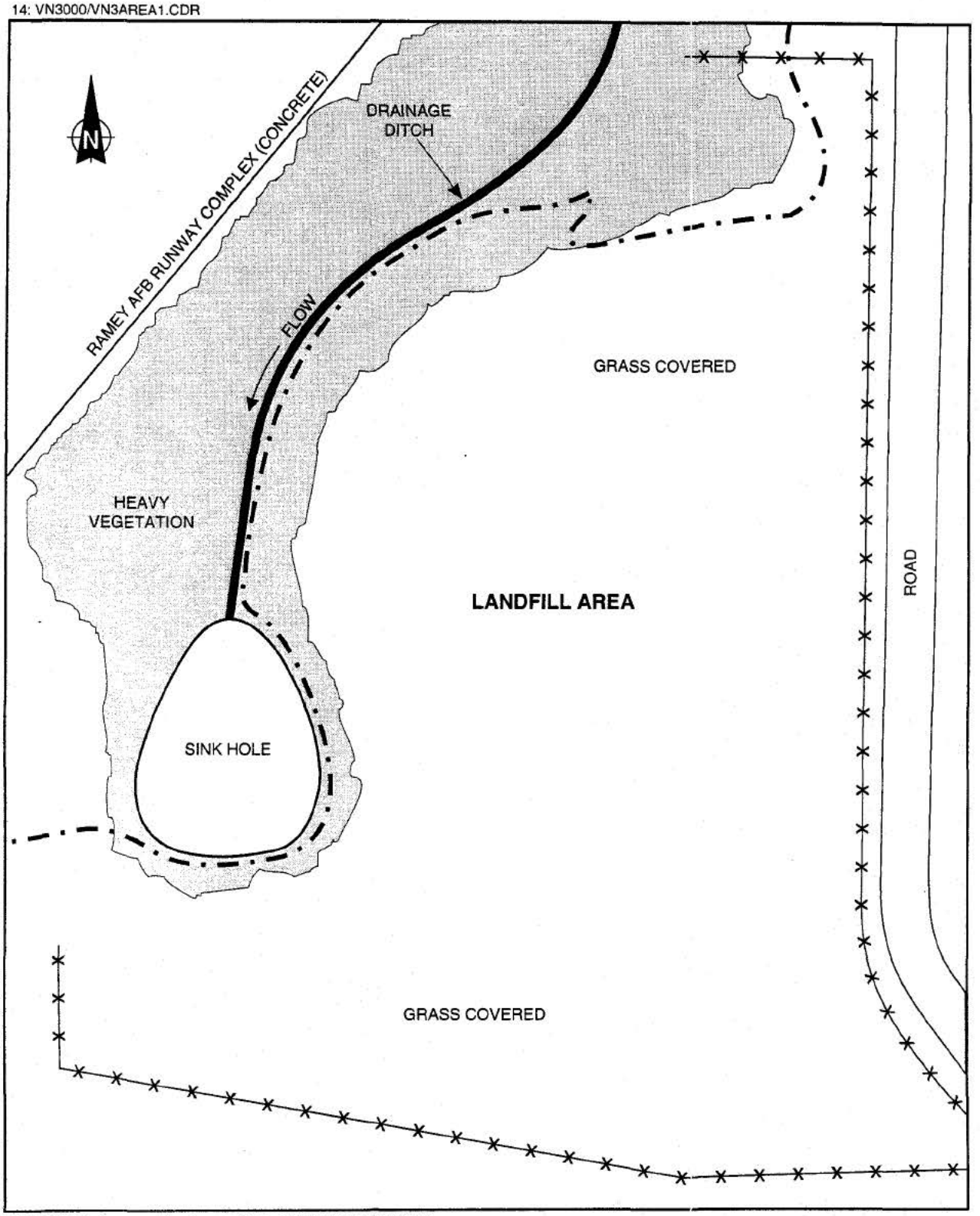

SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE
0 200 400 Feet

KEY:
Fence
Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)
Tree Line

Figure 3-3 SITE PLAN MAP -- LANDFILL AREA 1
FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

debris observed at and near the ground surface, and construction debris and scrap metal observed inside the sinkhole. Various medical wastes have also been observed inside the sinkhole, including intravenous bags and tubing, and syringes. Medical wastes appeared to have come from broken fabric bags buried with other debris. The southern end of the bottom of the sinkhole is covered by soil and undergrowth. In the northern end of the sinkhole exposed heavily weathered limestone was observed, and a potential karst limestone pipe, which likely drains the sinkhole, was observed. This feature was choked with large pieces of metal debris, limestone boulders, and logs. The sinkhole reportedly receives stormwater runoff from the runway via a drainage ditch. Evidence of storm water flow was observed, and debris caught in tree branches indicated the water level inside the sinkhole has exceeded eight feet in the past. USACE also reported standing water in the sinkhole during a December 1995 site visit (E & E 1996e).

USACE conducted a geophysical survey of Landfill Area 1 in February 1996, which identified subsurface anomalies which are expected to indicate areas where landfill material is buried. The survey results indicate subsurface anomalies extend beyond the extent of the USACE survey (See Appendix B). This suggests the extent of the landfill boundaries is still unknown (USACE 1996a; USACE 1996b).

USACE accompanied E & E on a site visit April 16, 1996. Observations of site conditions are included in the above site description. E & E also conducted a file review in Puerto Rico, and a document search summary is included in Appendix A (E & E 1996e).

3.1.3 Landfill Area 2

Landfill Area 2 is located south of the former "Tropical Acres" housing area. The site is approximately 65 acres in area, and is currently used to graze cattle (USACE 1996; E & E 1996). The site is generally flat-lying, grass-covered, and sectioned with barb-wire fencing Site features include several concrete building foundations, a newly constructed watering pond for cattle, and a shallow drainage ditch running along the northwestern margin of the site (see Figure 3-4). Evidence that the site was used as a landfill includes garbage and debris observed along the eroded sides of the drainage ditch. It is reported that the landfill received municipal, household garbage from the former, adjacent housing development. Several building foundations were observed at the site. These foundations were overgrown, and appeared to be of an age and design consistent with former DOD activity at the former

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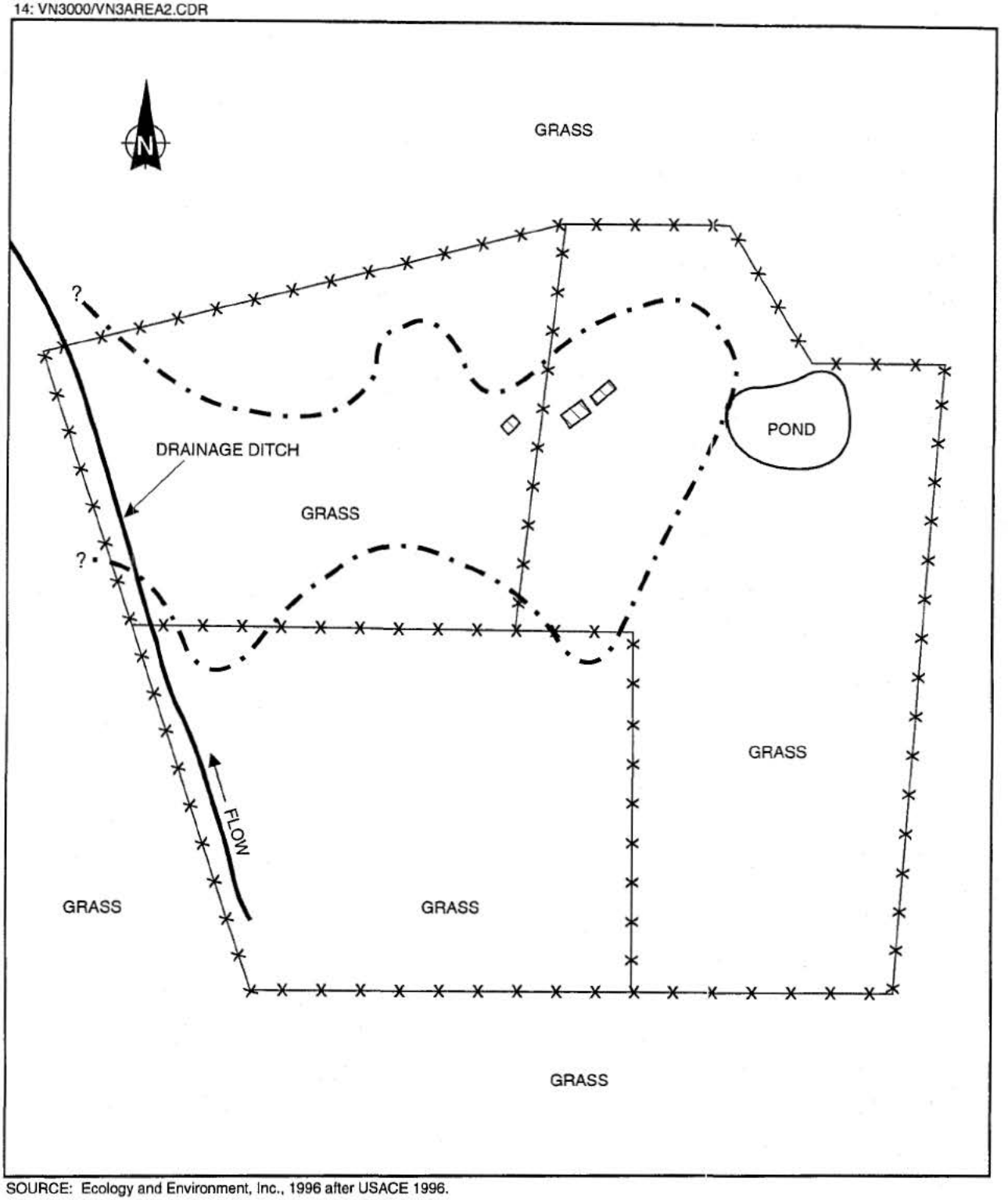

SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE

0 400 800 Feet

KEY:

Fence — Building Foundations — Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)

NOTE: Approximate boundary of landfill has not been delineated to the Northwest.

Figure 3-4 SITE PLAN MAP -- LANDFILL AREA 2
FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

Ramey Air Force Base (USACE 1996, E & E 1996).

USACE conducted a geophysical survey of Landfill Area 2 in February 1996, which identified subsurface anomalies which are expected to indicate areas where landfill material is buried. The survey results indicate subsurface anomalies extend beyond the extent of the USACE survey (see Appendix B). This suggests the extent of the landfill boundaries is still unknown (USACE 1996a; USACE 1996b).

USACE accompanied E & E on a site visit April 16, 1996. Observations of site conditions are included in the above site description. E & E also conducted a file review in Puerto Rico, and a document search summary is included in Appendix A (E & E 1996e).

3.2 REGIONAL GEOLOGY/HYDROGEOLOGY

3.2.1 Hydrogeology

Landfill Areas 1 and 2 occur within the Northern Coastal physiographic region of the island of Puerto Rico. The Northern Coast slopes gently from the foothills, which mark the Cordillera Central Mountain region, to the Atlantic Ocean. Surficial deposits consist of sand, silt and limestone clays, overlying a dissected paleo surface, the remnants of which stand above the lowlands as isolated *mogotes*, or limestone hills (Rodriquez - Martinez 1995; Tucci/Martinez 1995).

The sites and vicinity are underlain by Quaternary-age sand deposits. These deposits are characterized as unstratified, fine- to medium-grained quartz sand, and light- to moderate-brown clays. These unconsolidated materials are between 0 and 100 feet thick (USGS, 1969).

The surficial deposits are underlain by the Micocene-age Aymamon Limestone, which outcrops at Landfill Area 1. The Aymamon is typified by tropical karstic topography, including sinkholes and mogotes, both of which occur at Landfill Area 1. Dissolutioning of the Aymamon is generally very active in the intermogotal areas in the vicinity of the site. The Aymamon is characterized as a very dense, conchoidally fracturing limestone of white, light gray, buff and rose colors. The formation is estimated to be up to 1,000 feet thick beneath the site (Rodriquez-Martinez 1995; Tucci/Martizez 1995).

The Miocene-age Aquada Limestone underlies the Aymamon Limestone. The Aquada is characterized as a hard, thick-bedded to massive calcarenite and dense limestone interbedded with chalky limestone and marl, commonly containing some quartz grains. The

formation is estimated to be up to 1,000 feet thick beneath the site (Rodriquez-Martinez 1995).

3.2.2 Aquifer Description

Most groundwater in the site vicinity occurs within the water-table aquifer that extends throughout the North Coast Province. An underlying artesian aquifer, which is an important source of water in North-Central Puerto Rico, becomes fragmented and unproductive in the site vicinity (Tucci/Martinez 1995).

The water-table aquifer extends from the water-table surface to the top of the freshwater/saline-water interface. This is not a sharp interface, but rather a gradational zone 75 to 115 feet thick. The water-table aquifer is composed of the Aymamon and Aquada limestones, although some alluvial deposits are present in the uppermost portion of the aquifer in some coastal areas. The Aymamon is the most important part of the aquifer beneath the site because the Aquada lies below the freshwater/saline-water interface (Tucci/Martinez 1995).

3.2.3 Aquifer Characteristics

Estimated hydraulic conductivities within the Aymamon Limestone range from 57 to 570 feet per day and diminishes with depth. This diminishing is likely related to the maximum effective depth to which karstification will occur within the aquifer. Estimates of transmissivity in the site vicinity are sparse because no rigorous aquifer tests have been conducted in the area. Continuous streamflow and groundwater-level data were not obtained until 1985. Available transmissivity estimates for the freshwater zone of the water table aquifer range from 200 to more than 280,000 square feet per day. Transmissivity values this high probably reflect cavernous porosity and enhanced dissolutioning along bedding planes, joints, and fractures. The Aymamon in the site vicinity is also mostly a grainstone-packstone and coral boundstone with as much as 25 percent total porosity (Rodriquez-Martinez 1995; Tucci/Martinez 1995).

Groundwater is expected to be encountered from 100 to 150 feet below ground surface (BGS). The flow direction in the water table aquifer would be expected to be generally to the northwest, toward the Atlantic Ocean coastline.

3.2.4 Aquifer Use

The Puerto Rico Aqueduct and Sewer Authority (PRASA) reports that domestic water supply in the vicinity of the site is obtained from several surface water reservoirs located between 5 and 10 miles south and southeast, and upgradient of the site. All of the former Ramey Air Force Base is supplied by PRASA, and no indication of private supply wells for domestic use could be found during the site visit and file review (PRASA 1983; E & E 1996e).

4. ASSESSMENT ACTIVITIES

4.1 GEOPHYSICAL SURVEY

4.1.1 Landfill Area 1

A geophysical survey using an EM-31 will be conducted at Landfill Area 1 to identify the extent of landfill to the south and east. The new survey will overlap the previous USACE geophysical survey by approximately 150 feet and will extend south approximately 200 feet from the southern border of the USACE survey and east approximately 200 feet from the eastern border of the USACE survey. The survey will be performed on 50-foot centers to match the USACE survey. Section 5.1 of the GDAP describes the survey methodology.

4.1.2 Landfill Area 2

A geophysical survey using an EM-31 will be conducted in the northwest quadrant of Landfill Area 2. The new survey will overlap the previous USACE geophysical survey by approximately 150 feet and extend over an area approximately 800 feet by 800 feet using a data point spacing of 50 feet to match the USACE survey. Section 5.1 of the GDAP describes the survey methodology.

4.2 SURFACE WATER/SEDIMENT ASSESSMENT

One surface water and one sediment sample will be collected from the bottom of the sinkhole at Landfill Area 1 (see Figure 4-1). The sediment sample will be collected from 0 to 0.5 feet below the substrate along the eastern side of the sinkhole near areas where landfill material is being eroded and transported into the sinkhole by storm water. If no standing water is present in the sinkhole during the sampling effort, two surface soil samples will be collected instead of the surface water and sediment samples. In either case, sample locations will be selected along the most probable drainage pathway. Both samples will be analyzed for

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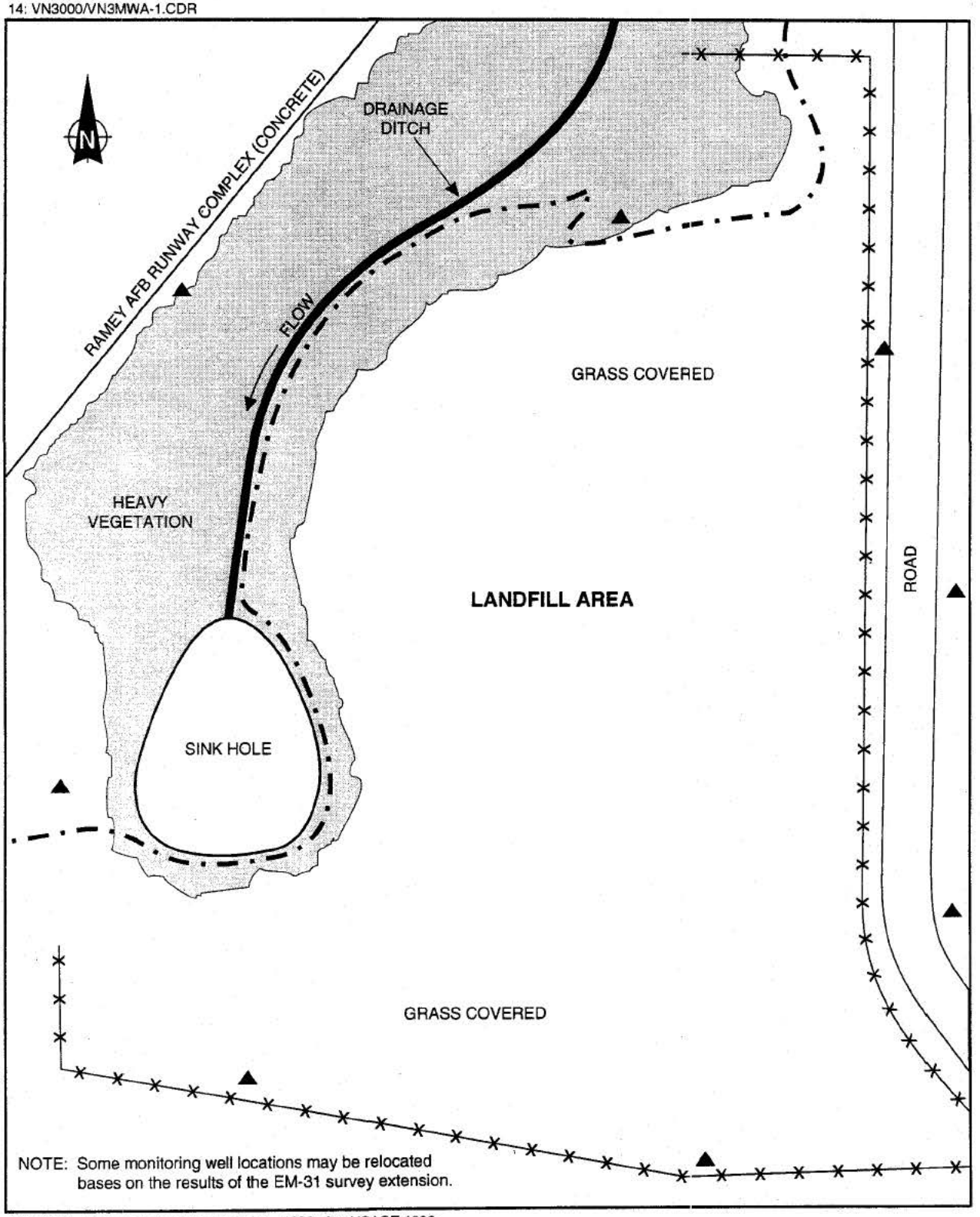

SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE

0 200 400 Feet

KEY:

- ▲ Proposed Monitoring Well Locations
- Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)
- Fence
- Tree Line

Figure 4-1 PROPOSED MONITORING WELL LOCATIONS -- LANDFILL AREA 1 FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

volatile organic compounds (VOCs; EPA Method 8260), base/neutral and acid extractable organic compounds (BNAs; EPA Method 8270B), pesticides and polychlorinated biphenyls (PCBs; EPA Method 8081), Target Analyte List (TAL) metals: silver, aluminum, arsenic, barium, beryllium, calcium, cadmium, chromium, copper, iron, mercury, potassium, magnesium, manganese, sodium, nickel, lead, antimony, selenium, titanium, vanadium and zinc (EPA Methods 6010, 7060, 7421, 7740, 7841, 7470, and 7471), and Total Petroleum Hydrocarbons (TPHs; EPA Method 8015M; see Table 4-1). In addition, the sediment sample will also be analyzed for explosives (EPA Method 8330). Decontamination procedures and management of IDW are described in the CDAP (Section 4.4.10 and 4.4.12 respectively), and in Section 4.7 of this work plan.

4.3 GROUNDWATER ASSESSMENT

4.3.1 Monitoring Well Installation

Because the exact depth to groundwater at the site is unkown and portions of the landfill boundaries have not been delineated, the number and locations of monitoring wells to be installed will not be finalized until the geophysical surveys are performed and an initial borehole is completed. The number and distribution of monitoring wells are proposed for three scenarios and that balance the need to adequately detect possible groundwater contamination emanating from the landfills and the level of effort needed to install the monitoring wells. If the depth to groundwater is less than 125 feet BGS, eight monitoring wells will be installed at each of the two landfills as shown in figures 4-1 and 4-2. If depth to groundwater is determined to be 125 to 175 feet BGS, five or six monitoring wells will be installed at each landfill. If depth to groundwater is determined to be greater than 175 feet, four or five monitoring wells will be installed at each landfill. Under either of the latter two scenarios, one of the wells at each landfill will be located upgradient (i.e., southeast) of the respective landfill; the other wells will be appropriately located along the northern and western perimeter of each landfill, which is presumed to be the downgradient direction (toward the coast).

The proposed monitoring well locations were chosen based on the USACE geophysical survey results, which located subsurface anomalies. These locations are intended to allow for groundwater data collection from points upgradient, downgradient, and adjacent to these anomalies. However, well locations along the southern and eastern boundaries of Landfill Area 1 and northwestern boundary of Landfill Area 2 are subject to change pending completion of the proposed supplemental geophysical surveys. The remainder of this section

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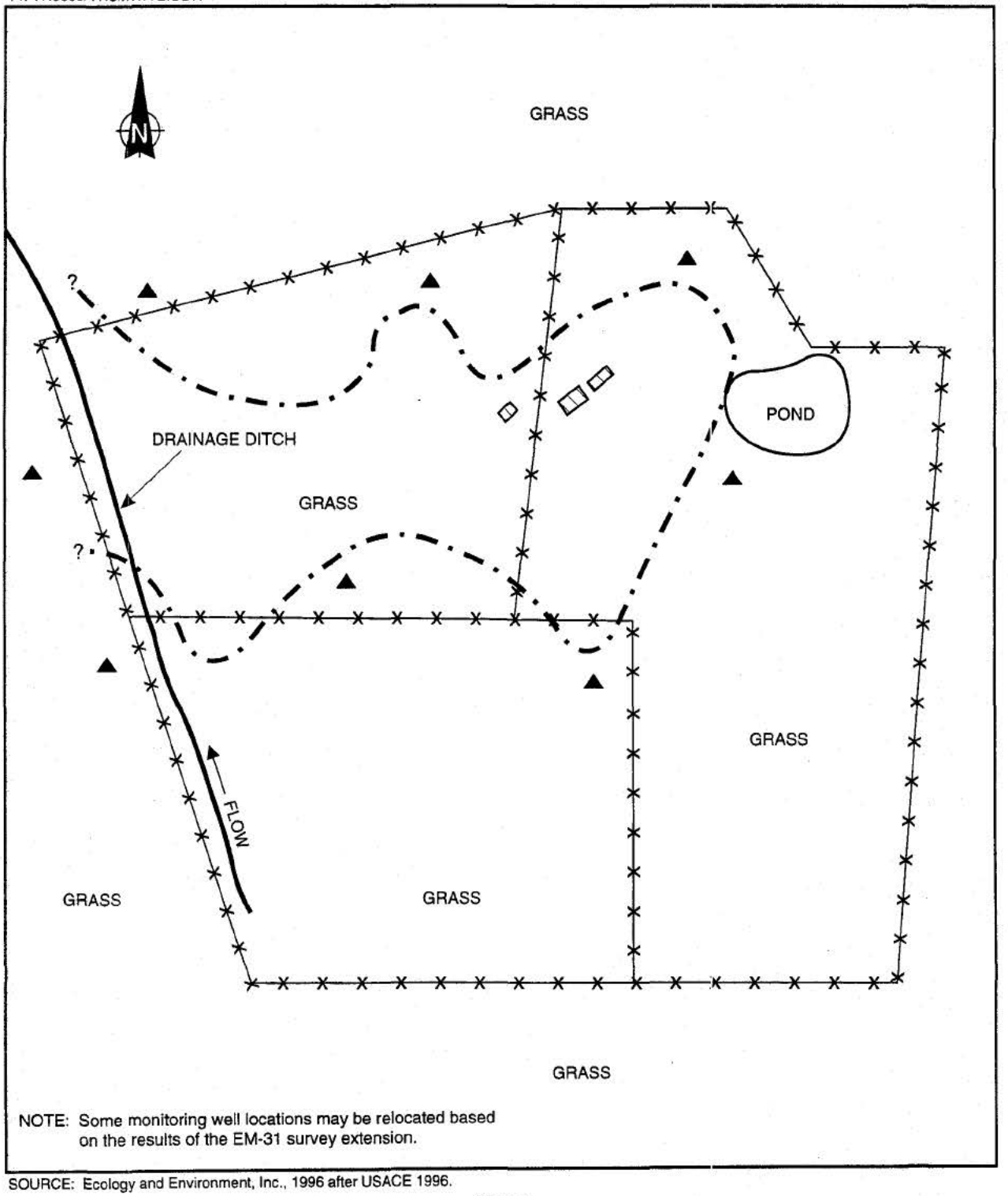


SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE

0 400 800 Feet

KEY:

▲ Proposed Monitoring Well Locations

Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)

Fence

Building Foundations

NOTE: Approximate boundary of landfill has not been delineated to the Northwest.

Figure 4-2 PROPOSED MONITORING WELL LOCATIONS -- LANDFILL AREA 2 FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

(Section 4) is based on the assumption that eight wells will be installed at each landfill area.

Eight 2-inch inside diameter, Schedule 40 polyvinyl chloride (PVC), monitoring wells will be installed at each of the two landfill areas using a drill rig equipped with hollow-stem augers and tri-cone reverse air coring techniques as described in Section 3 of the GDAP. All reasonable efforts will be made to avoid encountering subsurface scrap material that has been deposited at the site. Each location will be screened using a metal detector/magnetometer prior to intrusive activities. Soil samples will be collected using split-spoon techniques. Split-spoon samples will be collected on 5-foot centers beginning at ground surface, and terminating at the top of bedrock (estimated to occur at 35 feet BGS). A total of eight soil samples will be collected from each borehole.

The eight soil samples collected from each monitoring well borehole will be analyzed for VOCs (EPA Method 8260), BNAs (EPA Method 8270B), pesticides and PCBs (EPA Method 8081), TAL metals: silver, aluminum, arsenic, barium, beryllium, calcium, cadmium, chromium, copper, iron, mercury, potassium, magnesium, manganese, sodium, nickle, lead, antimony, selenium, titanium, vanadium, and zinc (EPA Methods 6010, 7060, 7421, 7740, 7841, 7470 and 7471), TPHs (EPA Method 8015M; see Table 4-1) and explosives (EPA Method 8330; see Tables 4-1 and 4-2).

The monitoring well boreholes will be completed using a combination of hollow-stem augering techniques and tri-cone reverse air techniques. Hollow-stem augering will be performed from the ground surface to the top of bedrock (see Section 3.3.1 of the GDAP). After encountering bedrock at each monitoring well borehole location, the drilling method will be switched from hollow-stem augers to tri-cone reverse air (see Section 3.3.3 of the GDAP). This method will be used to drill from the surface of the bedrock to the total well depth. Groundwater is expected to be encountered between 100 feet and 150 feet BGS. Use of the reverse air drilling method will allow the geologist to determine the precise depth to groundwater while drilling. Rock cuttings will be used to characterize the lithology of the bedrock at each well location according to Appendix E of the GDAP.

Each well will be constructed of the required length of flush-threaded casing, terminating with 15 feet of 0.02-inch factory-slotted screen bracketing the water table.

A sand pack will be installed from the bottom of the boring to approximately 2 feet above the top of the screen. A bentonite seal not less than 2 feet thick will be placed into the annular space above the sand pack. Cement grout will be placed above the bentonite seal to ground surface. Steel protective casings, locks, caps, a concrete pad, and protective posts

Table 4-1

SAMPLE ANALYTICAL SUMMARY
LANDFILL AREA 1
FORMER RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

Sample Type/Matrix	Analytical Parameter (Method Number)	Number of Samples	Field QC Samples				Field QA Samples[a]			Holding Times	Preservation	Sample Cntnrs	No. of Cntnrs
			Duplicate	Equipment Rinsates	Trip Blanks[1]	Total Field and QC Samples	Duplicates	Trip Blanks[1]	Total QA Samples				
Soil	VOC (8260[3])	64	6	0	6	76	6	6	12	14d	Ice to 4°C[4]	2-40 mL GSV	154
	BNA (8270B)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	77
	Pesticides/PCBs (8081)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	see note 2	77
	TAL Metals (Various[2])	64	6	0	0	70	6	0	6	6 mo	Ice to 4°C	8 oz cwm	77
	TPH (8015M)	64	6	0	0	70	6	0	6	28 days	Ice to 4°C	8 oz cwm	77
	Explosives (8330)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	77
Groundwater	VOC (8260[3])	8	1	1	1	11	1	1	2	14d	Ice to 4°C[4,5]	2-40 mL GSV	28
	BNA (8270B)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	Pesticides/PCBs (8081)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	TAL Metals (Various[2])	8	1	1	0	10	1	0	1	6 mo	Ice to 4°C[6]	1 L HDPE	12
	TPH (8015M)	8	1	1	0	10	1	0	1	28 days	Ice to 4°C[7]	2-1L Glass	24
Surface Water (If Present)	VOC (8260[3])	1	1	0	1	3	1	1	2	14d	Ice to 4°C[4,5]	2-40 mL GSV	28
	BNA (8270B)	1	1	0	0	2	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	Pesticides/PCBs (8081)	1	1	0	0	2	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	TAL Metals (Various[2])	1	1	0	0	2	1	0	1	6 mo	Ice to 4°C[6]	1 L HDPE	12
	TPH (8015M)	1	1	0	0	2	1	0	1	28 days	Ice to 4°C[7]	2-1L Glass	24

Key at end of table.

Table 4-1

SAMPLE ANALYTICAL SUMMARY
LANDFILL AREA 1
FORMER RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

Sample Type/Matrix	Analytical Parameter (Method Number)	Number of Samples	Field QC Samples				Field QA Samples[a]			Holding Times	Preservation	Sample Cntnrs	No. of Cntnrs
			Duplicate	Equipment Rinsates	Trip Blanks[1]	Total Field and QC Samples	Duplicates	Trip Blanks[1]	Total QA Samples				
Sediment	VOC (8260[3])	1	1	0	1	3	1	0	1	14d	Ice to 4°C[4]	2-40 mL GSV	154
	BNA (8270B)	1	1	0	0	2	1	0	1	14d/40d	Ice to 4°C	8 oz cwm	77
	Pesticides/PCBs (8081)	1	1	0	0	2	1	0	1	14d/40d	Ice to 4°C	see note 4	77
	TAL Metals (Various[2])	1	1	0	0	2	1	0	1	6 mo	Ice to 4°C	8 oz cwm	77
	TPH (8015M)	1	1	0	0	2	1	0	1	28 days	Ice to 4°C	8 oz cwm	77

Reference: USACE Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, 30 June 1995.

[a] To satisfy QA requirements, a split of each field QC sample will be sent to the USACE QA laboratory.

[1] One Trip Blank with every cooler containing VOC sample(s).
[2] TAL Metals. Ag, Al, Ba, Ca, Cd, Cr, Co, Fe, K, Mg, Mn, Na, Ni, Sb, Se, Ti, V, Zn (EPA 6010).
As (EPA 7060).
Hg (EPA 7470/7471).
Pb (7421).
[3] Including MTBE and Napthalene.
[4] No headspace.
[5] HCl to pH < 2.
[6] HNO_3 to pH < 2.
[7] H_2SO_4 to pH < 2.

Key:

A.G. = Amber glass.
BNA = Base/neutral and acid extractable organic compound.
cwm = Clear, wide-mouth jar.
GSV = Glass septa vial.
HDPE = High density polyethylene bottle.
oz = Ounce.
QA = Quality assurance.
QC = Quality control.
TPH = Total petroleum hydrocarbon.
VOC = Volatile organic compound.

Table 4-2

SAMPLE ANALYTICAL SUMMARY
LANDFILL AREA 2
FORMER RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

Sample Type/Matrix	Analytical Parameter (Method Number)	Number of Samples	Field QC Samples				Field QA Samples[a]			Holding Times	Preservation	Sample Cntnrs	No. of Cntnrs
			Duplicate	Equipment Rinsates	Trip Blanks[1]	Total Field and QC Samples	Duplicates	Trip Blank[1]	Total QA Samples				
Soil	VOC (8260[3])	64	6	0	6	76	6	6	12	14d	Ice to 4°C[4]	2-40mL GSV	152
	BNA (8270B)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	76
	Pesticides/PCBs (8081)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	see note 2	76
	TAL Metals[2] (Various[2])	64	6	0	0	70	6	0	6	6 mo	Ice to 4°C	8 oz cwm	76
	TPH (8015M)	64	6	0	0	70	6	0	6	28 days	Ice to 4°C	8 oz cwm	76
	Explosives (8330)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	76
Groundwater	VOC (8260[3])	8	1	1	1	11	1	1	2	14d	Ice to 4°C[4,5]	2-40mL GSV	26
	BNA (8270B)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	22
	Pesticides/PCBs (8081)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	22
	TAL Metals[2] (Various[2])	8	1	1	0	10	1	0	1	6 mo	Ice to 4°C[6]	1 L HDPE	11
	TPH (8015M)	8	1	1	0	10	1	0	1	28 days	Ice to 4°C[7]	2-1L Glass	22

Reference: USACE Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, 30 June, 1995.

[a] To satisfy QA requirements, a split of each field QC sample will be sent to the USACE QA laboratory.
[1] One Trip Blank with every cooler containing VOC sample(s).
[2] TAL Metals: Ag, Al, Ba, Ca, Cd, Cr, Co, Fe, K, Mg, Mn, Na, Ni, Sb, Se, Ti, V, Zn (6010); As (7060); Hg (7470/7471); Pb (7421).
[3] Including MTBE and Napthalene.
[4] No headspace.
[5] HCL to pH < 2.
[6] HNO_3 to pH < 2.
[7] H_2SO_4 to pH < 2.

Key:

A.G.	=	Amber glass.
BNA	=	Base/neutral and acid extractable organic compound.
cwm	=	Clear, wide-mouth jar.
GSV	=	Glass septa vial.
HDPE	=	High density polyethylene bottle.
oz	=	Ounce.
QA	=	Quality assurance.
QC	=	Quality control.
TPH	=	Total petroleum hydrocarbon.
VOC	=	Volatile organic compound.

will be installed to protect the monitoring wells. All monitoring well installation activities will be conducted in accordance with Section 3.4 of the GDAP.

4.3.2 Monitoring Well Development

After each well has been constructed, but no sooner than 48 hours after grouting is completed, the wells will be developed by surging and pumping. Water levels, specific conductance, temperature, and pH will be measured and recorded before and after the development of each well. Development will continue until the water is clear and free from sand, silt, and clay. If suitable development is not reached within 6 hours of continuous development action, the development activities will be stopped. Development water shall be drummed as IDW, labeled, and held for disposal until chemical analysis determines whether off-site disposal is required. Disposal criteria for the development water will be based on U.S. EPA groundwater standards.

After final development of each well, E & E will collect approximately 1 liter of water from the well in a clear glass jar, label and photograph it with 35mm color print film, and submit the photo as part of the well development record. The photograph will have suitable back-light and shall be taken close enough to show the clarity of the water. Well development will be completed in accordance with Section 3.5 of the GDAP.

4.3.3 Groundwater Sampling

Approximately 24-hours after the development and stabilization, the eight new monitoring wells in each of the two landfill areas will be sampled. The groundwater samples will be analyzed for BNAs (EPA Method 8270B); VOCs (EPA Method 8260); TPH (EPA Method 8015M); pesticides and PCBs (EPA Method 8081); and TAL metals (EPA Methods 6010, 7060, 7421, 7740, 7841, 7470, and 7471; see Table 4-1 and 4-2). The wells will be purged and samples will be collected in accordance with Section 4.4.6 of the CDAP. Specific conductance, temperature, and pH will be measured and recorded during and after the purge to assure samples are representative of aquifer conditions.

4.4 HYDROGEOLOGIC ASSESSMENT

4.4.1 Lithologic Samples

During soil boring activities, lithologic samples will be obtained for the purpose of characterizing the site-specific subsurface geologic conditions. Lithologic samples will be collected from ground surface to the total depth of each monitoring well using the techniques discussed in Section 4.3.1. A lithologic log of each borehole, containing a lithologic description, Unified Soil Classification, and total organic vapor (TOV) readings, will be maintained in the field in accordance with Sections 7.1 and 7.2 of the GDAP.

4.4.2 Water Level Measurements

Water level measurements will be made to the nearest 0.01 foot in the eight newly installed monitoring wells at each of the two landfill areas using an electronic water level indicator as described in Section 4.1.3 of the GDAP. Water level measurements will be referenced to the surveyed, top of casing (TOC) elevations. The water level elevation data will be used to determine the prevailing direction of groundwater flow across the site.

4.5 SURVEYING

All new monitoring wells at the site will be surveyed (see Section 8 of the GDAP) by a registered land surveyor and referenced to a permanent survey marker. The TOC elevations of each monitoring well will be surveyed to the nearest 0.01 foot and referenced to the National Geodetic Vertical Datum (NGVD).

4.6 SITE-SPECIFIC CHEMICAL DATA ACQUISITION PLAN

This Site-Specific Chemical Data Acquisition Plan (SCDAP) contains the specific sampling and analytical requirements for the assessment activities at both landfill areas at the former Ramey AFB, and any modifications to procedures specified in the CDAP.

As discussed in Sections 4.4.1 and 4.2.3, 128 soil samples and one sediment sample will be collected and analyzed for VOCs (EPA Method 8260); BNAs (PAHs only; EPA Method 8270B); pesticides and PCBs (EPA Method 8081); TAL metals: silver, aluminum, arsenic, barium, beryllium, calcium, cadmium, chromium, copper, iron, mercury, potassium, magnesium, manganese, sodium, titanium, vanadium and zinc (EPA Methods 6010, 7060, 7421, 7740, 7041, 7470, and 7471); TPH (EPA Method 8015M; see Table 4-1), and explosives (EPA Method 8330). One surface water sample and sixteen groundwater samples

will also be collected and analyzed for the same parameters as the soil and sediment samples, with the exception of explosives. Table 4-1 lists the number of samples, including QA and QC samples, and test methods required for chemical analyses. These analyses will be conducted at E & E's Analytical Services Center (ASC).

To satisfy QC requirements, duplicate, equipment rinsate, and trip blank samples will be collected and analyzed as specified in Table 4-1. These samples will be sent to E & E's ASC. To satisfy QA requirements, a split of each duplicate, equipment rinsate, and trip blank sample will be collected and sent to the USACE QA laboratory (South Atlantic Division Laboratory) for analysis.

All samples will be collected, preserved, packaged, transported, and analyzed in accordance with the CDAP. If sample integrity, such as holding times, temperature, etc. is compromised by E & E or subcontractors to E & E, E & E will be responsible for possible resampling at no cost to the government.

4.7 IDW MANAGEMENT AND DISPOSAL

All IDW, including decontamination fluids, well development and purge water, and soil and rock cuttings, will be containerized at the site using DOT 17-H, 55-gallon steel drums. Drums will be staged adjacent to each monitoring well location, and labeled with an adhesive sticker marked with the start date of storage, drum contents, site name, and the USACE and E & E points of contact. IDW will remain at the site until analytical results are received and reviewed.

If analytical results indicate the IDW concentrations are below EPA MCLs and EPA Region III risk-based soil concentration levels, E & E will propose the on-site disposal of the IDW. If IDW concentrations exceed these guidelines, E & E will evaluate the best disposal alternative, and propose off-site disposal at a permitted disposal facility.

5. REPORT

Following completion of the field investigation, E & E will prepare an SI report in accordance with USACE requirements as outlined in the USACE SOW. In conjunction with preparation of the SI report, E & E will evaluate all acquired data, characterize the nature and magnitude of site contamination and qualitatively assess the potential threats to human health and the environment. All site analytical data will also be reviewed by a chemist in Puerto Rico, as required by the Commonwealth of Puerto Rico. The SI report will include figures, tables, and text, and the results will be summarized in a conclusions/recommendations section. The report will be sealed by a Professional Engineer registered in Puerto Rico, as required by the Commonwealth of Puerto Rico.

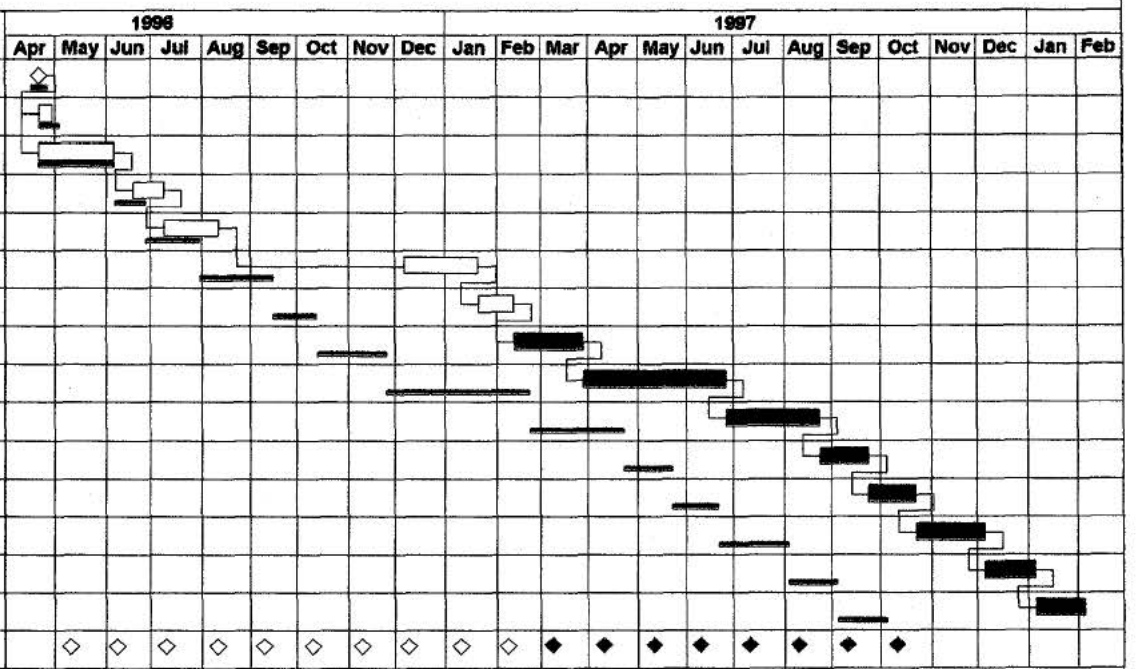
6. PROJECT SCHEDULE

Figure 6-1 presents the proposed project schedule for the site investigation at Landfill Areas 1 and 2 at the former Ramey AFB.

Figure 6-1: Project Schedule - Site Investigation at Landfill Areas 1 and 2
Former Ramey Air Force Base, Aguadilla, Puerto Rico

Current Date: 02/07/97

#	Task Name	Sched Start	Sched Fin
1	Notice to Proceed	04/22/96	04/22/96
2	Gantt Chart (E & E)	04/22/96	04/29/96
3	Draft SI Workplan (E & E)	04/22/96	06/06/96
4	Draft Workplan Review (USACE)	06/19/96	07/08/96
5	Prefinal SI Workplan (E & E)	07/09/96	08/12/96
6	Prefinal Workplan Review (USACE/EQB)	12/06/96	01/21/97
7	Final SI Workplan (E & E)	01/22/97	02/12/97
8	Workplan Approval (USACE/EQB)	02/13/97	03/27/97
9	Conduct Field Work (E&E)	03/28/97	06/25/97
10	Draft SI Report (E&E)	06/26/97	08/22/97
11	Draft Report Review (USACE)	08/25/97	09/23/97
12	Prefinal SI Report (E & E)	09/24/97	10/22/97
13	Prefinal Report Review (USACE/EQB)	10/23/97	12/04/97
14	Final SI Report (E & E)	12/05/97	01/05/98
15	Report Approval	01/06/98	02/04/98
16	Monthly Progress Reports	05/10/96	10/10/97



Critical
Critical Milestone
Free Float
Delay
Noncritical
Noncritical Milestone
Total Float (+)
Effort %Complete
Complete
Complete Milestone
Total Float (-)
Summary
Summary Milestone
Baseline
External
External Milestone
Non-Resource

Key:

USACE U.S. Army Corps of Engineers
EQB Puerto Rico Environmental Quality Board
E & E Ecology and Environment, Inc.
SI Site Investigation

Baseline denotes original schedule

7. REFERENCES

Ecology and Environment, Inc., 1996a, Chemical Data Acquisition Plan for the Site Investigation at Landfill Areas 1 and 2 at the Former Ramey Air Force Base, Aguadilla, Puerto Rico.

_____, 1996b, Data Management Plan for the Site Investigation at Landfill Areas 1 and 2 at the Former Ramey Air Force Base, Aguadilla, Puerto Rico.

_____, 1996c, Geologic Data Acquisition Plan for the Site Investigation at Landfill Areas 1 and 2 at the Former Ramey Air Force Base, Aguadilla, Puerto Rico.

_____, 1996d, Project Management Plan for the Site Investigation at Landfill Areas 1 and 2 at the Former Ramey Air Force Base, Aguadilla, Puerto Rico.

_____, 1996e, Project Field Logbook, Landfill Areas 1 and 2 at the Former Ramey Air Force Base, Aguadilla, Puerto Rico.

Puerto Rico Aqueduct and Sewer Authority (PRASA), 1983, Water Supply Systems Maps for Aguadilla, Puerto Rico.

Ramos, Jose, 1996, Personal communication between Perry Kelso and Jose Ramos.

U.S. Army Corps of Engineers, Savannah District, March 1996a, Scope of Work for the Site Investigation of Landfill Areas 1 and 2 at the Former Ramey Air Force Base, Aguadilla, Puerto Rico.

_____, 25 March 1996b, Geophysical Survey Memorandum.

_____, 30 June 1995, Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3.

_____, 15 April 1992, Sight Survey Summary Sheet for DERP-FUNS, Site No. IOZPR087900, Rafael Hernandez Airport (Former Ramey AFB).

U.S. Environmental Protection Agency, 1991a, Engineering Compliance Branch Standard Operating Procedures and Quality Assurance Manual.

_____, 1991b, Compendium of ERT Surface Water and Sediment Sampling Procedures, Interim Final, OSWER Directive 9360.4-03, Washington, D.C.

_____, 1987, A Compendium of Superfund Field Operation Methods, EPA/540, Office of Emergency and Remedial Response, Washington, D.C.

_____, 1986, RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD), OSWER-9950.1, Washington, D.C.

APPENDIX A

DOCUMENT SEARCH SUMMARY

DOCUMENT SEARCH SUMMARY

E & E conducted file reviews for the former Ramey Air Force Base project on April 18 and 19, 1996. Files were reviewed at the United States Geological Survey, the Aqueduct and Sewer Authority of Puerto Rico, and the Environmental Quality Board of Puerto Rico, including the Superfund Section, Water Quality Section, Air Quality Section, Solid Waste Section, Bio-Medical Waste Section, and the Hazardous Waste Section. File information was also received from the USACE Jacksonville District.

Neither USGS, nor EQB had any files related to the landfills or site activities, past or present. Geologic reference material was purchased at the USGS office, and updated laws and environmental regulations were purchased at EQB. The Aqueduct and Sewer Authority provided detailed maps and information concerning water supply and use in the Aguadilla area.

APPENDIX B

USACE GEOPHYSICAL SURVEY MEMORANDUM

CESAS-EN-GG

25 March 1996
WHITACRE/tjw/6003

MEMORANDUM THRU

EN-GG
EN-G

FOR EN-GH (Smith)

SUBJECT: Geophysical Survey at Landfill Site 11 and Site 12, Former Ramey AFB, Ramey Puerto Rico and Pistol Range Landfill, Former San Juan NAS, San Juan Puerto Rico.

1. This memorandum summarizes the results of the geophysical surveys conducted at Landfill Sites 11 and 12 at Former Ramey AFB and at the Pistol Range Landfill at Former San Juan NAS. EN-GG personnel (Tom Whitacre and Marty Fife) conducted the geophysical surveys using a continuous reading terrain conductivity meter. The goals of the surveys were to delineate the location and horizontal extent of each of the abandoned landfills. Field investigations were conducted from 13 February through 22 February, 1996.

2. Site Description:

a. Former Ramey AFB Landfill Site 11 covers an area approximately 1300 long by 1000 feet wide (See Attachment A). The area contains a sinkhole approximately 120 feet in diameter and 30 to 60 feet deep with an associated subsidence depression approximately 700 feet in diameter and 30 feet deep. Topographic relief at the site is approximately 100 feet. The northern portion of the site contains a limestone reef that is topographically expressed as a small bluff. The site is covered with a variety of tall grasses and brush, with extensive tree cover in the sinkhole drainage channel. The site is currently used for livestock pasture.

b. Former Ramey AFB Landfill Site 12 covers an area approximately 1500 feet long by 1700 feet wide (See Attachment A). The site topography consists of gently rolling hills and swales with a maximum relief of 25 feet. The site is subdivided by several barbed-wire fences. A retention pond for livestock use has recently been constructed in the northeast corner of the site. The site is covered with a variety of grasses and brush and is currently used for livestock pasture.

c. Former San Juan NAS Pistol Range Landfill covers an area approximately 1000 feet long by 750 feet wide (See Attachment A). The site is generally flat with a few earthen berms associated with the old pistol firing range. There are several buildings,

buried utilities, abandoned vehicles, and metallic debris scattered across the site. The southern half of the site is used for boarding and exercising horses. The northern half of the site is used by the Puerto Rican Fire Fighting Academy as a fire training facility. Portions of the site were covered by heavy vegetation which prevented access.

3. Instrumentation: A Geonics EM-31™ Terrain Conductivity Meter was used to conduct the geophysical surveys. The EM-31™ is a continuous reading instrument that can measure variation in ground conductivity and secondary induced magnetic fields. The instrument has an effective exploration depth of up to 3 meters. During the surveys, the equipment was operated in the single vertical dipole mode and carried approximately 1 meter above the ground surface.

4. Data Collection: Geophysical survey grids, on 50-foot centers, were laid out in each of the landfill sites. The instrument was carried over each marked station and both the quadrature (terrain conductivity) and in-phase components of the electric field were digitally recorded. The quadrature portion of the electric field is proportional to the conductivity of the ground. The in-phase component of the electric field is more responsive to metallic objects and debris. A total of 188 data points (both quadrature and in-phase readings at each station) were recorded at Landfill Site 11, 1039 data points were recorded at Landfill Site 12, and 313 data points were recorded at the Pistol Range Landfill. An Omidata Model DL720 data logger was attached to the instrument and electronically recorded and stored the data for later retrieval. A site map of each landfill showing the data sampling points is included in Attachment A. A hand-held Garmin Model 45 GPS unit was used to determine "real world" coordinates for a few selected control points at each site. The GPS coordinates are probably accurate to within 30 feet.

5. Data Reduction/Analysis: The geophysical data were electronically downloaded to a PC. Plots of Terrain Conductivity and In-Phase readings for each landfill site were generated using Surfer® data processing and display software. The raw data was reviewed and manually edited, where appropriate, prior to gridding and contouring via Surfer®. These plots are included in Attachment B.

6. Results of Investigation:

a. At the Site 11 Landfill, the geophysical survey indicated that nearly the entire fenced area is an abandoned landfill (See Attachment B). The landfill area is bounded on the north by the limestone bluff and extends south all the way to the main roadway. On the east the landfill extends from the access road west to the sinkhole. The landfill

appears to cover most of the area with higher conductivity and in-phase readings seen around the sinkhole and along the edge of the subsidence depression. It appears that the sinkhole and adjacent ground were the first areas to be filled with waste material which subsequently progress to the edge of the subsidence depression and then along both roads. Several large amplitude anomalies are seen adjacent to the subsidence depression, which are indicative of large pieces of buried metallic debris. One large anomaly is seen along the southernmost survey line (Line -1150). This feature is approximately 300 feet long and 50 feet wide. This anomaly may be associated with the rumored buried airplane and additional investigation of this anomaly is warranted. Two locations are recommended for installing perimeter monitoring wells around the landfill site. One location for well installation is the limestone bluff located on the northern edge of the landfill. The other location is immediately to the west of the sinkhole on the plateau. These areas appear to be located outside of the landfill boundaries. Attachment C contains Surfer® contour plots showing the interpreted extent of the landfill and the recommended location of the perimeter monitoring wells.

b. Results of the geophysical survey at the Site 12 Landfill, indicate that the northwestern one-third of the site contains buried debris (See Attachment B). The geophysical anomalies are expressed as smaller isolated features with small amplitudes. Several of the anomalies appear to be associated with old building foundations and possibly abandoned buried utilities, especially the anomalies in the central portion of the site. The highest concentration of anomalies is located adjacent to a ditch that runs along the northwestern boundary of the site. Landfill debris material was exposed in the walls along the northern 400 feet of the ditch. This area corresponds with the cluster of geophysical anomalies in the area. The southeastern two-thirds of the site appears to be devoid of any significant anomalies. The linear anomaly in the western portion of the site is an artifact caused by low battery power to the instrument. It is recommended that the geophysical survey be extended at least 500 to the north and west of the northwest corner of the site. Based on the current survey, there is a possibility that that landfill extends off of the property in these directions. At least two perimeter monitoring wells should be installed in the southeastern half of the site. One well should be located south of the retention pond and one well near the intersection of the three barbed-wire fences. After the additional geophysical survey of the northwestern area is completed, additional monitoring wells should be installed in that area. Attachment C contains Surfer® contour plots showing the interpreted extent of the landfill and the recommended location of the perimeter monitoring wells.

c. Results of the geophysical survey at the Pistol Range Landfill, indicate that most the site contains buried debris and/or disturbed material. The geophysical anomalies are numerous and have high amplitudes. There are several small anomalies in the southern portion of the site. These anomalies appear to be associated with near surface metallic debris (drum lids, bullet casings, wire, etc.). The northern edge of the property appears to be the only location containing relatively undisturbed material. Two locations are recommended for installing perimeter monitoring wells around the landfill site. One well should be located in the northern corner of the site, near the abandoned vehicles. The other well should be located in the asphalt parking lot near the fence the separates the northern and southern half of the site. Attachment C contains Surfer® contour plots showing the interpreted extent of the landfill and the recommended location of the perimeter monitoring wells.

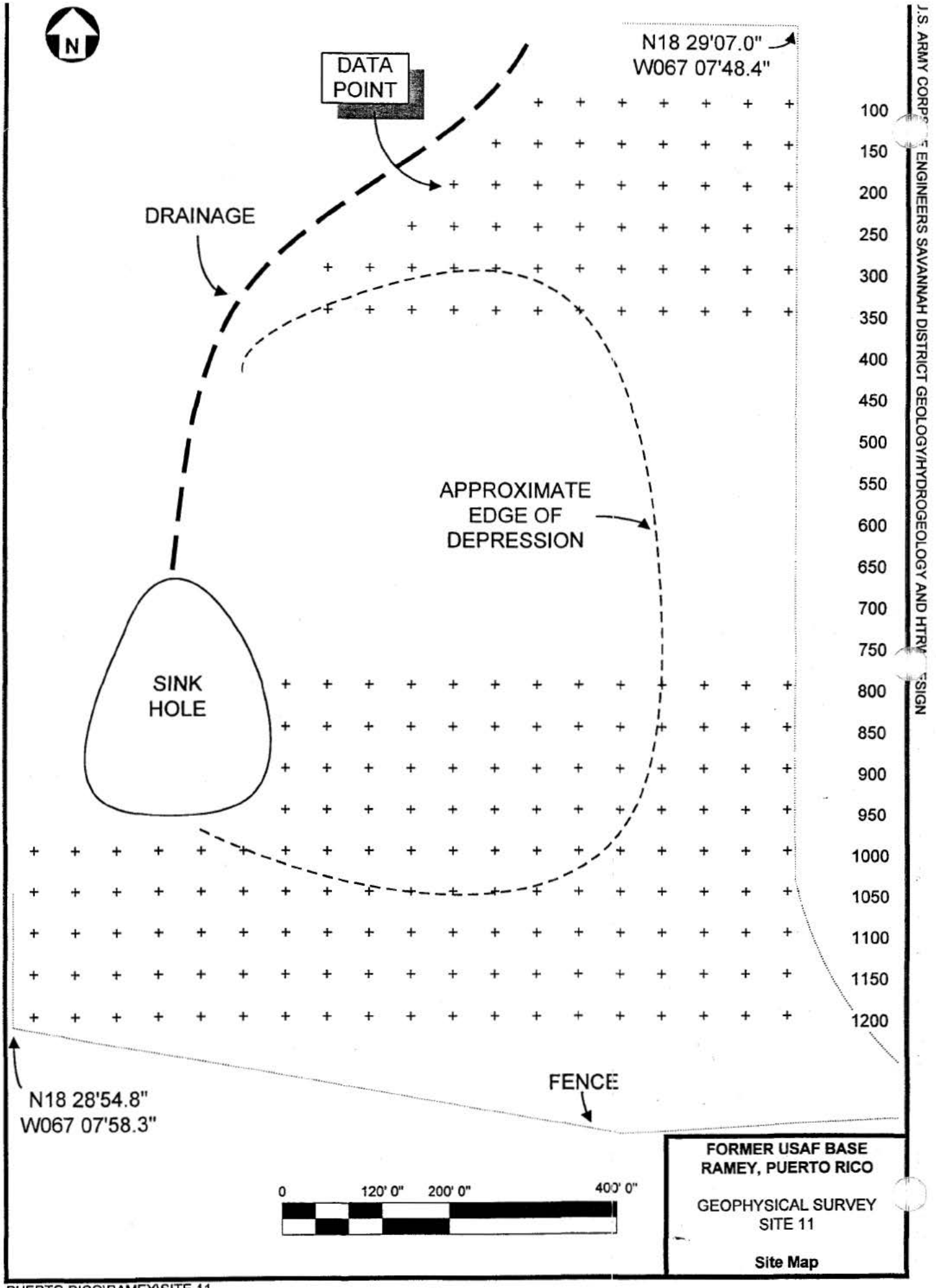
7. If any additional information or assistance is needed, do not hesitate to Thomas Whitacre, Project Geologist at 912/652-6003.

Robert V. O'Kelley

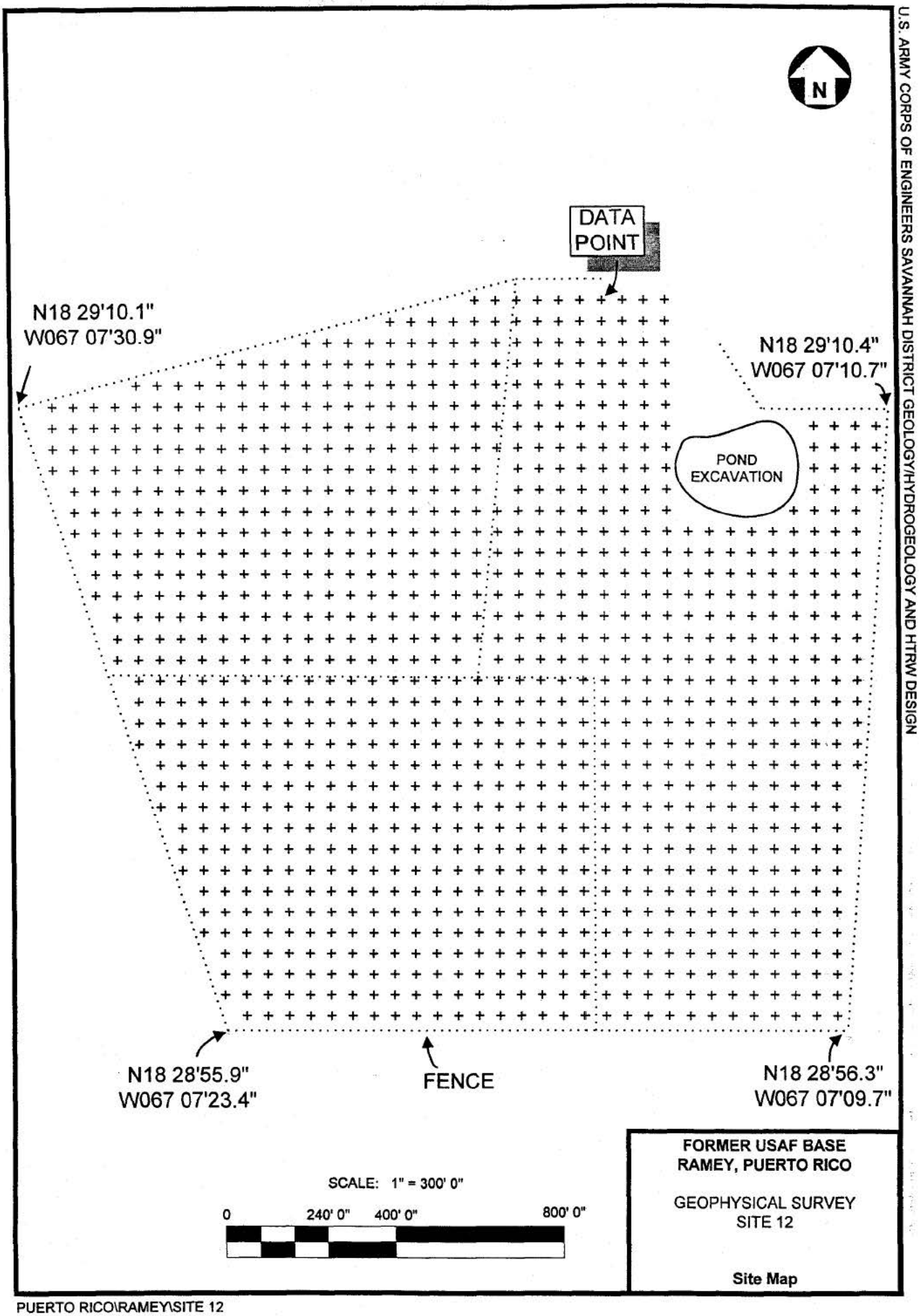
Encl

ROBERT V. O'KELLEY, P.G.
Chief, Geology/Hydrogeology & HTRW
Design Section

ATTACHMENT A

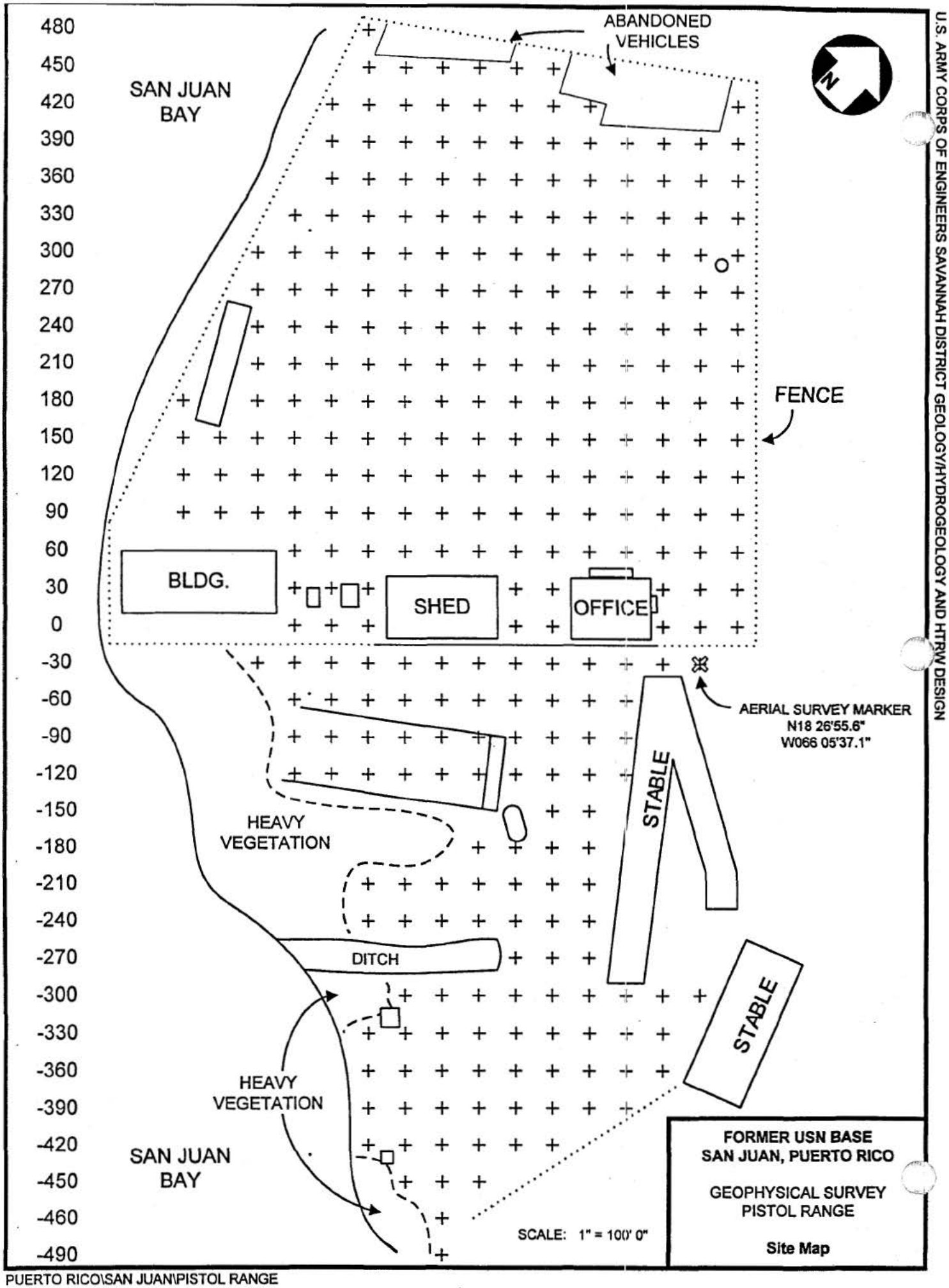


PUERTO RICO\RAMEY\SITE 11



U.S. ARMY CORPS OF ENGINEERS SAVANNAH DISTRICT GEOLOGY/HYDROGEOLOGY AND HTRW DESIGN

PUERTO RICO\RAMEY\SITE 12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120
90
60
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-60
-90
-120
-150
-180
-210
-240
-270
-300
-330
-360
-390
-420
-450
-460
-490
ABANDONED VEHICLES
SAN JUAN BAY
FENCE
BLDG.
SHED
OFFICE
AERIAL SURVEY MARKER
N18 26'55.6"
W066 05'37.1"
STABLE
HEAVY VEGETATION
DITCH
STABLE
HEAVY VEGETATION
SAN JUAN BAY
SCALE: 1" = 100' 0"
FORMER USN BASE
SAN JUAN, PUERTO RICO
GEOPHYSICAL SURVEY
PISTOL RANGE
Site Map
U.S. ARMY CORPS OF ENGINEERS SAVANNAH DISTRICT GEOLOGY/HYDROGEOLOGY AND HTRW DESIGN
PUERTO RICO\SAN JUAN\PISTOL RANGE

ATTACHMENT B

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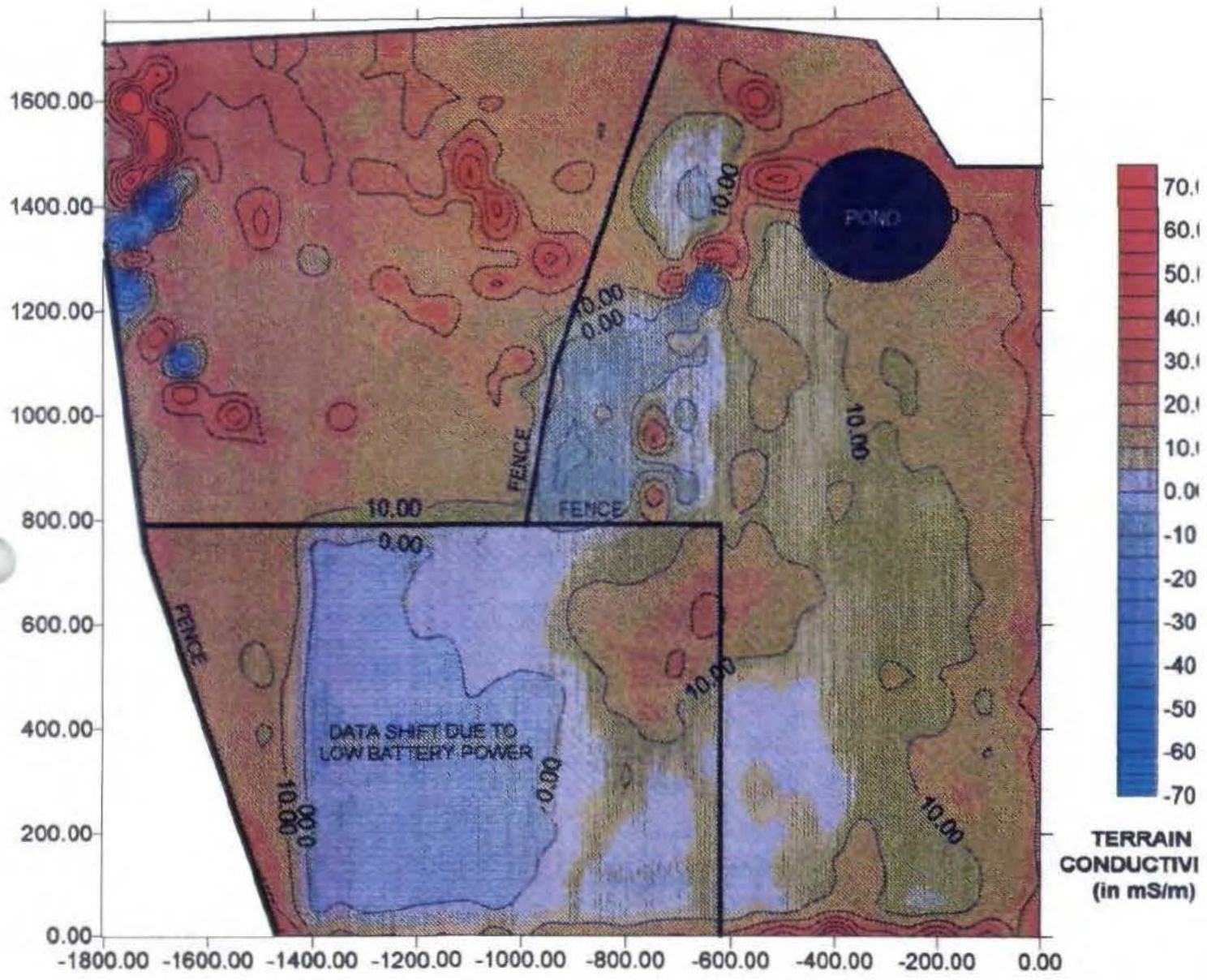
FORMER RAMEY AFB, RAMEY P.R.
LANDFILL SITE 12
TERRAIN CONDUCITIVITY VALUES



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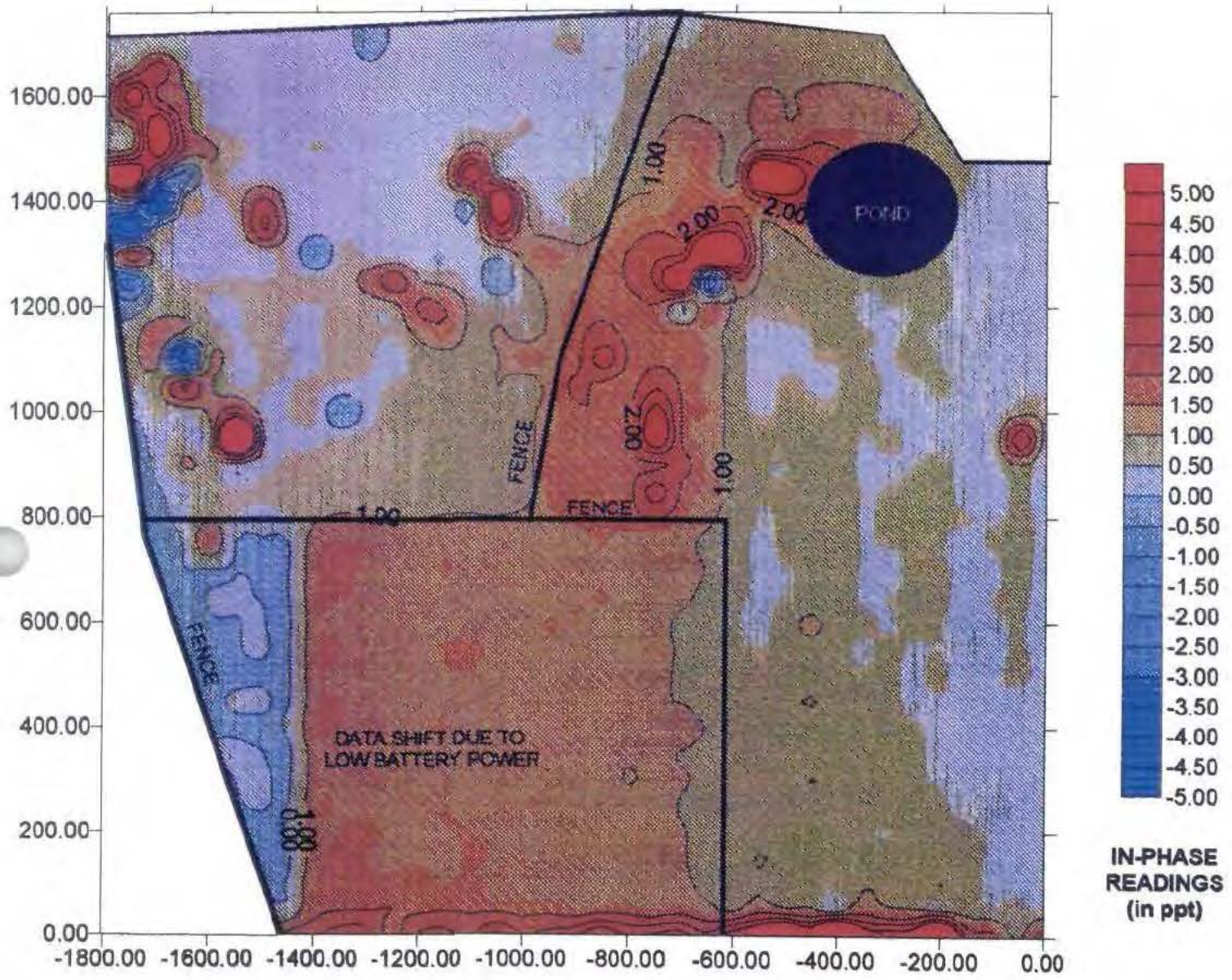
LANDFILL SITE 12
IN-PHASE VALUES



ATTACHMENT C

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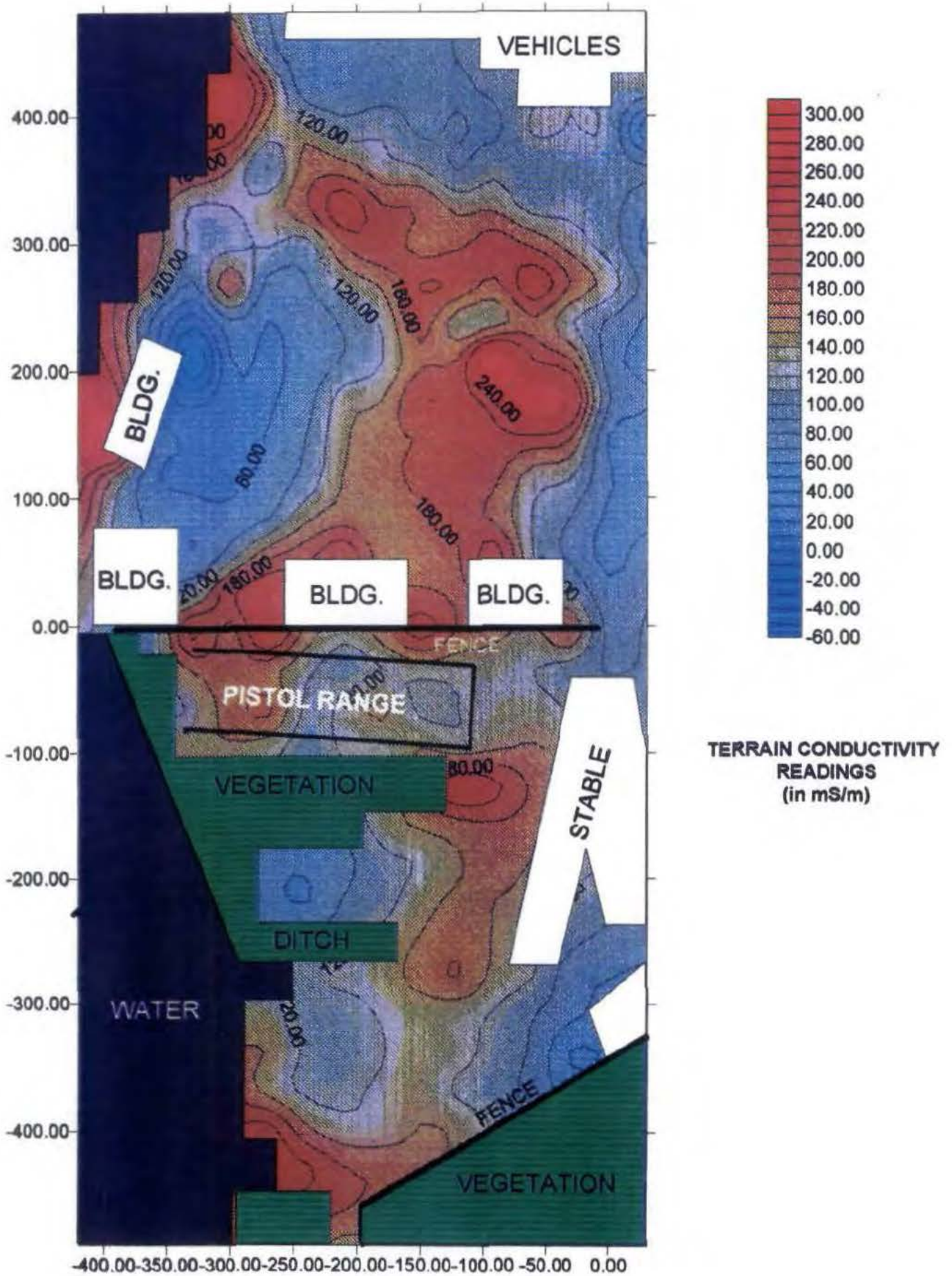
FORMER SAN JUAN NAS
PISTOL RANGE LANDFILL
TERRAIN CONDUCTIVITY VALUES



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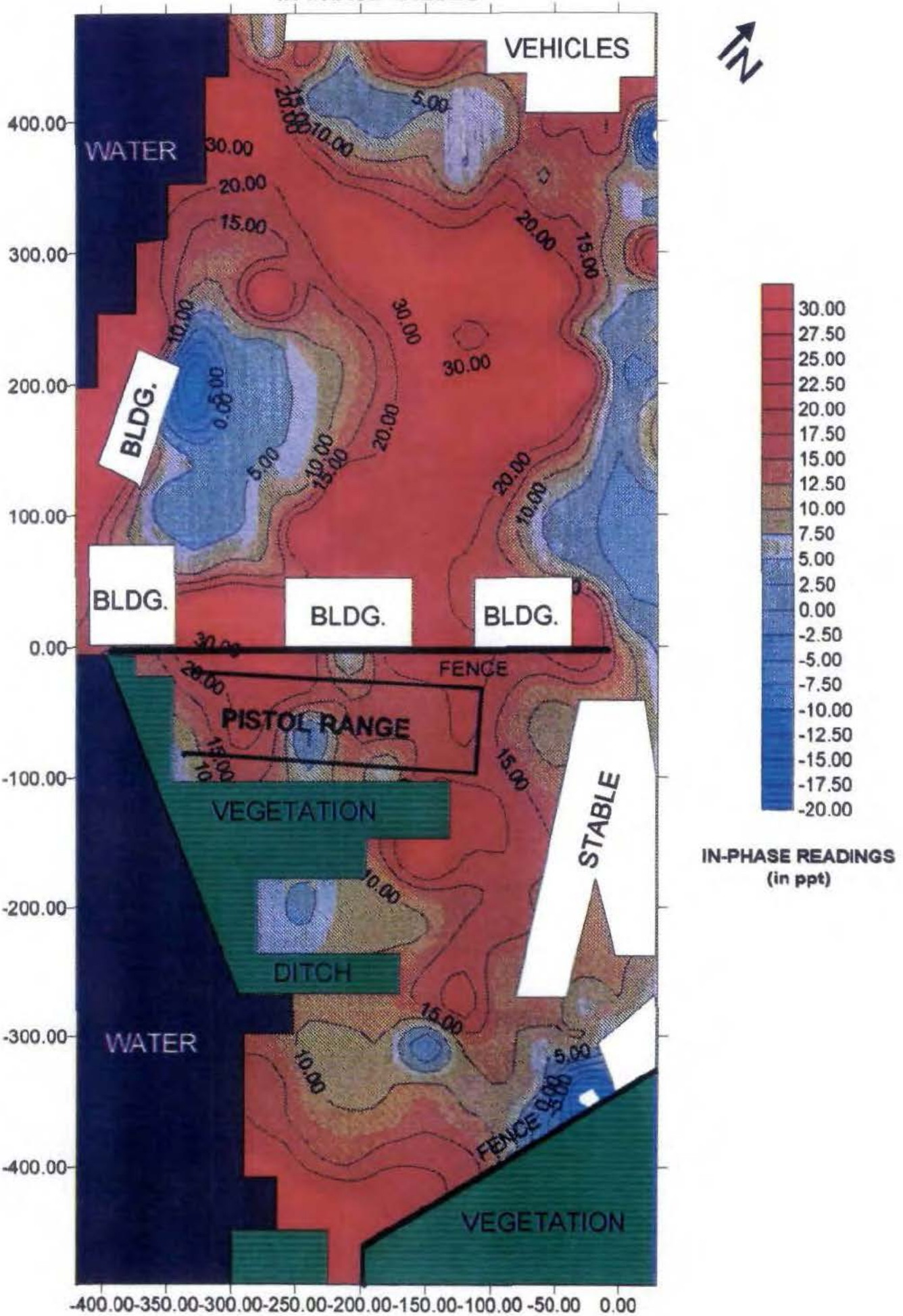
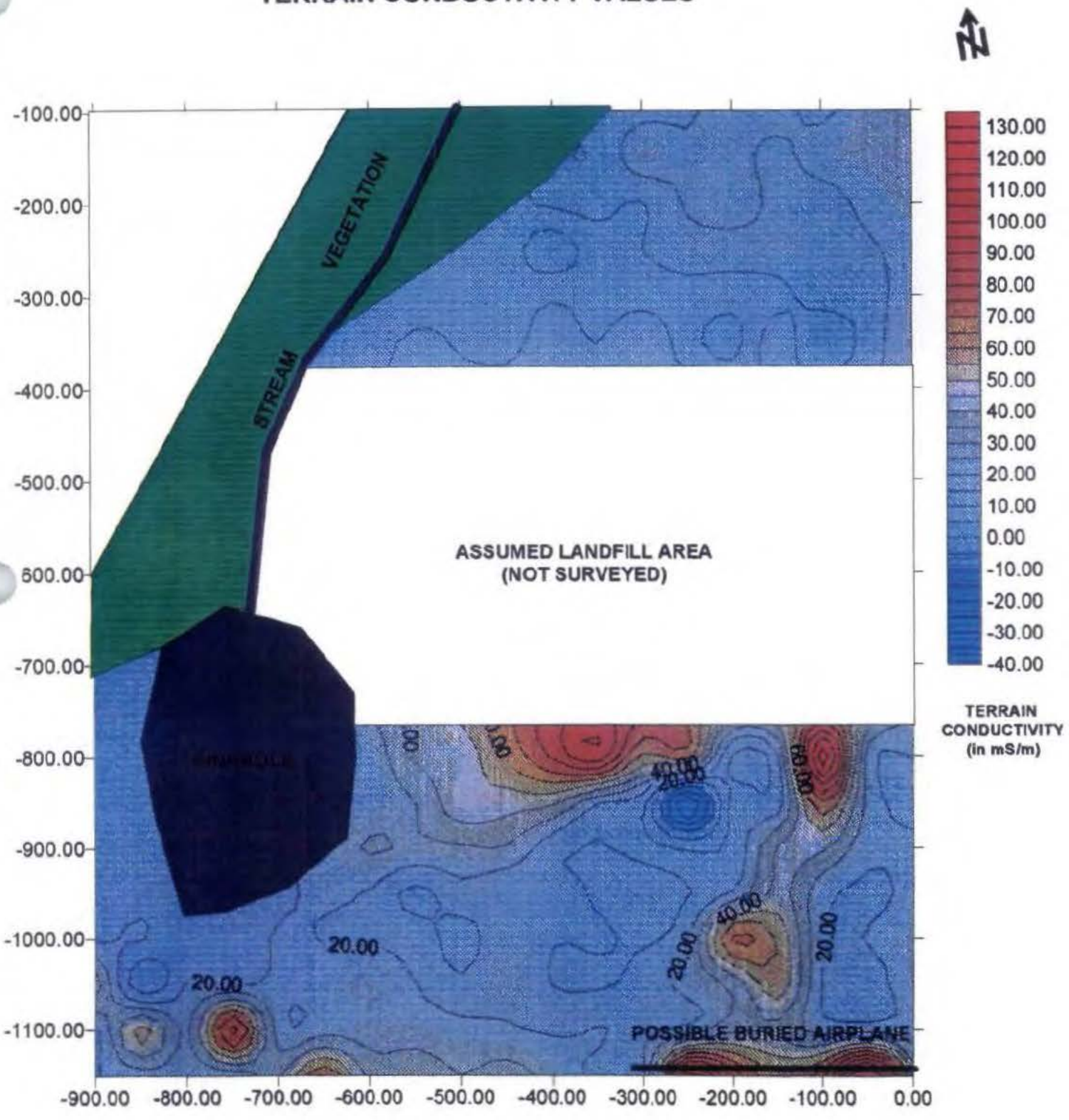
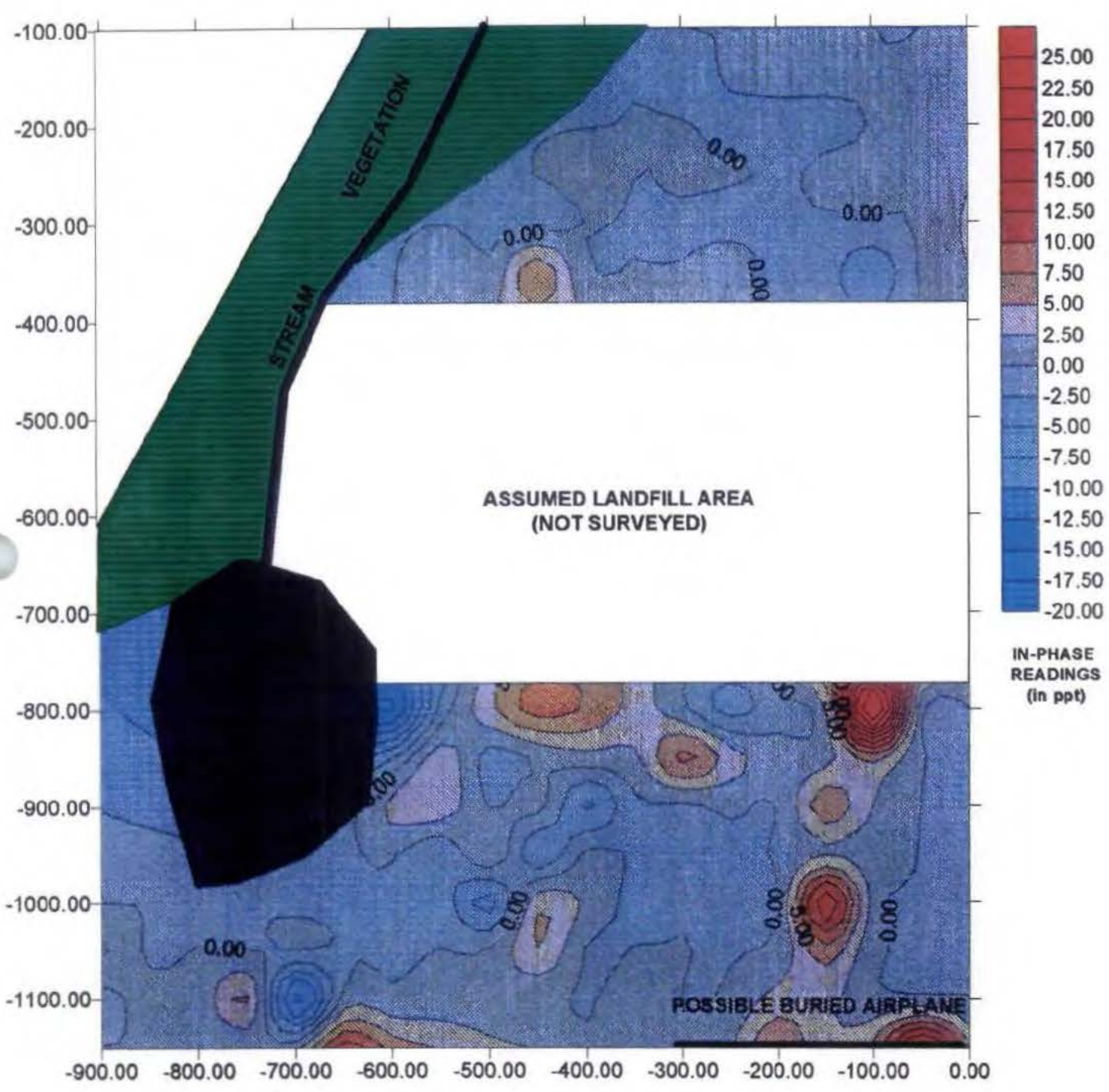


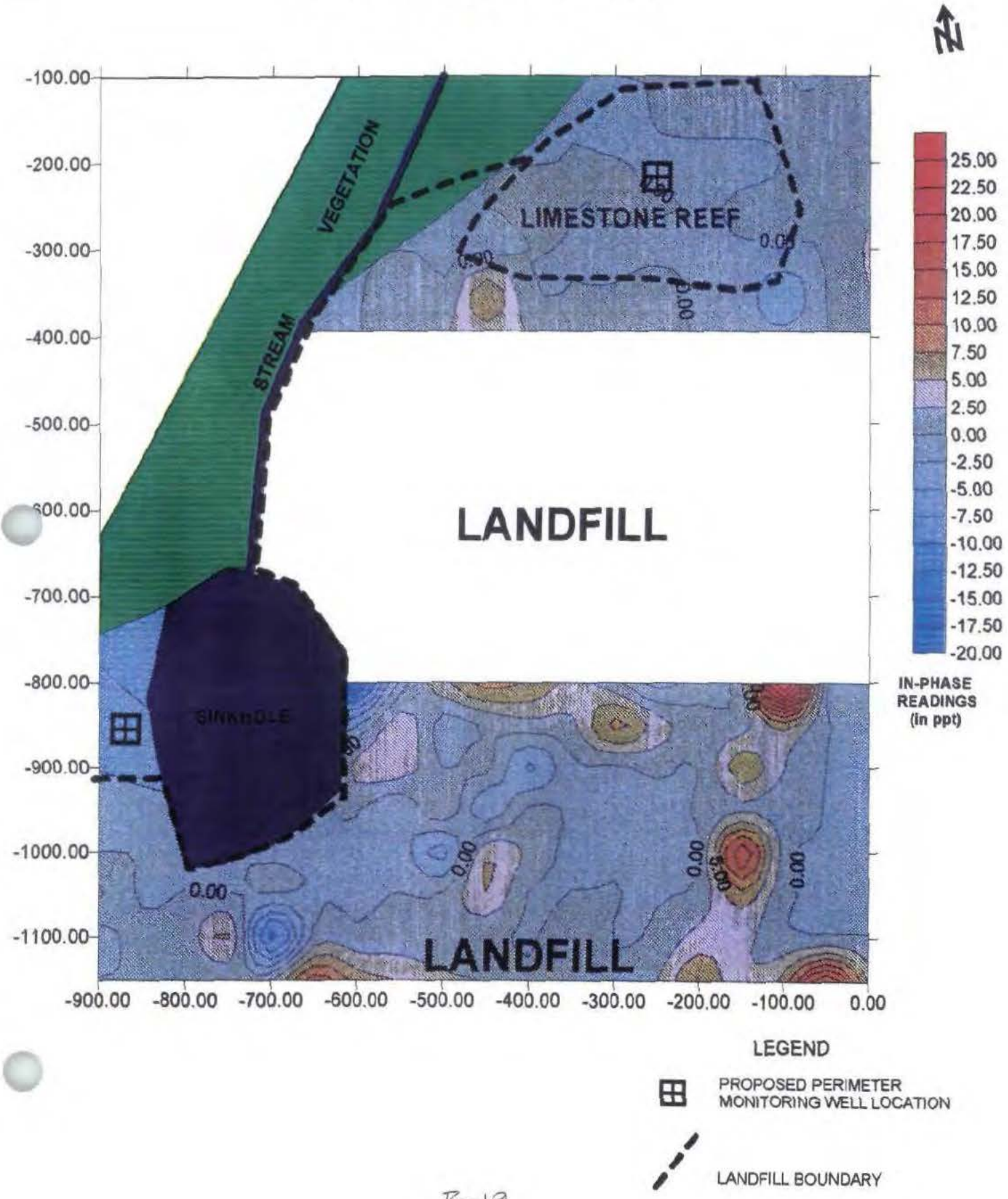
FORMER RAMEY AFB, RAMEY P.R.
LANDFILL SITE 11
TERRAIN CONDUCTIVITY VALUES



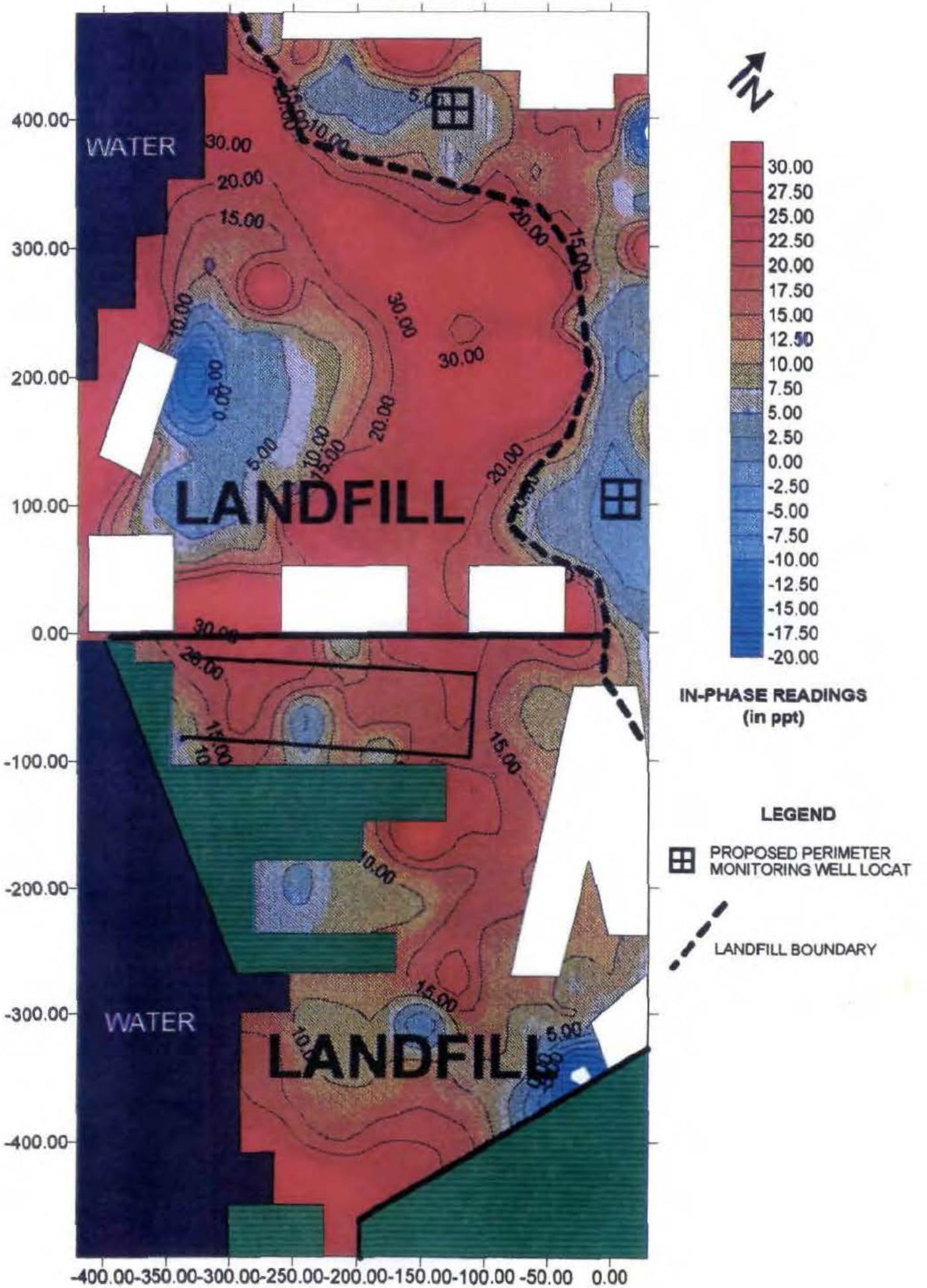
FORMER RAMEY AFB, RAMEY P.R.
LANDFILL SITE 11
IN-PHASE VALUES



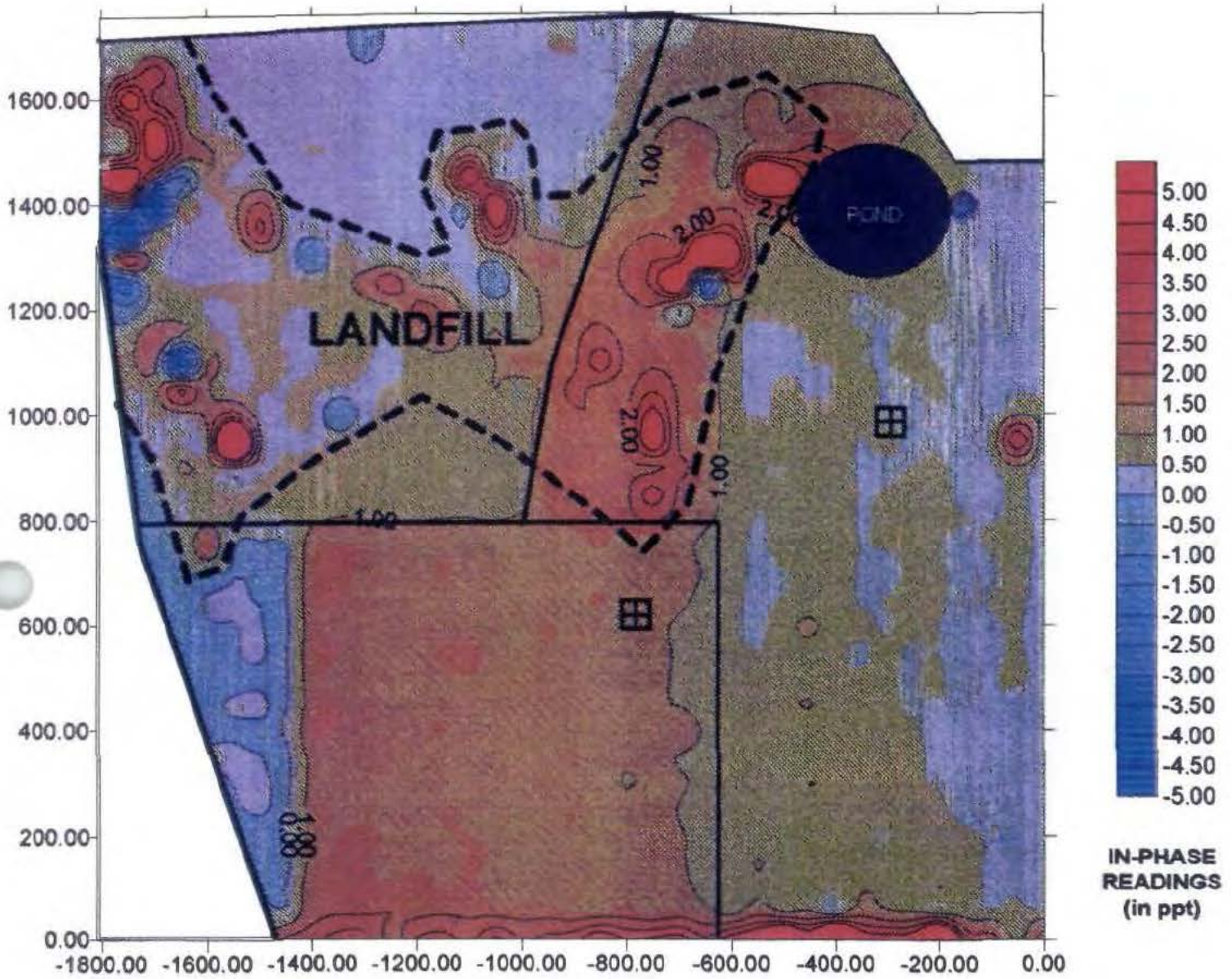
FORMER RAMEY AFB, RAMEY P.R.
LANDFILL SITE 11
LANDFILL BOUNDARY AND
PERIMETER WELL LOCATION



FORMER SAN JUAN NAS - PISTOL RANGE LANDFILL BOUNDARY AND PERIMETER WELL LOCATIONS



FORMER RAMEY AFB, RAMEY P.R.
LANDFILL SITE 12
LANDFILL BOUNDARY
AND PERIMETER WELL LOCATION



LEGEND

PROPOSED PERIMETER MONITORING WELL LOCATION

LANDFILL BOUNDARY

TABLE OF CONTENTS

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LIST OF TABLES

LIST OF ILLUSTRATIONS

LIST OF ACRONYMS

ASC	Analytical Services Center
AST	aboveground storage tank
BGS	below ground surface
BNA	base neutral acid extractable
CAP	Corrective Action Plan
CDAP	Chemical Data Acquisition Plan
DAP	Data Acquisition Plan
DMP	Data Management Plan
EPA	U.S. Environmental Protection Agency
E&E	Ecology and Environment, Inc.
IDW	investigation-derived wastes
NAS	Naval Air Station
NGVD	National Geodetic Vertical Datum
OSWER	Office of Solid Waste and Emergency Response
OVA	Organic Vapor Analyzer
PCB	polychlorinated biphenyl
PMP	Project Management Plan
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
SCDAP	Site-Specific Chemical Data Acquisition Plan
SSHP	Site-Specific Safety and Health Plan
TAL	target analyte list
TCLP	Toxicity Characteristic Leaching Procedure
TOC	top of casing
TOIC	top of inner casing
TPH	total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
VOC	volatile organic compound

1. INTRODUCTION

The safety and health of site workers and the public are the primary concerns and goals of Ecology and Environment, Inc. (E & E). Thus, a comprehensive, carefully managed, and thoroughly documented safety and health program is essential for the successful completion of all field activities. The purpose of this Site-Specific Safety and Health Plan (SSHP) is to outline the general safety and health procedures and protocol to be followed by E & E and subcontractor personnel, as well as any site visitors, during site assessment field activities conducted as part of Delivery Order No. 0021 issued by the United States Army Corps of Engineers (USACE), Savannah District, under Contract Number DACA21-93-D-0034, at Landfill Areas 1 and 2 at the former Ramey Air Force Base (AFB), Aguadilla, Puerto Rico.

The site-specific safety and health plans required by OSHA regulations have been developed by E & E and E & E's subcontractors. These plans have been reviewed by E & E for consistency with the Occupational Safety and health Administration (OSHA) General Industry Standard set forth at 29 CFR 1910.120. Relevant sections of the subcontractor site safety plans have been included in this SSHP.

The SSHP should not be considered a static document. Changes in working conditions or potential exposure levels may warrant appropriate modifications to this document as work progresses. These changes also will be reflected in an Existing Site Safety Plan Addendum Form (see Appendix A). This form will be routed to E & E's CIH for approval and to the USACE Project Manager for acceptance before being implemented. Any modifications will be presented to personnel during daily safety briefings and will be documented on the On-Site Safety Meeting Form (see Appendix B).

The following SSHP describes specific responsibilities, training, medical and environmental surveillance, hazard communication, emergency response, protective and emergency equipment, environmental monitoring, and safe operating procedures. The plan has been designed to ensure that E & E and subcontractor personnel comply with all applicable federal, state, and local safety and health regulations.

All field work conducted by E & E and its subcontractors will be performed in accordance with Occupational Safety and Health Administration (OSHA) General Industry Standard 29 Code of Federal Regulations (CFR) 1910, especially 29 CFR 1910.120, which regulates hazardous waste site operations; OSHA Construction Industry Standards 29 CFR 1926, as applicable; procedures specified in the USACE *Safety and Health Requirements Manual* (USACE 1992); ER 385-1-92, Appendix B, *Safety and Health Elements for HTRW and OEW Documents* (USACE 1994); and the E & E *Corporate Health and Safety Program for Toxic and Hazardous Substances (CHSR),* revised September 1993.

2. SITE BACKGROUND AND SETTING

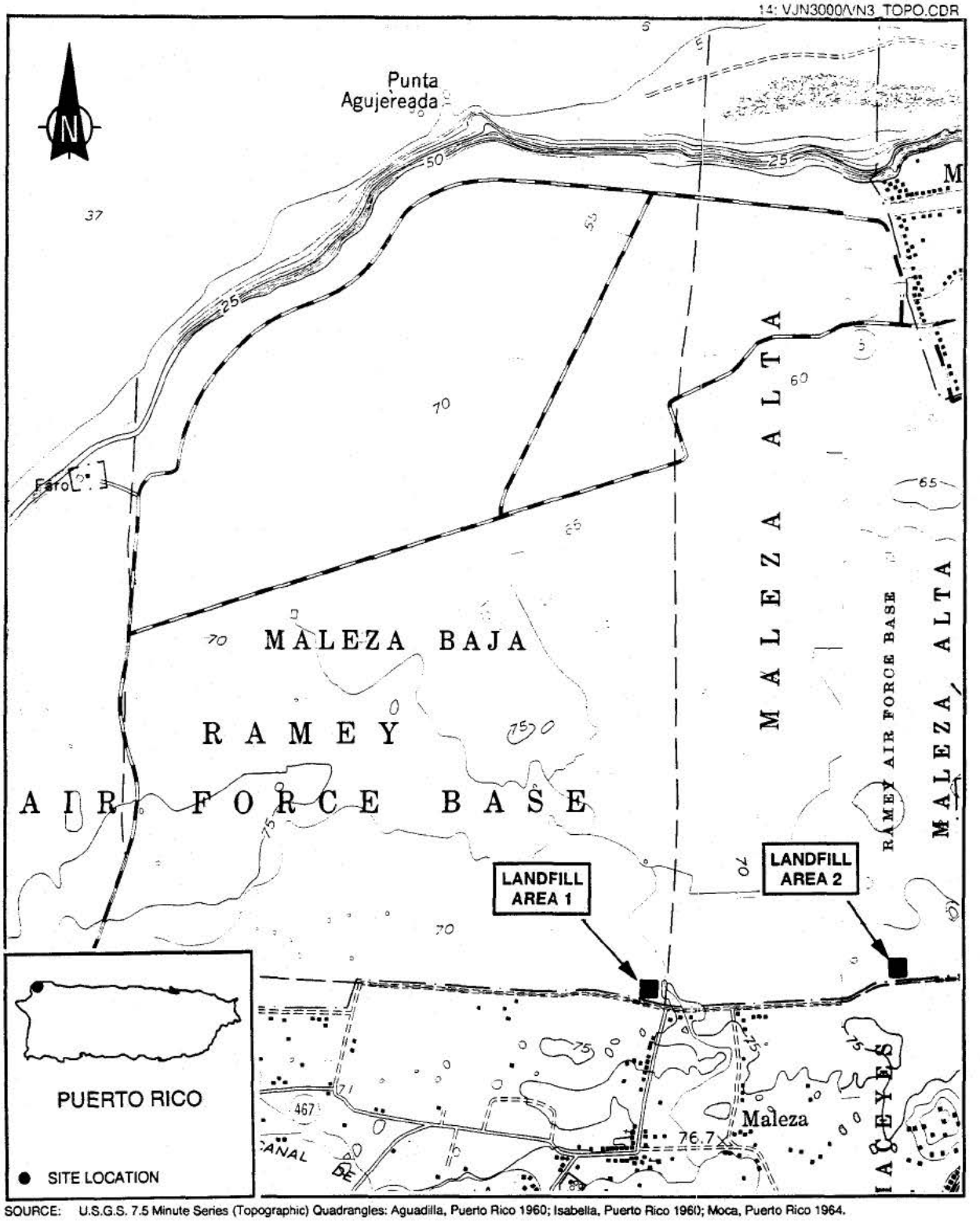
2.1 DESCRIPTION

2.1.1 Former Ramey Air Force Base

The former Ramey Air Force Base occupied approximately 4,357 acres north of the city of Aguadilla, on the extreme northwestern tip of the island of Puerto Rico (see Figure 2-1). The U.S. government acquired the property between 1939 and 1963 and utilized the site as a fully operational Air Force base until its deactivation in 1973 (see Figure 2-2). On March 1, 1974, ownership of most of the property was transferred to the Puerto Rican Industrial Development Company. Since March 1974, numerous land parcel transfers have occurred between U.S. government agencies, the U.S. government and private companies, and the U.S. government and local government agencies. This area is now operated by the Puerto Rican Port Authority as a municipal airport and industrial park, except for approximately 125 acres that are still utilized by the U.S. government as a U.S. Coast Guard installation (USACE 1992).

2.1.2 Landfill Area 1

Landfill Area 1 is located adjacent to, and south of, the airfield runway (see Figure 2-3). Area 1 is approximately 18 acres in area (USACE, 1996). Site features include a large (approximately five acres) sinkhole up to 25 feet deep, a fossilized coral reef forming a 30-foot high, 3-acre hill, and a broad, fenced area of heavy undergrowth, high grass, and trees. The hill is situated in the northern portion of the site. The site generally slopes at approximately 5° to the west, toward the sinkhole. Surface drainage of the site is into the sinkhole. Topographic relief at the site is approximately 100 feet. The site is reportedly used to graze cattle. Evidence that the site was used as a landfill includes abundant construction



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Aguadilla, Puerto Rico 1960; Isabella, Puerto Rico 1960; Moca, Puerto Rico 1964.

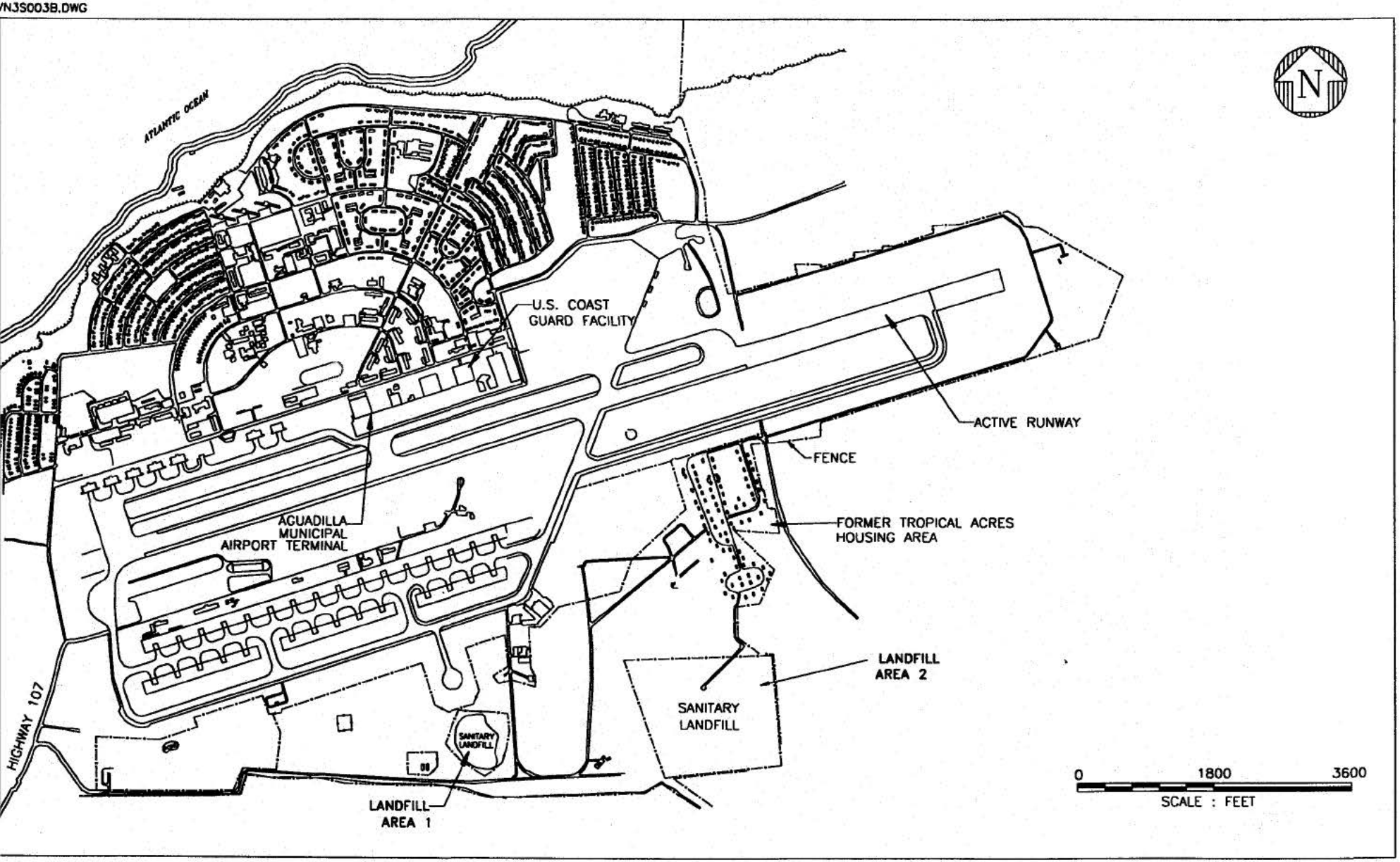
SCALE

0 .5 1 MILE

0 1000 2000 3000 4000 5000 FEET

Figure 2-1 LOCATION MAP -- LANDFILL AREAS 1 AND 2 AT THE FORMER RAMEY AIR FORCE BASE, AGUADILLA, PUERTO RICO

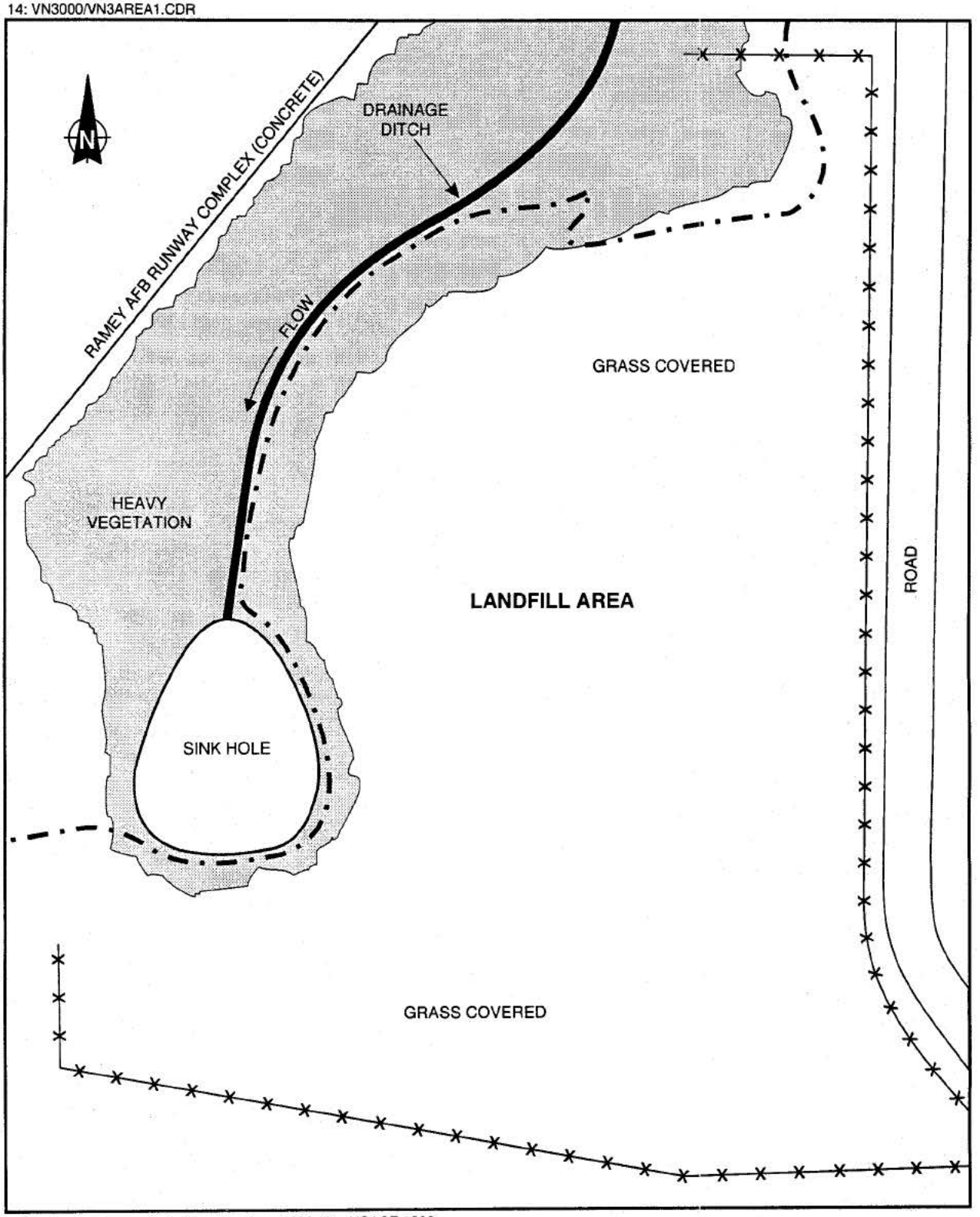
VN3S003B.DWG



URCE: Ecology and Environment, Inc., 1996., after Ramey Air Force Base Master Plan Map, November 1966.

Figure 2-2
HISTORICAL SITE VICINITY MAP
LANDFILL AREAS 1 and 2
AT THE FORMER
RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

14: VN3000/VN3AREA1.CDR



SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE
0 200 400 Feet

KEY:
Fence
Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)
Tree Line

Figure 2-3 SITE PLAN MAP -- LANDFILL AREA 1
FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

debris observed at and near the ground surface, and construction debris and scrap metal observed inside the sinkhole. Various medical wastes have also been observed inside the sinkhole, including intravenous bags and tubing, and syringes. Medical wastes appeared to have come from broken fabric bags buried with other debris. The southern end of the bottom of the sinkhole is covered by soil and undergrowth. In the northern end of the sinkhole exposed heavily weathered limestone was observed, and a potential karst limestone pipe, which likely drains the sinkhole, was observed. This feature was choked with large pieces of metal debris, limestone boulders, and logs. The sinkhole reportedly receives stormwater runoff from the runway via a drainage ditch. Evidence of storm water flow was observed, and debris caught in tree branches indicated the water level inside the sinkhole has exceeded eight feet in the past. USACE also reported standing water in the sinkhole during a December 1995 site visit (E & E 1996g).

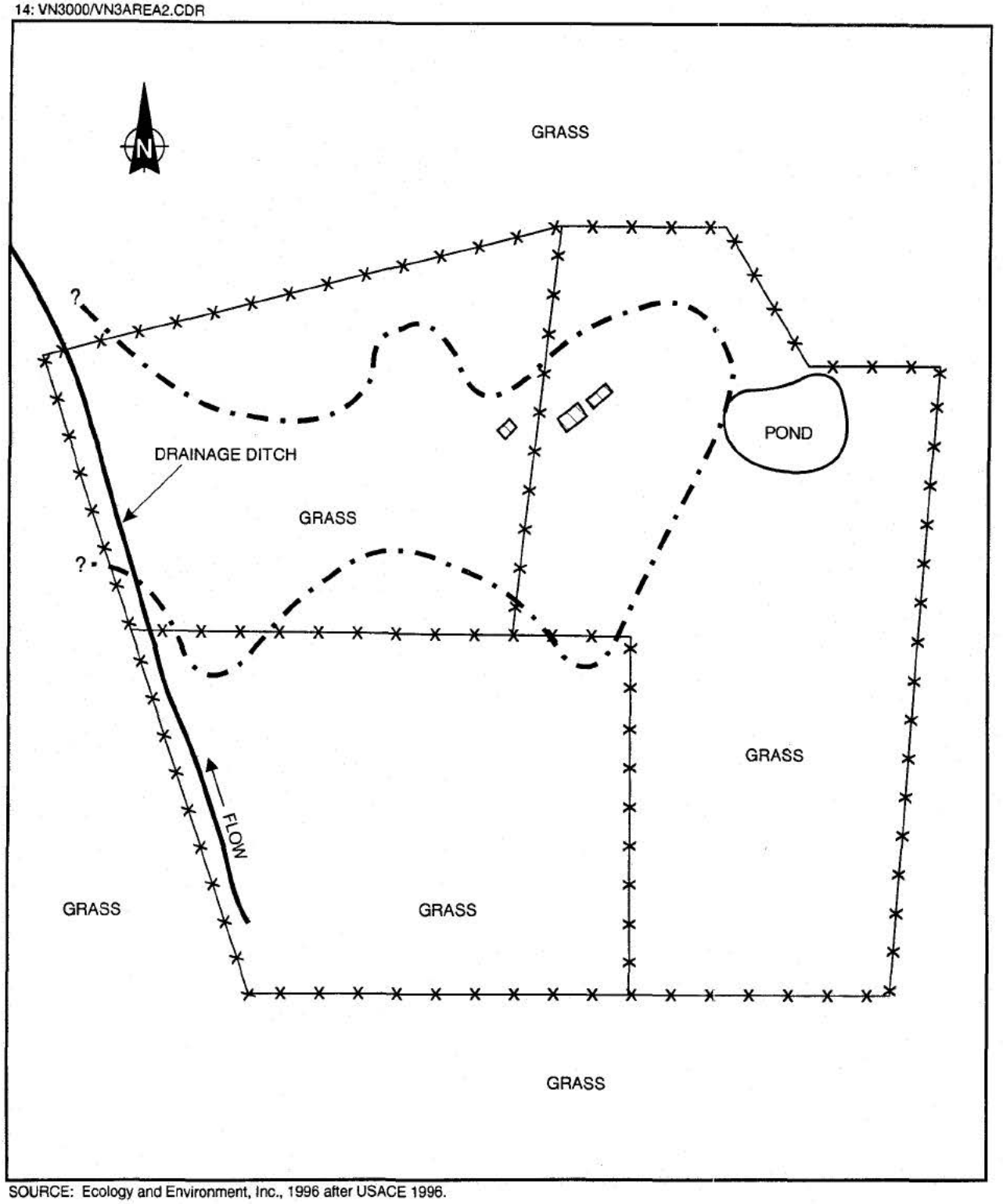
USACE conducted a geophysical survey of Landfill Area 1 in February 1996, which identified subsurface anomalies which are expected to indicate areas where landfill material is buried. The survey results indicate subsurface anomalies extend beyond the extent of the USACE survey (See Appendix A of the work plan). This suggests the extent of the landfill boundaries is still unknown (USACE 1996a; USACE 1996b).

USACE accompanied E & E on a site visit April 16, 1996. Observations of site conditions are included in the above site description. E & E also conducted a file review in Puerto Rico, and a document search summary is included in Appendix B of the work plan (E & E 1996e).

2.1.3 Landfill Area 2

Landfill Area 2 is located south of the former "Tropical Acres" housing area. The site is approximately 65 acres in area, and is currently used to graze cattle (USACE 1996; E & E 1996). The site is generally flat-lying, grass-covered, and sectioned with barb-wire fencing. Site features include several concrete building foundations, a newly constructed watering pond for cattle, and a shallow drainage ditch running along the northwestern margin of the site (see Figure 2-4). Evidence that the site was used as a landfill includes garbage and debris observed along the eroded sides of the drainage ditch. It is reported that the landfill received municipal, household garbage from the former, adjacent housing development. Several building foundations were observed at the site. These foundations were overgrown,

14: VN3000/VN3AREA2.CDR



SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE

0 400 800 Feet

KEY:

Fence

Building Foundations

Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)

NOTE: Approximate boundary of landfill has not been delineated to the Northwest.

Figure 2-4 SITE PLAN MAP -- LANDFILL AREA 2 FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

and appeared to be of an age and design consistent with former DOD activity at the former Ramey Air Force Base (USACE 1996, E & E 1996).

USACE conducted a geophysical survey of Landfill Area 2 in February 1996, which identified subsurface anomalies which are expected to indicate areas where landfill material is buried. The survey results indicate subsurface anomalies extend beyond the extent of the USACE survey (see Appendix A of the work plan). This suggests the extent of the landfill boundaries is still unknown (USACE 1996a; USACE 1996b).

USACE accompanied E & E on a site visit April 16, 1996. Observations of site conditions are included in the above site description. E & E also conducted a file review in Puerto Rico, and a document search summary is included in Appendix B of the work plan (E & E 1996e).

2.2 REGIONAL GEOLOGY/HYDROGEOLOGY

2.2.1 Hydrogeology

Landfill Areas 1 and 2 occur within the Northern Coastal physiographic region of the island of Puerto Rico. The Northern Coast slopes gently from the foothills, which mark the Cordillera Central Mountain region, to the Atlantic Ocean. Surficial deposits consist of sand, silt and limestone clays, overlying a dissected paleo surface, the remnants of which stand above the lowlands as isolated *mogotes*, or limestone hills (Rodriquez - Martinez 1995; Tucci/Martinez 1995).

The sites and vicinity are underlain by Quaternary-age sand deposits. These deposits are characterized as unstratified, fine- to medium-grained quartz sand, and light- to moderate-brown clays. These unconsolidated materials are between 0 and 100 feet thick (USGS, 1969).

The surficial deposits are underlain by the Micocene-age Aymamon Limestone, which outcrops at Landfill Area 1. The Aymamon is typified by tropical karstic topography, including sinkholes and mogotes, both of which occur at Landfill Area 1. Dissolutioning of the Aymamon is generally very active in the intermogotal areas in the vicinity of the site. The Aymamon is characterized as a very dense, conchoidally fracturing limestone of white, light gray, buff and rose colors. The formation is estimated to be up to 1,000 feet thick beneath the site (Rodriquez-Martinez 1995; Tucci/Martizez 1995).

The Miocene-age Aquada Limestone underlies the Aymamon Limestone. The Aquada is characterized as a hard, thick-bedded to massive calcarenite and dense limestone

interbedded with chalky limestone and marl, commonly containing some quartz grains. The formation is estimated to be up to 1,000 feet thick beneath the site (Rodriquez-Martinez 1995).

2.2.2 Aquifer Description

Most groundwater in the site vicinity occurs within the water-table aquifer that extends throughout the North Coast Province. An underlying artesian aquifer, which is an important source of water in North-Central Puerto Rico, becomes fragmented and unproductive in the site vicinity (Tucci/Martinez 1995).

The water-table aquifer extends from the water-table surface to the top of the freshwater/saline-water interface. This is not a sharp interface, but rather a gradational zone 75 to 115 feet thick. The water-table aquifer is composed of the Aymamon and Aquada limestones, although some alluvial deposits are present in the uppermost portion of the aquifer in some coastal areas. The Aymamon is the most important part of the aquifer beneath the site because the Aquada lies below the freshwater/saline-water interface (Tucci/Martinez 1995).

2.2.3 Aquifer Characteristics

Estimated hydraulic conductivities within the Aymamon Limestone range from 57 to 570 feet per day and diminishes with depth. This diminishing is likely related to the maximum effective depth to which karstification will occur within the aquifer. Estimates of transmissivity in the site vicinity are sparse because no rigorous aquifer tests have been conducted in the area. Continuous streamflow and groundwater-level data were not obtained until 1985. Available transmissivity estimates for the freshwater zone of the water table aquifer range from 200 to more than 280,000 square feet per day. Transmissivity values this high probably reflect cavernous porosity and enhanced dissolutioning along bedding planes, joints, and fractures. The Aymamon in the site vicinity is also mostly a grainstone-packstone and coral boundstone with as much as 25 percent total porosity (Rodriquez-Martinez 1995; Tucci/Martinez 1995).

Groundwater is expected to be encountered from 100 to 150 feet below ground surface (BGS). The flow direction in the water table aquifer would be expected to be generally to the northwest, toward the Atlantic Ocean coastline.

2.2.4 Aquifer Use

The Puerto Rico Aqueduct and Sewer Authority (PRASA) reports that domestic water supply in the vicinity of the site is obtained from several surface water reservoirs located between 5 and 10 miles south and southeast, and upgradient of the site. All of the former Ramey Air Force Base is supplied by PRASA, and no indication of private supply wells for domestic use could be found during the site visit and file review (PRASA 1983; E & E 1996e).

3. ASSESSMENT ACTIVITIES

3.1 GEOPHYSICAL SURVEY

3.1.1 Landfill Area 1

A geophysical survey using an EM-31 will be conducted at Landfill Area 1 to identify the extent of landfill to the south and east. The new survey will overlap the previous USACE geophysical survey by approximately 150 feet and will extend south approximately 200 feet from the southern border of the USACE survey and east approximately 200 feet from the eastern border of the USACE survey. The survey will be performed on 50-foot centers to match the USACE survey. Section 5.1 of the GDAP describes the survey methodology.

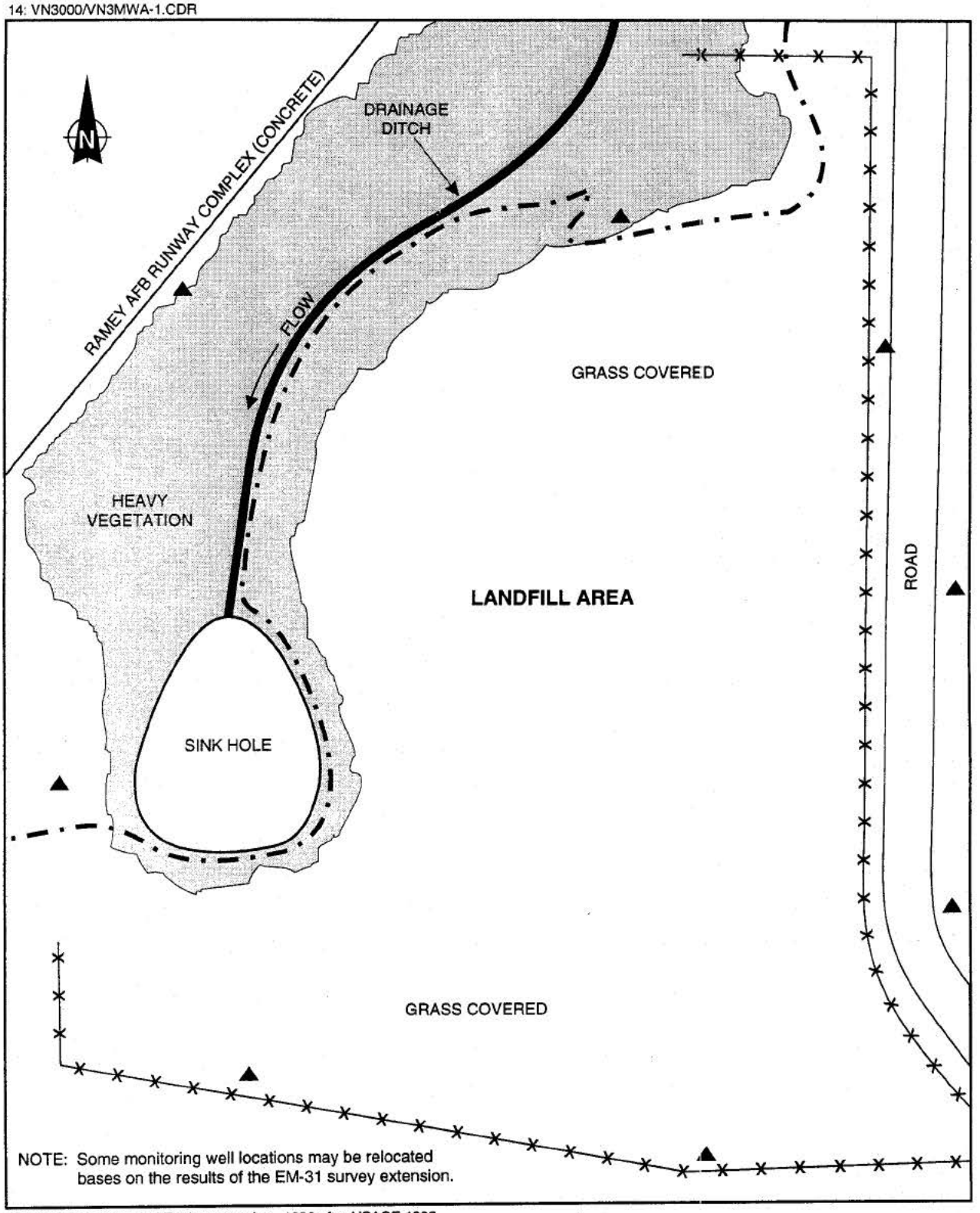
3.1.2 Landfill Area 2

A geophysical survey using an EM-31 will be conducted in the northwest quadrant of Landfill Area 2. The new survey will overlap the previous USACE geophysical survey by approximately 150 feet and extend over an area approximately 800 feet by 800 feet using a data point spacing of 50 feet to match the USACE survey. Section 5.1 of the GDAP describes the survey methodology.

3.2 SURFACE WATER/SEDIMENT ASSESSMENT

One surface water and one sediment sample will be collected from the bottom of the sinkhole at Landfill Area 1 (see Figure 3-1). The sediment sample will be collected from 0 to 0.5 feet below the substrate along the eastern side of the sinkhole near areas where landfill material is being eroded and transported into the sinkhole by storm water. If no standing water is present in the sinkhole during the sampling effort, two surface soil samples will be collected instead of the surface water and sediment samples. In either case, sample locations

14: VN3000/VN3MWA-1.CDR



SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE

0 200 400 Feet

KEY:

- ▲ Proposed Monitoring Well Locations
- Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)
- Fence
- Tree Line

Figure 3-1 PROPOSED MONITORING WELL LOCATIONS -- LANDFILL AREA 1 FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

will be selected along the most probable drainage pathway. Both samples will be analyzed for volatile organic compounds (VOCs; EPA Method 8260), PAH portion of base/neutral and acid extractable organic compounds (BNAs; EPA Method 8270B), pesticides and polychlorinated biphenyls (PCBs; EPA Method 8081), Target Analyte List (TAL) metals: silver, aluminum, arsenic, barium, beryllium, calcium, cadmium, chromium, copper, iron, mercury, potassium, magnesium, manganese, sodium, nickel, lead, antimony, selenium, titanium, vanadium and zinc (EPA Methods 6010, 7060, 7421, 7740, 7841, 7470, and 7471), and Total Petroleum Hydrocarbons (TPHs; EPA Method 8015M; see Table 3-1). In addition, the sediment sample will also be analyzed for explosives (EPA Method 8330). Decontamination procedures and management of IDW are described in the CDAP (Sections 4.4.10 and 4.4.12 respectively).

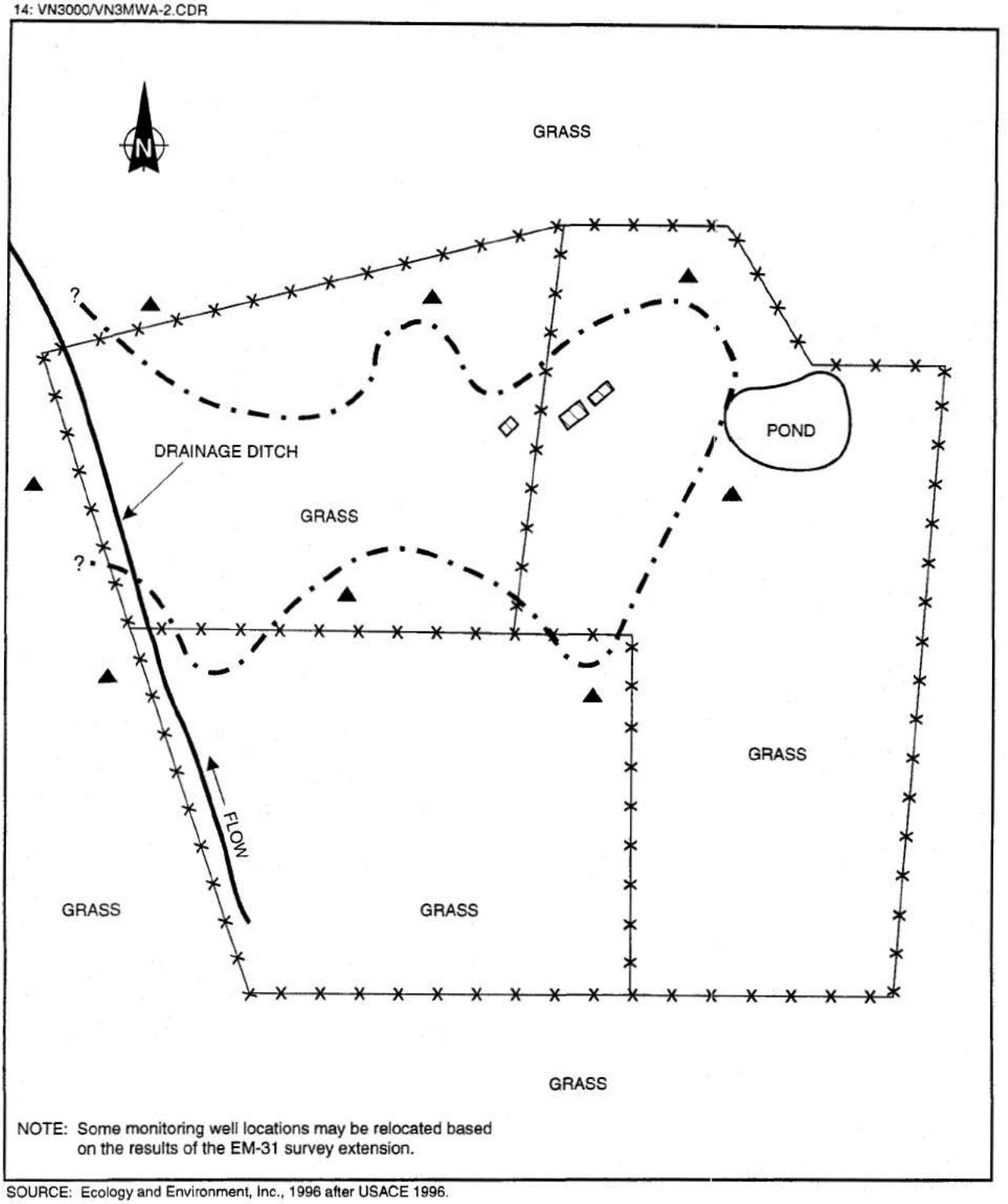
3.3 GROUNDWATER ASSESSMENT

3.3.1 Monitoring Well Installation

Because the exact depth to groundwater at the site is unkown and portions of the landfill boundaries have not been delineated, the number and locations of monitoring wells to be installed will not be finalized until the geophysical surveys are performed and an initial borehole is completed. The number and distribution of monitoring wells are proposed for three scenarios and that balance the need to adequately detect possible groundwater contamination emanating from the landfills and the level of effort needed to install the monitoring wells. If the depth to groundwater is less than 125 feet BGS, eight monitoring wells will be installed at each of the two landfills as shown in figures 3-1 and 3-2. If depth to groundwater is determined to be 125 to 175 feet BGS, five or six monitoring wells will be installed at each landfill. If depth to groundwater is determined to be greater than 175 feet, four or five monitoring wells will be installed at each landfill. Under either of the latter two scenarios, one of the wells at each landfill will be located upgradient (i.e., southeast) of the respective landfill; the other wells will be appropriately located along the northern and western perimeter of each landfill, which is presumed to be the downgradient direction (toward the coast).

The proposed monitoring well locations were chosen based on the USACE geophysical survey results, which located subsurface anomalies. These locations are intended to allow for groundwater data collection from points upgradient, downgradient, and adjacent to these anomalies. However, well locations along the southern and eastern boundaries of Landfill

14: VN3000/VN3MWA-2.CDR



SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE

0 400 800 Feet

KEY:

- Proposed Monitoring Well Locations
- Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)
- Fence
- Building Foundations

NOTE: Approximate boundary of landfill has not been delineated to the Northwest.

Figure 3-2 PROPOSED MONITORING WELL LOCATIONS -- LANDFILL AREA 2 FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

Area 1 and northwestern boundary of Landfill Area 2 are subject to change pending completion of the proposed supplemental geophysical surveys. The remainder of this section (Section 3) is based on the assumption that eight wells will be installed at each landfill area.

Eight 2-inch inside diameter, Schedule 40 polyvinyl chloride (PVC), monitoring wells will be installed at each of the two landfill areas using a drill rig equipped with hollow-stem augers and tri-cone reverse air coring techniques as described in Section 3 of the GDAP. All reasonable efforts will be made to avoid encountering subsurface scrap material that has been deposited at the site. Each location will be screened using a metal detector/magnetometer prior to intrusive activities. Soil samples will be collected using split-spoon techniques. Split-spoon samples will be collected on 5-foot centers beginning at ground surface, and terminating at the top of bedrock (estimated to occur at 35 feet BGS). A total of eight soil samples will be collected from each borehole.

The eight soil samples collected from each monitoring well borehole will be analyzed for VOCs (EPA Method 8260), BNAs (EPA Method 8270B), pesticides and PCBs (EPA Method 8081), TAL metals: silver, aluminum, arsenic, barium, beryllium, calcium, cadmium, chromium, copper, iron, mercury, potassium, magnesium, manganese, sodium, nickle, lead, antimony, selenium, titanium, vanadium, and zinc (EPA Methods 6010, 7060, 7421, 7740, 7841, 7470 and 7471), TPHs (EPA Method 8015M; see Table 4-1) and explosives (EPA Method 8330; see Tables 3-1 and 3-2).

The monitoring well boreholes will be completed using a combination of hollow-stem augering techniques and tri-cone reverse air techniques. Hollow-stem augering will be performed from the ground surface to the top of bedrock (see Section 3.3.1 of the GDAP). After encountering bedrock at each monitoring well borehole location, the drilling method will be switched from hollow-stem augers to tri-cone reverse air (see Section 3.3.3 of the GDAP). This method will be used to drill from the surface of the bedrock to the total well depth. Groundwater is expected to be encountered between 100 feet and 150 feet BGS. Use of the reverse air drilling method will allow the geologist to determine the precise depth to groundwater while drilling. Rock cuttings will be used to characterize the lithology of the bedrock at each well location according to Appendix E of the GDAP.

Each well will be constructed of the required length of flush-threaded casing, terminating with 15 feet of 0.02-inch factory-slotted screen bracketing the water table.

Table 3-1

SAMPLE ANALYTICAL SUMMARY
LANDFILL AREA 1
FORMER RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

Sample Type/Matrix	Analytical Parameter (Method Number)	Number of Samples	Field QC Samples				Field QA Samples[a]			Holding Times	Preservation	Sample Cntnrs	No. of Cntnrs
			Duplicate	Equipment Rinsates	Trip Blanks[1]	Total Field and QC Samples	Duplicates	Trip Blanks[1]	Total QA Samples				
Soil	VOC (8260[3])	64	6	0	6	76	6	6	12	14d	Ice to 4°C[4]	2-40 mL GSV	154
	BNA (8270B)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	77
	Pesticides/PCBs (8081)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	see note 2	77
	TAL Metals (Various[2])	64	6	0	0	70	6	0	6	6 mo	Ice to 4°C	8 oz cwm	77
	TPH (8015M)	64	6	0	0	70	6	0	6	28 days	Ice to 4°C	8 oz cwm	77
	Explosives (8330)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	77
Groundwater	VOC (8260[3])	8	1	1	1	11	1	1	2	14d	Ice to 4°C[4,5]	2-40 mL GSV	28
	BNA (8270B)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	Pesticides/PCBs (8081)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	TAL Metals (Various[2])	8	1	1	0	10	1	0	1	6 mo	Ice to 4°C[6]	1 L HDPE	12
	TPH (8015M)	8	1	1	0	10	1	0	1	28 days	Ice to 4°C[7]	2-1L Glass	24
Surface Water (If Present)	VOC (8260[3])	1	1	0	1	3	1	1	2	14d	Ice to 4°C[4,5]	2-40 mL GSV	28
	BNA (8270B)	1	1	0	0	2	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	Pesticides/PCBs (8081)	1	1	0	0	2	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	24
	TAL Metals (Various[2])	1	1	0	0	2	1	0	1	6 mo	Ice to 4°C[6]	1 L HDPE	12
	TPH (8015M)	1	1	0	0	2	1	0	1	28 days	Ice to 4°C[7]	2-1L Glass	24

Key at end of table.

Table 3-1

SAMPLE ANALYTICAL SUMMARY
LANDFILL AREA 1
FORMER RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

Sample Type/Matrix	Analytical Parameter (Method Number)	Number of Samples	Field QC Samples				Field QA Samples[a]			Holding Times	Preservation	Sample Cntnrs	No. of Cntnrs
			Duplicate	Equipment Rinsates	Trip Blanks[1]	Total Field and QC Samples	Duplicates	Trip Blanks[1]	Total QA Samples				
Sediment	VOC (8260[3])	1	1	0	1	3	1	0	1	14d	Ice to 4°C[4]	2-40 mL GSV	154
	BNA (8270B)	1	1	0	0	2	1	0	1	14d/40d	Ice to 4°C	8 oz cwm	77
	Pesticides/PCBs (8081)	1	1	0	0	2	1	0	1	14d/40d	Ice to 4°C	see note 4	77
	TAL Metals (Various[2])	1	1	0	0	2	1	0	1	6 mo	Ice to 4°C	8 oz cwm	77
	TPH (8015M)	1	1	0	0	2	1	0	1	28 days	Ice to 4°C	8 oz cwm	77

Reference: USACE Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, 30 June 1995.

[a] To satisfy QA requirements, a split of each field QC sample will be sent to the USACE QA laboratory.

[1] One Trip Blank with every cooler containing VOC sample(s).
[2] TAL Metals. Ag, Al, Ba, Ca, Cd, Cr, Co, Fe, K, Mg, Mn, Na, Ni, Sb, Se, Ti, V, Zn (EPA 6010).
As (EPA 7060).
Hg (EPA 7470/7471).
Pb (7421).
[3] Including MTBE and Napthalene.
[4] No headspace.
[5] HCl to pH < 2.
[6] HNO_3 to pH < 2.
[7] H_2SO_4 to pH < 2.

Key:

A.G. = Amber glass.
BNA = Base/neutral and acid extractable organic compound.
cwm = Clear, wide-mouth jar.
GSV = Glass septa vial.
HDPE = High density polyethylene bottle.
oz = Ounce.
QA = Quality assurance.
QC = Quality control.
TPH = Total petroleum hydrocarbon.
VOC = Volatile organic compound.

Table 3-2

SAMPLE ANALYTICAL SUMMARY
LANDFILL AREA 2
FORMER RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

Sample Type/Matrix	Analytical Parameter (Method Number)	Number of Samples	Field QC Samples				Field QA Samples[a]			Holding Times	Preservation	Sample Cntnrs	No. of Cntnrs
			Duplicate	Equipment Rinsates	Trip Blanks[1]	Total Field and QC Samples	Duplicates	Trip Blank[1]	Total QA Samples				
Soil	VOC (8260[3])	64	6	0	6	76	6	6	12	14d	Ice to 4°C[4]	2-40mL GSV	152
	BNA (8270B)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	76
	Pesticides/PCBs (8081)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	see note 2	76
	TAL Metals[2] (Various[2])	64	6	0	0	70	6	0	6	6 mo	Ice to 4°C	8 oz cwm	76
	TPH (8015M)	64	6	0	0	70	6	0	6	28 days	Ice to 4°C	8 oz cwm	76
	Explosives (8330)	64	6	0	0	70	6	0	6	14d/40d	Ice to 4°C	8 oz cwm	76
Groundwater	VOC (8260[3])	8	1	1	1	11	1	1	2	14d	Ice to 4°C[4,5]	2-40mL GSV	26
	BNA (8270B)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	22
	Pesticides/PCBs (8081)	8	1	1	0	10	1	0	1	7d/40d	Ice to 4°C	2-1L A.G.	22
	TAL Metals[2] (Various[2])	8	1	1	0	10	1	0	1	6 mo	Ice to 4°C[6]	1 L HDPE	11
	TPH (8015M)	8	1	1	0	10	1	0	1	28 days	Ice to 4°C[7]	2-1L Glass	22

Reference: USACE Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, 30 June, 1995.

[a] To satisfy QA requirements, a split of each field QC sample will be sent to the USACE QA laboratory.
[1] One Trip Blank with every cooler containing VOC sample(s).
[2] TAL Metals: Ag, Al, Ba, Ca, Cd, Cr, Co, Fe, K, Mg, Mn, Na, Ni, Sb, Se, Ti, V, Zn (6010); As (7060); Hg (7470/7471); Pb (7421).
[3] Including MTBE and Napthalene.
[4] No headspace.
[5] HCL to pH < 2.
[6] HNO_3 to pH < 2.
[7] H_2SO_4 to pH < 2.

Key:

A.G. = Amber glass.
BNA = Base/neutral and acid extractable organic compound.
cwm = Clear, wide-mouth jar.
GSV = Glass septa vial.
HDPE = High density polyethylene bottle.
oz = Ounce.
QA = Quality assurance.
QC = Quality control.
TPH = Total petroleum hydrocarbon.
VOC = Volatile organic compound.

A sand pack will be installed from the bottom of the boring to approximately 2 feet above the top of the screen. A bentonite seal not less than 2 feet thick will be placed into the annular space above the sand pack. Cement grout will be placed above the bentonite seal to ground surface. Steel protective casings, locks, caps, a concrete pad, and protective posts will be installed to protect the monitoring wells. All monitoring well installation activities will be conducted in accordance with Section 3.4 of the GDAP.

3.3.2 Monitoring Well Development

After each well has been constructed, but no sooner than 48 hours after grouting is completed, the wells will be developed by surging and pumping. Water levels, specific conductance, temperature, and pH will be measured and recorded before and after the development of each well. Development will continue until the water is clear and free from sand, silt, and clay. If suitable development is not reached within 6 hours of continuous development action, the development activities will be stopped. Development water shall be drummed as IDW, labeled, and held for disposal until chemical analysis determines whether off-site disposal is required. Disposal criteria for the development water will be based on U.S. EPA groundwater standards.

After final development of each well, E & E will collect approximately 1 liter of water from the well in a clear glass jar, label and photograph it with 35mm color print film, and submit the photo as part of the well development record. The photograph will have suitable back-light and shall be taken close enough to show the clarity of the water. Well development will be completed in accordance with Section 3.5 of the GDAP.

3.3.3 Groundwater Sampling

Approximately 24-hours after the development and stabilization, the eight new monitoring wells in each of the two landfill areas will be sampled. The groundwater samples will be analyzed for BNAs (EPA Method 8270B); VOCs (EPA Method 8260); TPH (EPA Method 8015M); pesticides and PCBs (EPA Method 8081); and TAL metals (EPA Methods 6010, 7060, 7421, 7740, 7841, 7470, and 7471; see Table 3-1 and 3-2). The wells will be purged and samples will be collected in accordance with Section 4.4.6 of the CDAP. Specific conductance, temperature, and pH will be measured and recorded during and after the purge to assure samples are representative of aquifer conditions.

3.4 HYDROGEOLOGIC ASSESSMENT

3.4.1 Lithologic Samples

During soil boring activities, lithologic samples will be obtained for the purpose of characterizing the site-specific subsurface geologic conditions. Lithologic samples will be collected from ground surface to the total depth of each monitoring well using the techniques discussed in Section 3.3.1 of the work plan. A lithologic log of each borehole, containing a lithologic description, Unified Soil Classification, and total organic vapor (TOV) readings, will be maintained in the field in accordance with Sections 7.1 and 7.2 of the GDAP.

3.4.2 Water Level Measurements

Water level measurements will be made to the nearest 0.01 foot in the eight newly installed monitoring wells at each of the two landfill areas using an electronic water level indicator as described in Section 4.1.3 of the GDAP. Water level measurements will be referenced to the surveyed, top of casing (TOC) elevations. The water level elevation data will be used to determine the prevailing direction of groundwater flow across the site.

3.5 SURVEYING

All new monitoring wells at the site will be surveyed (see Section 8 of the GDAP) by a registered land surveyor and referenced to a permanent survey marker. The TOC elevations of each monitoring well will be surveyed to the nearest 0.01 foot and referenced to the National Geodetic Vertical Datum (NGVD).

3.6 SITE-SPECIFIC CHEMICAL DATA ACQUISITION PLAN

This Site-Specific Chemical Data Acquisition Plan (SCDAP) contains the specific sampling and analytical requirements for the assessment activities at both landfill areas at the former Ramey AFB, and any modifications to procedures specified in the CDAP.

As discussed in Sections 3.4.1 and 3.2.3 of the work plan, 128 soil samples and one sediment sample will be collected and analyzed for VOCs (EPA Method 8260); BNAs (PAHs only; EPA Method 8270B); pesticides and PCBs (EPA Method 8081); TAL metals: silver, aluminum, arsenic, barium, beryllium, calcium, cadmium, chromium, copper, iron, mercury, potassium, magnesium, manganese, sodium, titanium, vanadium and zinc (EPA Methods 6010, 7060, 7421, 7740, 7041, 7470, and 7471); TPH (EPA Method 8015M; see Table 3-1),

and explosives (EPA Method 8330). One surface water sample and sixteen groundwater samples will also be collected and analyzed for the same parameters as the soil and sediment samples, with the exception of explosives. Table 3-1 lists the number of samples, including QA and QC samples, and test methods required for chemical analyses. These analyses will be conducted at E & E's Analytical Services Center (ASC).

To satisfy QC requirements, duplicate, equipment rinsate, and trip blank samples will be collected and analyzed as specified in Table 3-1. These samples will be sent to E & E's ASC. To satisfy QA requirements, a split of each duplicate, equipment rinsate, and trip blank sample will be collected and sent to the USACE QA laboratory (South Atlantic Division Laboratory) for analysis.

All samples will be collected, preserved, packaged, transported, and analyzed in accordance with the CDAP.

3.7 IDW MANAGEMENT AND DISPOSAL

All IDW, including decontamination fluids, well development and purge water, and soil and rock cuttings, will be containerized at the site using DOT 17-H, 55-gallon steel drums. Drums will be staged adjacent to each monitoring well location, and labeled with an adhesive sticker marked with the start date of storage, drum contents, site name, and the USACE and E & E points of contact. IDW will remain at the site until analytical results are received and reviewed.

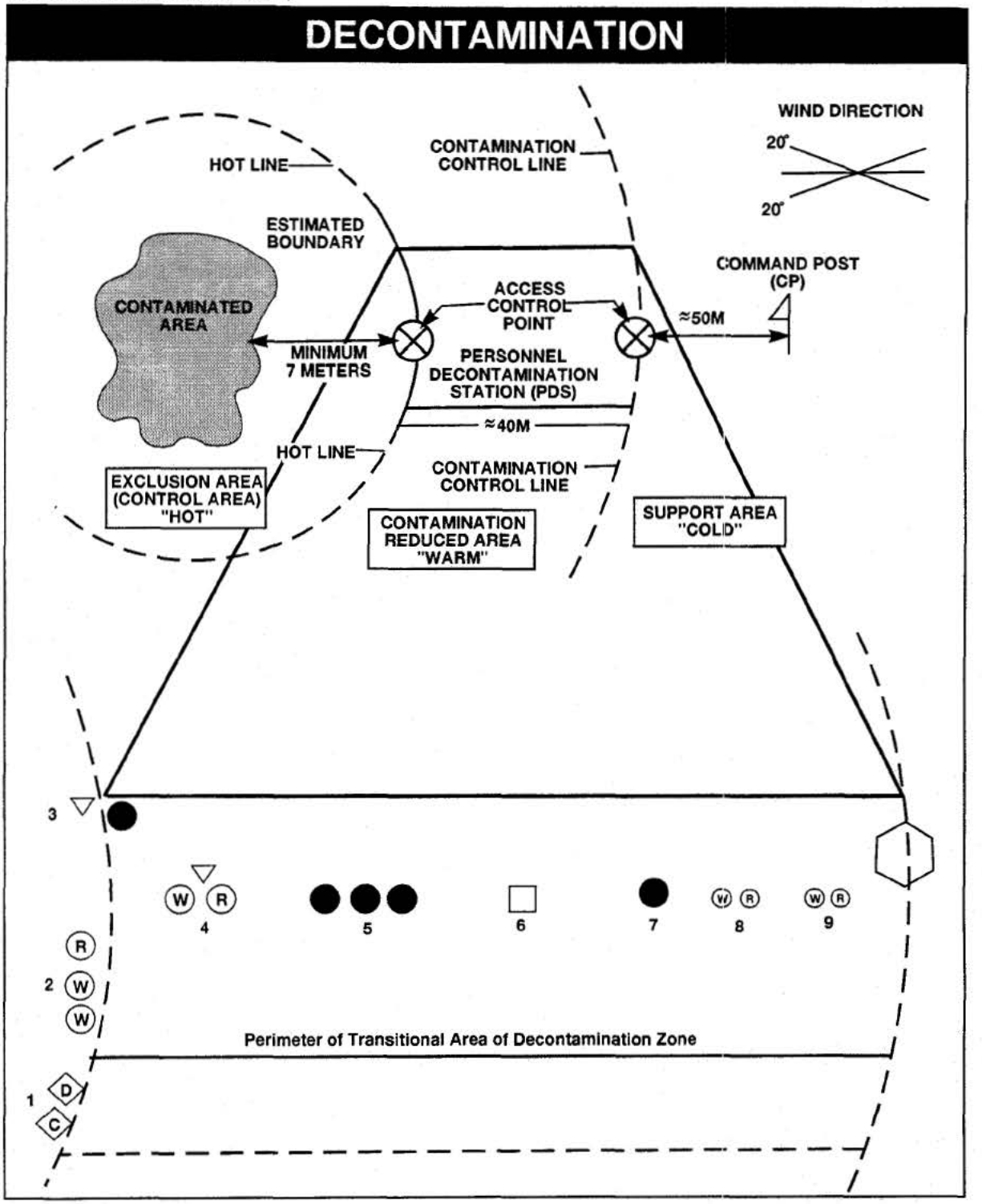
If analytical results indicate the IDW concentrations are below EPA MCLs and EPA Region III risk-based soil concentration levels, E & E will propose the on-site disposal of the IDW. If IDW concentrations exceed these guidelines, E & E will evaluate the best disposal alternative, and propose off-site disposal at a permitted disposal facility.

4. SITE-SPECIFIC SAFETY AND HEALTH PLAN

The SSHP document in this section summarizes the hazard assessment/risk analysis for all chemical and physical hazards associated with Landfill Areas 1 and 2, on the former Ramey AFB. The SSHP provides the following information:

- Administrative project information (Section A);
- Physical and chemical site/waste characteristics (Section B);
- Physical and chemical hazard evaluation associated with each site task (Section C);
- Site safety work plan specifying the level of protection by task, action levels for contaminants, air monitoring instruments and procedures, site operation safety protocols, team members, responsibilities and training (Section D);
- Emergency information with regard to local resources, site resources, emergency contacts, emergency hospital routes and contingency plan for on-site emergencies (Section E);
- Equipment checklist (Section F); and
- Site work zones (Figure 4-1).

Hazard evaluation sheets and material safety data sheets are included in Appendix C, and a hospital route map is provided in Appendix D. E & E employee training and physical examination summaries are provided in Appendices E and F, respectively. The subcontractors that will perform work on site are Suelos Tech, Inc., and Caribbean Aerial Surveys, Inc. Each of the subcontractors has developed a safety and health program in



KEY:

- Drop Cloth (C - Clean, D - Dirty)
- Basin (W - Wash, R - Rinse)
- Chair/Stool
- Garbage Can
- 5-Gal. Bucket
- Field Shower

1. Equipment Drop
2. Outer Garment Decontamination
3. Bootie Removal
4. Glove and Boot Decontamination
5. Outer Garment Removal
6. SCBA Drop
7. Disposable Garment Removal
8. Hand Wash
9. Mask Wash
10. Field Shower

Figure 4-1
SITE WORK ZONES AND PERSONNEL DECONTAMINATION STATION TYPICAL LAYOUT

accordance with 29 CFR 1910 that will be followed during field investigations. Additionally, each subcontractor will follow the safety and health guidelines outlined in this SSHP. Suelos Tech equipment checklist, employee training and physical examination summaries are provided in Appendix G. Caribbean Aerial Surveys' equipment checklist, employee training and physical examination summaries are provided in Appendix H. E & E's certified industrial hygienist's biography is provided in Appendix I. The project's administrative organization is provided in Appendix J. E & E's Standard Operating Procedure for Emergencies due to Heat and Heat Stress Monitoring is presented in Appendix K. USACE's accident/incident report Form 3394 must be completed and submitted to the USACE Project Manager within two working days of an incident.

ecology and environment, inc.

SITE-SPECIFIC SAFETY AND HEALTH PLAN

A. GENERAL INFORMATION

Project Title: Former Ramey Air Force Base Landfill Areas 1 and 2 Delivery Order No. 21	**Project No.:** VN3000 **Contract No.:** DACA21-93-D-0034
Project Manager: D. Heatwole	**Project Director:** J. Barksdale
Location(s): *Aguadilla, Puerto Rico*	
Prepared by: M. Letson	**Date Prepared:** 5/29/96
Approved by: T. Siener	**Date Approved:** 5/31/96
Site Safety Officer Review: D. Bowman	**Date Reviewed:**

Scope/Objective of Work: Activities will include installation, construction, and sampling of groundwater monitoring wells; sampling surface water and sediment from a sinkhole on Landfill Area 1; survey of well/boring locations; and proper storage/disposal of investigation-derived wastes.

Proposed Date of Field Activities: October 22, 1996 - November 19, 1996

Background Information: Complete: [ ] Preliminary (no analytical data available) [X]

Documentation/Summary:

Overall Chemical Hazard:	Serious	[ ]	Moderate	[ ]
	Low	[X]	Unknown	[ ]
Overall Physical Hazard:	Serious	[ ]	Moderate	[ ]
	Low	[X]	Unknown	[ ]

B. SITE/WASTE CHARACTERISTICS

Waste Type(s):

Liquid	[X]	Solid	[X]	Sludge	[ ]	Gas/Vapor	[X]

Characteristic(s):

Flammable/Ignitable	[X]	Volatile	[X]	Corrosive	[ ]	Acutely Toxic	[X]
Explosive	[ ]	Reactive	[ ]	Carcinogen	[X]	Radioactive[a]	[ ]

Other: Medical

Physical Hazards:

Overhead	[X]	Confined Space	[ ]	Below Grade	[ ]	Trip/Fall	[X]
Puncture	[X]	Burn	[X]	Cut	[X]	Splash	[X]
Noise	[X]	Other: Poisonous spiders and snakes, ticks, poison ivy, and vehicular traffic.					

[a] Requires completion of additional form and special approval from the Corporate Health/Safety group. Contact RSC or HQ.

Site History/Description and Unusual Features: See work plan and Section 2 of this SSHP for description.
Locations of Chemicals/Wastes: Potential contaminants may be located in soil and/or groundwater in the immediate vicinity of Landfill Areas 1 and 2 or in the surfacewater and/or sediment in the pond on Landfill 1.
Estimated Volume of Chemicals/Wastes: Unknown at this time.
Site Currently in Operation Yes [ ] No [X]

C. HAZARD EVALUATION AND CONTROL

Potential physical hazards and their applicable control measures are described in the following table. Descriptions of each task are contained in Section D.

Hazard	Task Number	Hazard Control Measures
Biological (flora, fauna, etc.)	1-8	• Potential hazard: Poisonous snakes, spiders, ticks. • Personnel will proceed into grassy and wooded areas with caution and be alert for the presence of snakes. When handling equipment and opening wells, watch for the presence of poisonous spiders such as the black widow and brown recluse. Personnel also will check themselves for ticks if working in potentially infested areas.
Drilling	1, 3	• See SOP for Health and Safety on Drilling Rig Operations. Additional documentation may be required.
Drums and Containers	1-5	• Ensure compliance with 29 CFR 1910.120(j). • Consider unlabeled drums or containers to contain hazardous substances and handle accordingly until the contents are identified. • Inspect drums or containers and assure integrity prior to handling. • Move drums or containers only as necessary; use caution and warn nearby personnel of potential hazards. • Open, sample, and/or move drums or containers in accordance with established procedures; use approved drum/container-handling equipment.
Fire and Explosion	1, 3	• Inform personnel of the location(s) of potential fire/explosion hazards. • Establish site-specific procedures for working around flammables. • Ensure that appropriate fire suppression equipment and systems are available and in good working order. • Define requirements for intrinsically safe equipment. • Identify special monitoring needs (see Section 8). • Remove ignition sources from flammable atmospheres. • Coordinate with local fire-fighting groups regarding potential fire/explosion situations. • Establish contingency plans and review daily with team members.
Heat Stress	1-8	• Provide cool break area and adequate breaks. • Provide cool noncaffeinated beverages. • Promote heat stress awareness. • Use active cooling devices (e.g., cooling vests) where specified. • See *Heat Stress Prevention and Treatment* (see Appendix K).
Heavy Equipment Operation	1, 3, 4	• Define equipment routes, traffic patterns, and site-specific safety measures. • Ensure that operators are properly trained and equipment has been properly inspected and maintained. Verify back-up alarms.

C. HAZARD EVALUATION AND CONTROL		
Heavy Equipment Operation (Continued)	1, 2, 4	• Ensure that ground spotters are assigned and informed of proper hand signals and communication protocols. • Identify special PPE (Section 7) and monitoring (Section 8) needs. • Ensure that field personnel do not work in close proximity to operating equipment. • Ensure that lifting capacities, load limits, etc., are not exceeded.
Noise	1, 3, 4	• Establish noise level standards for on-site equipment/operations. • Inform personnel of hearing protection requirements (Section 7). • Define site-specific requirements for noise monitoring (Section 8).
Overhead Obstructions	1-5, 7	• Wear hard hat.
Power Tools	1, 3	• Ensure compliance with 29 CFR 1910 Subpart P.
Sunburn	1-8	• Apply sunscreen. • Wear hats/caps and long sleeves.
Slip/Trip	1-8	• Keep area clear of obstructions.
Utility Lines	1, 3, 4	• Identify/locate existing utilities prior to work. • Ensure that overhead, underground, and nearby utility lines are at least 25 feet away from project activities. • Contact utilities to confirm locations, as necessary.
Weather Extremes	1-8	• Potential hazards: Hurricanes • Establish site-specific contingencies for severe weather situations. • Provide for frequent weather broadcasts. • Weatherize safety gear, as necessary. • Identify special PPE (Section F) needs. • Discontinue work during severe weather.
Other: Falls	1-8	• Assure open holes are appropriately marked or guarded in accordance with 29 CFR 1910.23 and 29 CFR 1926.651(K) as applicable.
Other: Chemical burns	1-5, 7	• Identify special PPE (Section F) needs.
Other: Thermal burns	1, 3, 4	• Identify special PPE (Section F) needs.
Other: Strains (Ergonomics)	1-8	• Maintain proper posture and lift in an ergonomically correct manner.
Other: Airborne (flying) aerosols and particles	1-8	• Identify special PPE (Section F) needs for eye protection.

HAZARD EVALUATION					
Compound	**PEL/ TLV**	**Route of Exposure**	**Acute Symptoms**	**Odor Threshold**	**Odor Description**
Benzene	1 ppm/ 1 ppm	Inhalation, ingestion, ocular and dermal absorption	Skin irritant, CNS depressant, initial excitation followed by headache, dizziness, vomiting, delirium, possibly tremors, blurred vision, shallow respiration, convulsions	61 ppm	Aromatic

HAZARD EVALUATION					
Compound	**PEL/ TLV**	**Route of Exposure**	**Acute Symptoms**	**Odor Threshold**	**Odor Description**
Toluene	100 ppm/ 50 ppm	Inhalation, ingestion, ocular and dermal contact	Dizziness, fatigue, headache; vomiting; nausea; eye irritant, dries skin	1.6 ppm	Benzene-Like
Xylene	100 ppm/ 100 ppm	Inhalation, ingestion, ocular and dermal contact	Eye and mucous membrane irritant, CNS depressant, ingestion causes gastrointestinal upset	20 ppm	Aromatic
Lead	0.05 mg/m^3/ 0.15 mg/m^3	Inhalation, ingestion, and dermal and ocular contact	Stomach distress; vomiting; diarrhea; anemia; and nervous system effects	None reported	None reported
Chromium	1 mg/m^3/ 0.5 mg/m^3	Inhalation and ingestion	Contact dermatitis headache; nausea; coughing, wheezing, fever, vomiting, irritation of mucous membranes and upper respiratory tract	Odorless	Odorless
Ethylbenzene	100 ppm/ 100 ppm	Ingestion, inhalation, dermal and ocular contact	Irritation of eyes, nose, throat, skin; weakness; dizziness; drowsiness	None reported	Aromatic, Oily
Bis(2-ethylhexyl)phthalate	None reported	Ingestion, inhalation, and dermal contact	Chest pain; cough; tremor; indecision; headache, weak, eye and skin irritation	Odorless	Odorless
Cadmium	0.005 mg/m^3/ 0.01 mg/m^3	Inhalation and ingestion	Irritation of nose and throat, coughing, chest pain, nausea, vomiting, dizziness, chills, stomach distress, diarrhea	Odorless	Odorless
Anthracene	None reported	Inhalation, ingestion, dermal and ocular contact	Bronchitis, allergic skin reaction	None reported	Weak aromatic
Naphthalene	10 mg/m^3/ 10 mg/m^3	Inhalation, ingestion, dermal and ocular contact	Irritation of nose and throat, eye burns	None reported	Coal tar

Note: Complete and attach a Hazard Evaluation Sheet for major known contaminant and MSDS for chemicals brought on site for preservation and decontamination purposes.

HAZARD EVALUATION					
Compound	**PEL/ TLV**	**Route of Exposure**	**Acute Symptoms**	**Odor Threshold**	**Odor Description**
Aluminum	10 mg/m^3/ 5 mg/m^3	Inhalation, ingestion, dermal contact	Mental confusion, light headedness, nausea/vomiting, headache, staggering, unconsciousness, irritation of eyes/respitory/skin	None reported	None reported
Antimony	0.5 mg/m^3/ 0.5 mg/m^3/	Inhalation, eye/dermal contact	Nose, throat, mouth irritant, cough, dizziness, nausea	None	None
Arsenic	0.010 mg/m^3/ 0.2mg/m^3	Inhalation, absorption, ingestion, contact	Headache, dizziness, nausea, vomiting, convulsions	Odorless	Garlic
Barium	0.5 mg/m^3/ .01 mg/m^3	Inhalation, ingestion, dermal contact	Tightness of neck and facial muscles, vomiting, diarrhea, pain, weakness, cardiac disturbances, convulsions	Odorless	Odorless
Beryllium	0.002 mg/m^3/ 0.002 mg/m^3	Inhalation, dermal contact	Acute pneumonitis, dermatitis	Odorless	Odorless
Copper	0.1 mg/m^3/ 0.2 mg/m^3	Inhalation, ingestion, contact	Nose and throat irritation, chest pain, skin reddening	None reported	None reported
Mercury	0.05 mg/m^3/ 0.05 mg/m^3	Ingestion, inhalation, and dermal contact	Chest pain, cough, tremor, indecision, headache, weak, eye and skin irritation	Odorless	Odorless
Nickel	0.1 mg/m^3/ 0.05 mg/m^3	Inhalation, ingestion, dermal contact	Mental confusion, light headedness, headache, nausea, vomiting, staggering, eye/respitory/skin irritation	Odorless	Odorless
PCBs	0.5 mg/m^3 0.5 mg/m^3	Inhalation, ingestion, dermal contact	Eye/skin irritation, jaundice, dark urine, chloracne, nausea, vomiting	None reported	Mild hydrocarbon
Pesticides	None reported	Inhalation, ingestion, dermal and ocular contact	Irritation of nose, throat, eye, and skin	None reported	None reported

Note: Complete and attach a Hazard Evaluation Sheet for major known contaminant and MSDS for chemicals brought on site for preservation and decontamination purposes.

HAZARD EVALUATION					
Compound	**PEL/ TLV**	**Route of Exposure**	**Acute Symptoms**	**Odor Threshold**	**Odor Description**
Selenium	0.2 mg/m^3/ 0.2 mg/m^3	Inhalation, absorption, ingestion, eye/dermal contact	Nose/throat/mouth irritant, disturbed vision, headache	None	Metal taste Garlic breath
Silver	0.1 mg/m^3/ 0.1 mg/m^3	Inhalation, ingestion, ocular and dermal contact	Eye irritation, dry skin	None reported	None reported
Tin	2.0 mg/m^3/ 2.0 m/m^3/	Inhalation, eye/dermal contact	eye/skin irritant	None	None
Titanium Dioxide	10.0 mg/m^3/ 5.0 mg/m^3	Inhalation	Lung disease	None reported	None reported
Vinyl Chloride	1 ppm/5 ppm	Inhalation	Giddiness, intoxication, nausea, CNS depression	Odorless	Sweet
Zinc	5 mg/m^3 10 mg/m^3	Inhalation, ingestion	Nose and throat irritation, chest pain	None reported	Acrid

Note: Complete and attach a Hazard Evaluation Sheet for major known contaminant and MSDS for chemicals brought on site for preservation and decontamination purposes.

D. SITE SAFETY WORK PLAN

Site Control: The exclusion zone and contamination reduction zones will be determined separately for each site based on soil boring/well locations, surface features, wind direction, surrounding buildings, site entrance and exit locations, powerlines or other overhead obstructions, vehicular traffic, surrounding population, and location of emergency egress routes. All of these factors will be considered in determining the exact location of the support zone and contamination reduction zone. The exclusion zone also will be determined based on the specific task, level of contamination, and monitoring results. The size and locations of these zones may vary on a daily basis to accommodate changes in any of the previously listed conditions.

Perimeter identified?	[Y]	Site secured?	[N]
Work areas designated?	[Y]	Zone(s) of contamination identified?	[N]

Personal protection (TLD badges required for all field personnel): Hard hat, safety glasses, and safety boots.

Anticipated level of protection (cross-reference task numbers to Section C): Level D

Task Number	Description	A	B	C	D
Task 1	Monitoring Well Installation Using Drill Rig			(X)	X
Task 2	Groundwater/Surface Water/Sediment Sampling			(X)	X
Task 3	Soil Sampling			(X)	X
Task 4	Waste Management			(X)	X
Task 5	Decontamination			(X)	X
Task 6	Survey Well Locations			(X)	X
Task 7	Exposure Monitoring			(X)	X
Task 8	Geophysical Survey			(X)	X

Modifications: Hearing protection will be worn during all drilling operations. Tyvek coveralls, booties, double-layer nitrile gloves, and neoprene overgloves will be worn for all tasks where the potential exists for soil contamination contact. Saranex apron over Tyvek coveralls, double-layer nitrile gloves, and neoprene over gloves will be worn for all tasks where the potential exists for liquid or groundwater contamination contact with the torso. The site safety officer will determine if additional full body splash protection (Saranex coveralls with hoods) is needed on a task-by-task basis. Tasks 1 and 3: All personnel on site will be shown the locations of kill switches on drill rig. Respiratory protection will be upgraded to Level C (full-face APR with GMC-H cartridges) based on exposure monitoring with the OVA in the breathing zone. A face shield will be worn to provide eye and face splash protection when handling potentially contaminated water.

The following conditions must be met for the appropriate use of Level D protection:

- Oxygen levels between 19.5% and 24%;
- LEL less than 10% in open air or confined spaces;
- No organic vapors present above background levels;
- Particulates less than 2.5 mg/m^3; and
- No radiation present above background levels on alert dosimeter.

Action levels for evacuation of the work zone for each specific level of protection will be determined as follows. If these action levels are exceeded, all personnel will evacuate the work zone, upgrade to appropriate level of PPE, and re-enter the work zone to reassess conditions prior to continuing work. The alert dosimeter will be worn by the individual responsible for the monitoring of the work area. Only one alert dosimeter will be on site. The criteria for deciding an upgrade in the level of PPE is as follows:

Evacuation at Level D will occur if:

- Oxygen levels are less than 19.5% or greater than 24%;
- Explosive atmosphere is greater than 10% LEL in open air;
- Organic vapors are above background levels;
- Particulate levels are above 2.5 mg/m^3; and
- Radiation is present above background levels.

Evacuation at Level C will occur if:

- Oxygen levels are less than 19.5% or greater than 24%;
- Explosive atmosphere is greater than 10% LEL in open air;
- Unknown organic vapor levels are present in the breathing zone above 5 ppm; and
- Radiation is present above background levels.

Evacuation at Level B will occur if:

- Explosive atmosphere is greater than 10% LEL in open air;
- Unknown organic vapors are present above 500 ppm; and
- Radiation is present above background levels.

Evacuation at Level A will occur if:

- Explosive atmosphere is greater than 10% LEL in open air;
- Unknown organic vapors are present above 500 ppm;
- Radiation is present above background levels; and
- Integrity of encapsulating suit is compromised.

D. SITE SAFETY WORK PLAN

Air Monitoring (daily calibration unless otherwise noted):

Contaminant of Interest	Type of Sample (area, personal)	Monitoring Equipment	Frequency of Sampling
Volatile Organics	breathing zone, area/personal (upwind and downwind of the [exclusion area] work area)	OVA	Continuous
Oxygen/Combustible Gases	area	0_2 Meter/Explosimeter	Continuous
Particulates	breathing zone	Miniram	Continuous
Vinyl Chloride and Benzene	breathing zone, area	Draeger Tubes	Periodic during drilling activities, and when organic vapors are detected above background.
Radiation	area	Rad Alert Monitor 4	Continuous

Decontamination solutions and procedures for equipment, sampling gear, etc.: A decontamination termination area will be set up for decontamination of all equipment (see Figure 4-1). Manual removal of gross contamination with shovels or other tools will be followed by steam cleaning a wash in alconox, a tap water rinse, an isopropyl alcohol rinse, a final rinse with distilled water, and air drying. Dermal and eye splash protection will be worn during solvent use. Spent decontamination solutions will be handled with other IDW as provided in Section 4.9 of the Workplan and Section 4.4.12 of the CDAP. Disposal of all IDW will meet state and federal requirements. The contamination reduction area will be no less than 20 feet outside the estimated contamination area.

Personnel decontamination protocol:

1. Establish Personnel Decontamination Station (PDS) in accordance with Figure 4-1:

   - PDS contains ten steps as follows:

     Step 1 - Equipment Drop
     Step 2 - Outer Decontamination
     Step 3 - Bootie Removal
     Step 4 - Glove and Boot Wash
     Step 5 - Outer Garment Removal
     Step 6 - SCBA Drop
     Step 7 - Disposable Garment Removal/Collection
     Step 8 - Hand Wash
     Step 9 - Mask Wash
     Step 10 - Field Shower

   - Located in reduction area, between the hot zone (source of contamination) and the suppport area.

   - Control access.

   - Personnel/equipment must be decontaminated prior to crossing the "hot line," except when life and health of personnel are threatened (see emergency use of PDS).

   - Supply needed materials such as:
     - Tubs, buckets, brushes, sprayers, tarps;
     - Detergents, solvents, neutralizers;
     - Drums or other containers for disposable personnel protective equipment (PPE) and spent solution (separate);
     - PPE for decontamination personnel, including dermal and respiratory protection; and
     - Copious amounts of fresh water.

2. Preparation of Decontamination Solution:

   A solution of 5% trisodium phosphate, (a powdered laundry detergent [Tide] is suitable), use approximately 4 oz. per 5 gal. water.

3. Personal Protection Level During Decontamination:

   - Full face respirator (with specified cartridges) and dermal protective equipment (gloves, disposable coveralls, booties).
   - As a rule, decontamination teams should be dressed one level lower in PPE than remediators.

4. Personnel Decontamination Procedures (see Figure 4-1):

   Step 1 - Equipment Drop:

   - Situated on the hot side of the hot line.
   - Consists of two plastic drop cloths:
     - One, labeled "C" for clean, is for receiving and distributing clean equipment/sample materials.
     - One, labeled "D" for dirty, is for receiving contaminated equipment/samples.
     - The dirty drop cloth should be diked in a manner which will contain runoff from contaminated equipment/materials.
   - Personnel leaving or entering the hot zone will drop off all equipment/samples used within the hot zone at this point.
   - This area may also be used for air tank changes when required.
   - Personnel operating the equipment drop area of the PDS should approach and stay within the contamination reduction area and should not cross the hot line.

     CONTAMINATED EQUIPMENT SHOULD NOT BE BROUGHT THROUGH THE PDS.

   Step 2 - Outer Garment Decon Area:

   - Contains at least two washes and one rinse.
   - Large brushes, sprayers and decontamination fluids are used.
   - Avoid spilling/splashing or cross contaminating the decon personnel.
   - Fluids from this area should be kept to a minimum and collected and drummed for disposal.

   Step 3 - Bootie Removal Area:

   - A chair or suitable item is situated on the hot side of the hot line. After the booties are removed, the contaminated person swivels their feet into the PDS.
   - It should be stressed that at this point, cross contamination from the feet of the personnel is highly likely unless special care is taken.
   - Disposable booties should be doubled-bagged for disposal.

   Step 4 - Glove and Boot Decon Area:

   - A single wash and rinse are normally required, but additional washes/rinses may be added depending on the amount of contamination.
   - Personnel should be stationed here to offer assistance.

Step 5 - Outer Garment Removal:

- Decontaminated outer garments are removed, and depending on the situation, either stored for future use or disposed of.
- Outer garments consist of hoods, full protective suits, outer boots and gloves, aprons, etc.

Step 6 - SCBA Drop:

- SCBA equipment is collected at this step.
- Personnel should be stationed here to assist workers in removing SCBA.
- Harnesses, tanks, and masks should be considered contaminated and require decontamination prior to re-use or storage.

Step 7 - Disposable Garment Removal:

- Disposable garments should be rendered useless by cutting or tearing them, and double-bagged for proper disposal.

Step 8 - Hand Wash:

- All personnel will be required to wash their hands prior to exiting the PDS.
- One wash tub/pail and one rinse tub/pail should be sufficient.
- Disposable means of hand drying is recommended (i.e., paper towels), which will be collected and double-bagged for disposal.

Step 9 - Mask Wash:

- Protective masks are disassembled and washed/rinsed.
- Proper tools required should be present.
- Protective masks are air dried.
- Preventive maintenance on protective masks is also performed at this station. Replacement parts should be available (i.e., head straps, valves, nose pieces, rubber gaskets).

Step 10 - Field Shower:

- Depending on the situation and chemical contaminant, a field shower may be required.
- Fluids from the shower system will be collected for future testing and disposal.
- Disposable means of drying will be available and collected.

Decontamination solution monitoring procedures, or procedures, if applicable: Decontamination will be performed in a well-ventilated area. OVA monitoring will be performed. Appropriate dermal and respiratory PPE will be worn.

Special site equipment, facilities, or procedures (sanitary facilities and lighting must meet 29 CFR 1910.120): Sanitary facilities will be available in the site vicinity. A portable eyewash station and an additional reserve of water will be kept on site. An all-purpose dry chemical-type fire extinguisher (4.5 lb) also will be kept on site and drill rig. Personnel will become familiar with all facility emergency signals and evacuation plans prior to commencement of work at the site. Heat and cold stress awareness and appropriate procedures to be implemented.

Site entry procedures and special considerations : The buddy system will be adhered to at all times. The area will be continuously scanned with the OVA and, O_2 explosimeter. All monitoring wells will be checked for volatile organics with the OVA during installation when opened for sampling. Upwind and downwind of the exclusion area/work area will be monitored with the OVA periodically. All team members will be trained in recognition of medical wastes prior to commencing site work. Each work site will be inspected for medical wastes, and any wastes found will be avoided during all activities.

Work limitations (time of day, weather conditions, etc.) and heat/cold stress requirements: All fieldwork will be performed only during daylight hours. Personnel will move to a safe location in the event of an electrical storm. Personnel will take breaks as necessary and heat/cold stress monitoring will be performed as appropriate.

General spill control, if applicable: Vermiculite will be kept on site to act as a sorbent material for liquid spills. Sodium bicarbonate will be kept on site to neutralize potential preservative acid spills.

Investigation-derived material disposal (i.e., expendables, decon waste, cuttings): Personal protection and other non-hazardous expendables will be consolidated in trash bags for proper disposal off site. All other waste will be segregated and containerized for storage on-site, pending receipt of analytical results, and determination of site status. Drums will be labeled with an adhesive sticker marked with the start date of storage, drum contents, site name, the USACE and E & E point of contacts, on-site point of contact, and phone numbers for all POCs. The label will be placed on the top and side of each drum. The security of the containers will be the responsibility of the site contacts. Documentation to be kept in project file.

Sample handling procedures including protective wear: All samples will be handled wearing disposable gloves, safety glasses, and, when performing acid preservation, splash protection equipment. All sample preservation will be performed in a well-ventilated area. All samples will be packaged according to proper shipping regulations.

Note: All entries into the exclusion zone require use of the buddy system. All E & E field staff must have participated in a medical monitoring program and completed applicable training per 29 CFR 1910.120. The respiratory protection program must meet requirements of 29 CFR 1910.134 and ANSI Z88.2 (1980).

E. EMERGENCY INFORMATION

(Use supplemental sheets, if necessary)

LOCAL RESOURCES

(Obtain a local telephone book from your hotel, if possible)

Ambulance: 891-3000

Hospital emergency room: (809) 891-3000 Aguadilla Municipal Hospital
Route 107, Aguadilla, Puerto Rico

Poison Control Center: 1-800-282-3170

Police (include local, county sheriff, state): 890-2020

Fire Department: 343-2330

Agency safety contact: (404) 347-4062 USEPA Environmental Response Team.
(800) 424-8802 US Coast Guard Environmental Response Team

Local laboratory: (716) 685-8080 E & E Analytical Services Center

Federal Express: 890-0001 or 1-800-238-5355

Client contact: (912) 652-5945 Dave Roulo — USACE Savannah

Site Contact: NA

SITE RESOURCES

Site emergency evacuation alarm method: Vocal alert or three short car horn blasts

Water supply source: To be determined.

Telephone location, number: See site contacts above.

Cellular phone, if available: Cellular phone number to be determined.
Other:

EMERGENCY CONTACTS	
1. Ecology and Environment, Inc., Safety Director Paul Jonmaire	(716) 684-8060 (office) (716) 655-1260 (home)
2. Regional Safety Contact - Debra Bowman	(904) 671-3085 (home) (904) 574-1400 (office)
3. Program Manager - John Barksdale	(904) 432-9078 (home) (904) 435-8925 (office)

EMERGENCY ROUTES

(Note: Field team must know route(s) prior to start or work)

Directions to hospital (include map): Exit the former Ramey AFB through the south gate, travel south on Route 107 approximately 3 miles and the hospital will be on the left.

Emergency egress procedures to get off site: In the event of a medical emergency/on-site incident that requires evacuation, First Aid/CPR will be administered as appropriate. One person will remain on site and assist the First Aid/CPR attendant. The injured person will be moved to a safe area as soon as possible. A designated team member will evacuate nonessential personnel via preestablished ingress/egress routes, and medical/fire personnel will be summoned. Site personnel will proceed to the predesignated rally point, where a muster will be held to ensure all personnel are accounted for. A team member who is located at the predesignated rally point will await the arrival of medical/fire personnel and guide them to the accident victim and/or incident location. The level of protection for emergency response personnel will be determined on site according to air monitoring data and weather conditions. Level D is the anticipated required level of protection, with other PPE available for use in instances where the potential for exposure to bodily fluids exists.

The USACE accident/incident report form 3394 must be completed and submitted to the USACE Project Manager within two working days of the incident.

F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

Level A	No.	Level B	No.
SCBA		SCBA	
SPARE AIR TANKS		SPARE AIR TANKS	
ENCAPSULATING SUIT (Type _____)		PROTECTIVE COVERALL (Type _____)	
UNDER GLOVES		RAIN SUIT	
NEOPRENE SAFETY BOOTS		BUTYL APRON	
BOOTIES		UNDER GLOVES	
GLOVES (Type _____)		GLOVES (Type _____)	
OUTER WORK GLOVES		OUTER WORK GLOVES	
HARD HAT		NEOPRENE SAFETY BOOTS	
CASCADE SYSTEM		BOOTIES	
5-MINUTE ESCAPE COOLING VEST		HARD HAT WITH FACE SHIELD	

F. EQUIPMENT CHECKLIST

		CASCADE SYSTEM	
		MANIFOLD SYSTEM	
Level C		**Level D**	
ULTRA-TWIN RESPIRATOR	X	PROTECTIVE COVERALL (Type Tyvek/Saranex)*	X
POWER AIR-PURIFYING RESPIRATOR		RAIN SUIT	X
CARTRIDGES (Type GMC-H)	X	NEOPRENE SAFETY BOOTS	X
5-MINUTE ESCAPE MASK		BOOTIES	X
PROTECTIVE COVERALL (Type Tyvek)*	X		
RAIN SUIT	X	HARD HAT WITH FACE SHIELD	X
BUTYL APRON		SAFETY GLASSES	X
UNDER GLOVES	X	UNDER GLOVES	X
GLOVES (Type Neoprene)	X	WORK GLOVES - NEOPRENE	X
OUTER WORK GLOVES	X	SARANEX APRON	X
NEOPRENE SAFETY BOOTS	X	TLD BADGE	X
HARD HAT	X		
BOOTIES	X		
HARD HAT			
SARANEX APRON	X		
TLD BADGE	X		

INSTRUMENTATION	No.	**DECON EQUIPMENT**	No.
OVA	X	WASH TUBS	X
THERMAL DESORBER		BUCKETS	X
O_2/EXPLOSIMETER W/CAL. KIT AND LEAD FILTER	X	SCRUB BRUSHES	X
PHOTOVAC TIP		PRESSURIZED SPRAYER	
HNu (Probe 10.2 eV)		DETERGENT (Type Alconox)	X
MAGNETOMETER		SOLVENT (isopropyl alcohol)	X
PIPE LOCATOR	X	PLASTIC SHEETING	X
WEATHER STATION		TARPS AND POLES	
DRAEGER PUMP, TUBES (vinyl chloride/benzene)	X	TRASH BAGS	X
BRUNTON COMPASS	X	TRASH CANS	X
MONITOX CYANIDE		MASKING TAPE	
HEAT STRESS MONITOR		DUCT TAPE	X
NOISE EQUIPMENT (ear plugs)	X	PAPER TOWELS	X
PERSONAL SAMPLING PUMPS		FACE MASK	X
MINI RAM (particulates)	X	FACE MASK SANITIZER	X

F. EQUIPMENT CHECKLIST			
PID		FOLDING CHAIRS	X
		STEP LADDERS	
RADIATION EQUIPMENT		DISTILLED WATER	X
DOCUMENTATION FORMS			
PORTABLE RATEMETER		**SAMPLING EQUIPMENT**	
SCALER/RATEMETER		16-OZ. BOTTLES	X
NaI Probe		HALF-GALLON BOTTLES	X
ZnS Probe		VOA BOTTLES	X
GM Pancake Probe		STRING	X
GM Side Window Probe		HAND BAILERS	X
MICRO R METER		THIEVING RODS WITH BULBS	X
ION CHAMBER		SPOONS	X
ALERT DOSIMETER	X	KNIVES	
POCKET DOSIMETER		FILTER PAPER	
TLD Badge	X	PERSONAL SAMPLING PUMP SUPPLIES	
FIRST AID EQUIPMENT		4-OZ. JARS	X
FIRST AID KIT	X	GAUZE	
OXYGEN ADMINISTRATOR		SQUEEZE BOTTLE	X
STRETCHER			
PORTABLE EYE WASH	X		
BLOOD PRESSURE MONITOR			
FIRE EXTINGUISHER	X		

VAN EQUIPMENT	No.	**MISCELLANEOUS (Cont.)**	No.
TOOL KIT	X	BINOCULARS	
HYDRAULIC JACK		MEGAPHONE	
LUG WRENCH	X	CAMERA	X
TOW CHAIN			
VAN CHECK OUT:			
Gas			
Oil			
Antifreeze			
Battery			
Windshield wash			
Tire pressure			
MISCELLANEOUS		**SHIPPING EQUIPMENT**	
PITCHER PUMP		COOLERS	X
SURVEYOR'S TAPE	X	PAINT CANS WITH LIDS, 7 CLIPS EACH	

100 FIBERGLASS TAPE	X	VERMICULITE	X
300 NYLON ROPE		SHIPPING LABELS	X
NYLON STRING	X	DOT LABELS: "DANGER"	
SURVEYING FLAGS	X	"UP"	X
FILM	X	"INSIDE CONTAINER COMPLIES ..."	
WHEEL BARROW		"HAZARD GROUP"	
BUNG WRENCH		STRAPPING TAPE	X
SOIL AUGER	X	BOTTLE LABELS	X
PICK	X	BAGGIES	X
SHOVEL	X	CUSTODY SEALS	X
CATALYTIC HEATER		CHAIN-OF-CUSTODY FORMS	X
PROPANE GAS		FEDERAL EXPRESS FORMS	X
BANNER TAPE	X	CLEAR PACKING TAPE	X
SURVEYING METER STICK	X		
CHAINING PINS AND RING			
TABLES	X		
WEATHER RADIO	X		

* Coated Tyvek projects to be used in wet, muddy environs.

5. REFERENCES

Ecology and Environment, Inc., 1993, Corporate Health and Safety Program for Toxic and Hazardous Substances.

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APPENDIX A

E & E EXISTING SITE SAFETY PLAN ADDENDUM FORM

ecology and environment, inc.

EXISTING SITE SAFETY PLAN ADDENDUM FORM

Site Name:	TDD/Pan/Project Number:
Date of original SSP:	
Date of amendment:	
Date of proposed new work:	
Added activities and hazard evaluations:	
Added monitoring activities:	
Level of protection: A B C D	
Reason for up/downgrading:	
PPE:	
Decon:	

Team Members	Responsibility

Equipment	Quantity	Equipment	Quantity

THE TERMS OF THE ORIGINAL SSP SHALL BE EFFECTIVE EXCEPT AS NOTED ON THIS FORM.

Prepared by:	Date:
Reviewed by:	Date:

INSTRUCTIONS: This form to be approved through normal channels and attached to original plan. Form SSP-A

APPENDIX B

E & E ON-SITE SAFETY MEETING FORM

ecology and environment, inc.

ON-SITE SAFETY MEETING

Project		TDD/Pan
Date:	Time:	Job No.
Address:		
Specific Location:		
Type of Work:		

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment:

Chemical Hazards:

Radiation Hazards:

Physical Hazards:

Emergency Procedures:

Hospital/Clinic:	Telephone:
Hospital Address:	
Special Equipment:	
Other:	

Checklist

1. Emergency information reviewed? and made familiar to all team members?
2. Route to nearest hospital driven? and its location known to all team members?
3. Site safety plan readily available and its location known to all team members?

Meeting shall be attended by all personnel who will be working within the exclusion area. Daily informal update meetings will be held when site tasks and/or conditions change.

ATTENDEES

(Expand on back of sheet if necessary)

Meeting Conducted by: _____ _____

(Print) (Signature)

_____ _____

(Site Safety Coordinator) (Team Leader)

ATTENDEES (Cont.)	
Name Printed	**Signature**

APPENDIX C

HAZARD EVALUATION SHEETS AND MATERIAL SAFETY DATA SHEETS

ecology and environment, inc.

HAZARD EVALUATION OF CHEMICALS

Chemical name: Copper	Date:
DOT Name/U.N. No.:	Job No.:
CAS Number: 7440-50-8	

References Consulted (underline):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Chemical Properties: Synonyms: Varies

Chemical Formula: Cu Molecular Weight:

Physical State: Varies Solubility (H_2O): Boiling Point:

Flash Point: Vapor Pressure/Density: Freezing Point:

Specific Gravity: Odor Characteristic: Flammable Limits:

Incompatibilities: Acetylene gas/Mg metal; flammable in dust form.

Biological Properties:

TLV-TWA: PEL: 0.1 mg/m^3 Odor/Odor Threshold: Odorless

IDLH: NA Human: Aquatic: Rat/Mouse:

Route of exposure: Inhalation, ingestion, contact

Carcinogen: Teratogen: Mutagen:

Handling Recommendations: (Personal protective measures) Protective clothing, gloves, eye protection.

Monitoring Recommendations: Air monitoring for particulates.

Disposal/Waste Treatment: Varies with type of compound.

Health Hazards and First Aid: Nose, throat, respiratory system irritant, nasal ulcers if ingested.
Contact may cause dermatitis. Wash with soap and water. Remove to fresh air.
Give water, induce vomiting if ingested.

Symptoms:

Acute: Nose, throat irritation, chest pain, skin reddening.

Chronic:

ecology and environment, inc.

HAZARD EVALUATION OF CHEMICALS

Chemical name: Zinc	Date:
DOT Name/U.N. No.:	Job No.:
CAS Number: 7440-66-6	

References Consulted (underline):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Chemical Properties: Synonyms: Varies

Chemical Formula: Zn Molecular Weight: Varies

Physical State: Varies Solubility (H_2O): Boiling Point:

Flash Point: Vapor Pressure/Density: Freezing Point:

Specific Gravity: Odor Characteristic: Flammable Limits:

Incompatibilities: Flammable in dust form.

Biological Properties:

TLV-TWA: PEL: 5 mg/m^3 Odor/Odor Threshold: Acrid

IDLH: NA Human: Aquatic: Rat/Mouse:

Route of exposure: Inhalation, ingestion

Carcinogen: Teratogen: Mutagen:

Handling Recommendations: (Personal protective measures) Protective clothing, gloves, eye protection.

Monitoring Recommendations: Air, monitoring for particulates.

Disposal/Waste Treatment: Varies with type of compound.

Health Hazards and First Aid: Skin and respiratory irritant. Remove to fresh air; give artificial respiration if necessary. Wash affected areas with soap and water.

Symptoms:

Acute: Nose, throat irritation, chest pain

Chronic: Anemia

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Arsine (Arsenic) Date 12/31/92

DOT Name/U.N. No. 1558 Job No. _____

CAS Number 7784-42-1

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Arsine; Arsenic)

Chemical Formula As Molecular Weight 74.9

Physical State Solid Solubility (H2O) Insoluble Boiling Point Sublimes

Flash Point N/A Vapor Pressure/Density 0 mm Freezing Point N/A

Specific Gravity 5.73 Odor Characteristic N/A Flammable Limits Non

Incompatabilities STRONG OXIDIZERS, BROMINE AZIDE, HYDROGEN GAS

Biological Properties:

TLV-TWA 0.05ppm/0.16 mg/m^3 PEL 0.05ppm/ 0.2 mg/m^3 Odor/Odor Threshold garlic

IDLH 100 mg/m^3 Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure Inh, Abs, Ing, Con

Carcinogen Yes Teratogen _____ Mutagen _____

Handling Recommendations: (Personal protective measures)

Tyvek and safety glasses with full-face respirator available for upgrade.

Monitoring Recommendations:

Continuous Mini-Ram

Disposal/Waste Treatment:

Health Hazards and First Aid:

Eye: wash immediately; skin: wash immediately; Swallow: immediate medical attention - irritation from exposure requires immediate medical attention.

Symptoms: Acute: Headache, dizziness, nausea, vomiting, convulsions

Chronic: Coma

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[SAFETY]HAZARD EVALUATION:Arsine (Arsenic)

ecology and environment, inc.

HAZARD EVALUATION OF CHEMICALS

Chemical Name Cadmium Date 12/31/92

DOT Name/U.N. No. 2570 Job No. _____

CAS Number 7440-43-9

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Cadmium dust & salts)

Chemical Formula Cd Molecular Weight 112.4

Physical State solid Solubility (H2O) Insoluble Boiling Point 1409° F

Flash Point N/A Vapor Pressure/Density 0 mm Freezing Point 610° F

Specific Gravity 8.65 Odor Characteristic --- Flammable Limits _____

Incompatabilities Strong oxidizers

Biological Properties:

TLV-TWA 0.05 mg/m^3 PEL 0.005 mg/m^3 Odor/Odor Threshold Odorless

IDLH 50 mg/m^3 Human --- Aquatic --- Rat/Mouse ---

Route of Exposure Inhalation, Ingestion

Carcinogen X Teratogen _____ Mutagen _____

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Monitoring Recommendations:

Mini-Ram

Disposal/Waste Treatment:

Health Hazards and First Aid:

Large quantities of water, induce vomiting, medical attention; remove to fresh air, medical attention immediately

Symptoms: Acute: irritation of nose and throat, coughing, chest pain, nausea, vomiting, dizziness, chills, stomach distress, diarrhea

Chronic: loss of smell, liver damage, kidney damage, cancer

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[SAFETY]HAZARD EVALUATION:Cadmium

ecology and environment, inc.

HAZARD EVALUATION OF CHEMICALS

Chemical Name Silver Date 12/31/92

DOT Name/U.N. No. _____ Job No. _____

CAS Number 7440-22-4

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Silver metal)

Chemical Formula Ag Molecular Weight 107.9

Physical State solid Solubility (H2O) insoluble Boiling Point 3632°F

Flash Point n/a Vapor Pressure/Density 0 mm Melting Point 1761°F

Specific Gravity 10.49 Odor Characteristic _____ Flammable Limits _____

Incompatabilities Acetylene, ammonia, hydrogen peroxide, bromozide, chlorine, trifluoride

Biological Properties:

TLV-TWA 0.1 mg/m^3 PEL 0.01 mg/m^3 Odor/Odor Threshold _____

IDLH _____ Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure Inhalation, Ingestion, Dermal Contact, Eye (Ocular)

Carcinogen _____ Teratogen _____ Mutagen _____

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impervious clothing, Viton gloves, faceshield respirator in windy/dusty areas.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

Flush area with water and wash with soap; move to fresh air if inhaled; if swallowed, do not induce vomiting. Contact physician immediately.

Symptoms: Acute: irritates eyes, dries skin

Chronic: _____

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[SAFETY]HAZARD EVALUATION:Silver

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Nickel (metal) Date 12/31/92

DOT Name/U.N. No. _____ Job No. _____

CAS Number 7440-02-0

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Raney alloy; nickel particles)

Chemical Formula Ni Molecular Weight 58.7

Physical State solid (powder) Solubility (H2O) insoluble Boiling Point 4946°F

Flash Point N/A Vapor Pressure/Density N/A Freezing Point 2651°F

Specific Gravity N/A Odor Characteristic none Flammable Limits N/A

Incompatabilities strong acids, sulfur, wood, potassium perchlorate

Biological Properties:

TLV-TWA _____ PEL 0.1 mg/m3 Odor/Odor Threshold odorless

IDLH _____ Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure inh, ing, derm

Carcinogen Human/animal suspected Teratogen Experimental Mutagen Experimental

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Viton); APR in windy/dusty areas.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

Inh: move to fresh air, APR if necessary; Eye/skin: flush with water for 15 minutes, wash skin with soap/water; Ing: seek medical attention

Symptoms: Acute: Mental confusion, light-headedness, nausea/vomiting, headache, staggering, unconsciousness, irritation of eyes/resp/skin

Chronic: Dermatitis from skin sensitization. Cancer of lungs and nasal passages in nickel refining employees.

[SAFETY]HAZARD EVALUATION:Nickel (metal)

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Pesticides Date 12/31/92

DOT Name/U.N. No. _____ Job No. _____

CAS Number _____

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: Farm Chemicals Handbook

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: _____)

Chemical Formula varies Molecular Weight _____

Physical State Liquid/Solid Solubility (H2O) Readily Boiling Point _____

Flash Point _____ Vapor Pressure/Density _____ Freezing Point _____

Specific Gravity _____ Odor Characteristic _____ Flammable Limits _____

Incompatabilities _____

Biological Properties:

TLV-TWA _____ PEL _____ Odor/Odor Threshold _____

IDLH _____ Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure Dermal, ocular, ingestion, inhalation

Carcinogen _____ Teratogen _____ Mutagen _____

Radiological Properties:

_____

Handling Recommendations: (Personal protective measures)

Long-sleeved shirt, long pants, chemical gloves, and goggles/safety glasses.

Monitoring Recommendations:

_____

Disposal/Waste Treatment:

_____

Health Hazards and First Aid:

Get medical aid. Eyes, flush with penty of water for 15 minutes. Skin, flush with plenty of water; remove contaminated clothing; wash clothes before reuse. Ingestion, immediately dilute by swallowing milk or water.

Symptoms: Acute: Irritate eyes, nose, throat, and skin.

Chronic: _____

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[SAFETY]HAZARD EVALUATION:Pesticides

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Tin Date 12/31/92

DOT Name/U.N. No. _____ Job No. _____

CAS Number 7440-31-5

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Metallic tin, tin flake, tin powder)

Chemical Formula Sn Molecular Weight 118.7

Physical State solid Solubility (H2O) insoluble Boiling Point 4545° F

Flash Point N/A Vapor Pressure/Density 0 mm Melting Point 449°F

Specific Gravity 7.28 Odor Characteristic N/A Flammable Limits N/A

Incompatabilities Chlorine, turpentine, acids, alkalis

Biological Properties:

TLV-TWA 2.0 mg/m^3 PEL 2.0 mg/m^3 Odor/Odor Threshold N/A

IDLH 400 mg/m^3 Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure Inhalation, Ingestion, Dermal

Carcinogen --- Teratogen --- Mutagen ---

Radiological Properties:

Handling Recommendations: (Personal protective measures)

5 mg/m^3 high efficiency particulate respirator; other concentrations- SCBA; avoid skin contact or ingestion.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

ING: Give water, induce vomiting, medical attention immediately; INH: move to fresh air, medical attention; DER: wash with soap and water promptly.

Symptoms: Acute: stomach distress, vomiting, diarrhea, black stool, headache, dizziness, metallic taste

Chronic: muscle weakness, joint/muscle pain, insomnia, coma, death

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[SAFETY]HAZARD EVALUATION:Tin

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Titanium Dioxide Date 12/31/92

DOT Name/U.N. No. _____ Job No. _____

CAS Number 13463-67-7

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Rutile, Titanium oxide, Titanium peroxide)

Chemical Formula TiO_2 Molecular Weight 79.9

Physical State solid Solubility (H2O) insoluble Boiling Point 4532° F

Flash Point N/A Vapor Pressure/Density 0 mm Melting Point 3362 °F

Specific Gravity 4.26 Odor Characteristic N/A Flammable Limits N/A

Incompatabilities None reported

Biological Properties:

TLV-TWA 10.0 mg/m^3 PEL 5.0 mg/m^3 Odor/Odor Threshold N/A

IDLH 400 mg/m^3 Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure Inhalation

Carcinogen XXX Teratogen --- Mutagen ---

Radiological Properties:

Handling Recommendations: (Personal protective measures)

APR in windy/dusty areas.

ingestion.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

INH: move to fresh air, medical attention

Symptoms: Acute: stomach distress, vomiting, diarrhea, black stool, headache, dizziness, metallic taste

Chronic: lung disease

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Aluminum Date 12/31/92

DOT Name/U.N. No. _____ Job No. _____

CAS Number 7429-90-5/1344-28-1

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Metal dust/ aluminum oxide)

Chemical Formula Al Molecular Weight 26.9

Physical State solid Solubility (H2O) _____ Boiling Point _____

Flash Point _____ Vapor Pressure/Density _____ Freezing Point _____

Specific Gravity _____ Odor Characteristic _____ Flammable Limits _____

Incompatabilities _____

Biological Properties:

TLV-TWA 10 mg/m^3 PEL 5 mg/m^3 Odor/Odor Threshold _____

IDLH _____ Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure inh, ing, derm

Carcinogen _____ Teratogen _____ Mutagen _____

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Viton), APR in dusty or windy areas

Monitoring Recommendations:

Mini-Ram or equivalent.

Disposal/Waste Treatment:

Health Hazards and First Aid:

Inh: move to fresh air, APR if necessary; Eye/skin: flush with water for 15 minutes, wash skin with soap/water; Ing: seek medical attention

Symptoms: Acute: Mental confusion, light-headedness, nausea/vomiting, headache, staggering, unconsciousness, irritation of eyes/resp/skin,

Chronic: _____

[SAFETY]HAZARD EVALUATION:Aluminum

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HAZARD EVALUATION OF CHEMICALS

Chemical Name PCBs Date 12/31/92

DOT Name/U.N. No. UN2315 Job No. _____

CAS Number 1336-36-3

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: Chemtex data

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Aroclor 1254, 1221, 1232, 1242, 1245, etc.)

Chemical Formula $C_{12}H_5C_{12}$ (Approx) Molecular Weight 326

Physical State Liquid Solubility (H2O) Insoluble Boiling Point 617° to 691°F

Flash Point 431.3°F Vapor Pressure/Density 0.001 mm Freezing Point -2°F

Specific Gravity 1.3 - 1.8 Odor Characteristic _____ Flammable Limits _____

Incompatabilities Strong oxidizers

Biological Properties:

TLV-TWA lowest feasible PEL lowest feasible Odor/Odor Threshold mild hydrocarbon

IDLH _____ Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure INHALATION; INGESTION; DERMAL

Carcinogen X Teratogen _____ Mutagen Suspect

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impermeable clothing, gloves, face shields. Use neoprene, butyl rubber, saranex. APR in dusty or windy areas of known PCB contamination.

Monitoring Recommendations:

Disposal/Waste Treatment:

Store contaminated clothing in closed container until discarded or laundered.

Health Hazards and First Aid:

Skin or eye contact - flush with water for at least 15 minutes.

Symptoms: Acute: Irritates eyes and skin; jaundice, dark urine; chloracne; nausea; vomiting.

Chronic: Liver damage.

[SAFETY]HAZARD EVALUATION:PCBs

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Vinyl Chloride Date 12/31/92

DOT Name/U.N. No. 1086 Job No.

CAS Number 75-01-4

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Chloroethylene, VC, Chloroethene)

Chemical Formula C_2H_3Cl Molecular Weight 62.5

Physical State Colorless gas Solubility (H2O) Negligible Boiling Point 7°F

Flash Point -108°F Vapor Pressure/Density 2580 mm Freezing Point -245°F

Specific Gravity 0.9121 Odor Characteristic 3000 ppm Flammable Limits 3.6% - 33%

Incompatabilities Strong oxidizers, strong bases, iron, steel, copper, peroxide

Biological Properties:

TLV-TWA 1 ppm PEL 1 ppm Odor/Odor Threshold Odorless gas, sweet

IDLH 500 ppm Human Aquatic Rat/Mouse

Route of Exposure Inh

Carcinogen Human Teratogen Mutagen Suspect

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Wash immediately upon contact with skin; impervious clothing, gloves, face shield; 10 ppm app/organic ?

25 ppm 100 ppm - SCBA

Monitoring Recommendations:

PID 10:2, FID

Disposal/Waste Treatment:

N/A

Health Hazards and First Aid:

Wash skin, eyes immediately, if contaminated; move to fresh air if large amounts are breathed in; induce vomiting if swallowed

Symptoms: Acute: Giddiness, intoxication, nausea, light headedness, CNS depression

Chronic: Liver damage, CNS depression, reproductive effects

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Barium Date 4/17/93

DOT Name/U.N. No. 1446 Job No. _____

CAS Number 10022-31-8/ 10361-37-2/

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Barium Nitrate, Barium Chloride)

Chemical Formula $Ba(NO_3)$/ $BaCl_2$ Molecular Weight 261.4/208.3

Physical State solid Solubility (H2O) 38 % Boiling Point 2840°F

Flash Point N/A Vapor Pressure/Density 0 mm Hg Melting Point 1098/1765°F

Specific Gravity 3.24/3.86 Odor Characteristic none Flammable Limits N/A

Incompatabilities N/A

Biological Properties:

TLV-TWA 0.5 mg/m_3 PEL 0.5 mg/m_3 NOTE: _____

IDLH 1100 mg/m_3 Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure Inh, Ing, Dermal

Carcinogen _____ Teratogen _____ Mutagen _____

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Viton,Latex)

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

Inh: move to fresh air, blow nose to remove dust, do not sniffle. Der: remove contaminated, flush w/ soap/water for 15 min; Ing: seek medical attention.

Symptoms: Acute: tightness of neck and facial muscles, vomiting, diarrhea, pain, weakness, cardiac disturbances, convulsion

Chronic: _____

[SAFETY]HAZARD EVALUATION:Barium

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Benzene Date 12/31/92

DOT Name/U.N. No. 1114 Job No. _____

CAS Number 71-43-2

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Benzol, Benzole, Cyclohexatriene)

Chemical Formula C_6H_6 Molecular Weight 78

Physical State Liquid Solubility (H2O) Slightly Boiling Point 176°F

Flash Point 12°F Vapor Pressure/Density 75 mm Freezing Point 42°F

Specific Gravity 0.879 Odor Characteristic 61 ppm Flammable Limits 1.3-7.1%

Incompatabilities Strong oxidizers, chlorine, bromine

Biological Properties:

TLV-TWA 1 ppm PEL 1 ppm Odor/Odor Threshold Aromatic

IDLH 100/CNS Human _____ Aquatic _____ Rat/Mouse 50/24H

Route of Exposure Inhalation, ingestion, eye (ocular), dermal absorption

Carcinogen Human - suspected Teratogen _____ Mutagen Experimental

Radiological Properties:

Handling Recommendations: (Personal protective measures)

10 ppm use SCBA. Use protective clothing: excel-viton; good-neoprene, saranax; poor-butyl, natural rubber for gloves. Avoid skin/eye contact

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

Do not induce vomiting or give water or milk; get medical attention immediately, remove to fresh air, give artificial respiration if needed, medical attention, flush with water, rinse/wash skin with soap and water thoroughly

Symptoms: Acute: Skin irritant, CNS depressant, mostly IHL, initial excitation followed by headache, dizziness, vomiting, delirium, severe exposure may see tremors, blurred vision, shallow respiration, convulsions

Chronic: Anorexia, drowsiness, anemia, bleeding under skin, reduced blood clotting; liver, kidney, bone marrow damage, leukemia

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Ethylbenzene Date 12/31/92

DOT Name/U.N. No. 1175 Job No. _____

CAS Number 100-41-4

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Ethylbenzol, Phenylethane)

Chemical Formula $CH_3CH_2C_6H_5$ Molecular Weight 106.2

Physical State liquid Solubility (H2O) 0.01% Boiling Point 277°F

Flash Point 55°F Vapor Pressure/Density 10 mm Freezing Point -139°F

Specific Gravity 0.87 Odor Characteristic _____ Flammable Limits 1.0%-6.7%

Incompatabilities Strong oxidizers

Biological Properties:

TLV-TWA 100 ppm PEL 100 ppm Odor/Odor Threshold aromatic, oily

IDLH 2000 ppm Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure: Inhalation, Ingestion

Carcinogen _____ Teratogen _____ Mutagen _____

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Tyvek or saranex coveralls; APR in dusty/ windy conditions or known high concentrations.

Monitoring Recommendations:

OVA or 10.2 eV probe on HNu.

Disposal/Waste Treatment:

Health Hazards and First Aid:

ING: seek medical attention; INH: move to fresh air, seek medical attention; DER: wash promptly with soap and water.

Symptoms: Acute: irritation of eyes, nose, throat, skin; weakness; dizziness; drowsiness; unconsciousness

Chronic: skin rash, inflammation, dermatitis

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Mercury Date 12/31/92

DOT Name/U.N. No. 2809 Job No.

CAS Number 7439-97-6

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Colloidal mercury, Metallic mercury, Quicksilver)

Chemical Formula Hg Molecular Weight 200

Physical State liquid Solubility (H2O) Insoluble Boiling Point 674° F

Flash Point N/A Vapor Pressure/Density 0.0012 mm Freezing Point -38° F

Specific Gravity 13.6 Odor Characteristic N/A Flammable Limits Non

Incompatabilities Acetylene, ammonina, chlorine dioxide, azides, calcium, sodium carbide, lithium, rubidium, and copper

Biological Properties:

TLV-TWA 0.05 mg/m^3 PEL 0.05 mg/m^3 Odor/Odor Threshold odorless

IDLH 28 mg/m^3 Human Aquatic Rat/Mouse

Route of Exposure Ingestion, Inhalation, Dermal

Carcinogen Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

INH & ING: seek medical attention promptly; DER: wash with soap and water.

Symptoms: Acute: cough; chest pain; temor; indecision; headache; weak; irrition of eyes and skin

Chronic: GI tract depression

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Naphthalene Date 12/31/92

DOT Name/U.N. No. 1334 Job No. _____

CAS Number 91-20-3

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Naphthalin, Tar camphor, White tar)

Chemical Formula $C_{10}H_8$ Molecular Weight 128.2

Physical State solid Solubility (H2O) 0.003 % Boiling Point 424°F

Flash Point 174°F Vapor Pressure/Density 0.08 mm Hg Melting Point 176°F

Specific Gravity 1.12 Odor Characteristic 0.038 ppm Flammable Limits _____

Incompatabilities Nitric acid, strong oxidizers, chromic anhydride

Biological Properties:

TLV-TWA 10 ppm PEL 10 ppm Odor/Odor Threshold tar, mothballs

IDLH 500 ppm Human _____ Aquatic _____ Rat/Mouse 1250 mg/kg

Route of Exposure inh, ing, derm

Carcinogen _____ Teratogen _____ Mutagen _____

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Viton); APR in windy/dusty areas

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

Inh: move to fresh air, APR if necessary; Eye/skin: flush with water for 15 minutes, wash skin with soap/water; Ing: seek medical attention

Symptoms: Acute: Mental confusion, light-headedness, nausea/vomiting, headache, staggering, unconsciousness, irritation of eyes/resp/skin,

Chronic: Kidney and/or liver damage; cataracts

[SAFETY]HAZARD EVALUATION:Naphthalene

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Lead Date 12/31/92

DOT Name/U.N. No. 2291 Job No.

CAS Number 7439-92-1

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Plumbum)

Chemical Formula Pb Molecular Weight 207.2

Physical State solid Solubility (H2O) insoluble Boiling Point 3164 F

Flash Point N/A Vapor Pressure/Density 0 mm Freezing Point N/A

Specific Gravity 11.34 Odor Characteristic N/A Flammable Limits N/A

Incompatabilities Strong oxidizers, hydrogen peroxide, acids

Biological Properties:

TLV-TWA .150 mg/m^3 PEL .050 mg/m^3 Odor/Odor Threshold N/A

IDLH 700 mg/m^3 Human Aquatic Rat/Mouse

Route of Exposure Inhalation, Ingestion, Dermal

Carcinogen --- Teratogen --- Mutagen ---

Radiological Properties:

Handling Recommendations: (Personal protective measures)

5 mg/m^3 high efficiency particulate respirator; other concentrations- SCBA; avoid skin contact or ingestion.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

ING: Give water, induce vomiting, medical attention immediately; INH: move to fresh air, medical attention; DER: wash with soap and water promptly.

Symptoms: Acute: stomach distress, vomiting, diarrhea, black stool, headache, dizziness, metallic taste

Chronic: muscle weakness, joint/muscle pain, insomnia, coma, death

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Toluene Date 12/31/92

DOT Name/U.N. No. 1294 Job No.

CAS Number 108-88-3

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Methyl benzene, Toluol, Phenyl methane)

Chemical Formula C_7H_8 Molecular Weight 92

Physical State Colorless Liquid Solubility (H2O) 0.05g/100 H_2O Boiling Point 231°F

Flash Point 40°F Vapor Pressure/Density 22mm Freezing Point -139°F

Specific Gravity 0.8669 Odor Characteristic 1.6ppm Flammable Limits 1.3% - 7.1%

Incompatabilities Strong Oxidizers, HNO_3, H_2SO_4, O_2, Peroxides, Heat

Biological Properties:

TLV-TWA 50 ppm PEL 100 ppm Odor/Odor Threshold Benzene-Like

IDLH 2,000 ppm Human IHL TCLD - 200 ppm Aquatic 96:100-10 ppm Rat/Mouse 4000 ppm

Route of Exposure Inhalation, Ingestion, Dermal Contact, Eye (Ocular)

Carcinogen Experimental Teratogen Experimental Mutagen Experimental

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impervious clothing, Viton gloves, faceshield respirator w/organic vapor cartridge up to 1000 ppm, >1000 ppm use APR with chemical cartridge; 2000 ppm-SCBA

Monitoring Recommendations:

Disposal/Waste Treatment:

Concentrated: incineration; dilute discharge to municipal sewer after primary treatment, incineration for dilute organic mixture

Health Hazards and First Aid:

Flush area with water and wash with soap; move to fresh air if inhaled; if swallowed, do not induce vomiting. Contact physician immediately.

Symptoms: Acute: Dizziness, fatigue, nausea, headache, vomiting, irritates eyes, dries skin

Chronic: Bone marrow, depression, defatting of skin, dermatitis, kidney and/or liver damage if ingested

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Xylene Date 12/31/92

DOT Name/U.N. No. 1307 Job No. _____

CAS Number 1330-20-7/ 95-47-6/ 108-38-3/ 106-42-3

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: _____

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Dimethylbenzene, Xylol)

Chemical Formula C_8H_{10} Molecular Weight 106

Physical State Colorless Liquid Solubility (H2O) _____ Boiling Point 292°F

Flash Point 77°F Vapor Pressure/Density 3.7 Freezing Point -12°F

Specific Gravity 0.86 Odor Characteristic 20 ppm Flammable Limits 1.0% - 7.0%

Incompatabilities Strong oxidizers, strong acid, heat, peroxide

Biological Properties:

TLV-TWA 100 ppm PEL 100 ppm Odor/Odor Threshold Aromatic

IDLH 1,000 ppm Human IHL TCL 0-200 ppm Aquatic _____ Rat/Mouse IHL LD_{50} - 500 ppm/4HC

Route of Exposure Inhale, skin

Carcinogen Experimental Teratogen _____ Mutagen _____

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impervious clothing, PVC gloves, faceshield, avoid prolonged contact. Respirator w/organic vapor cartridge up to 5,000 ppm; >10,000 ppm use SCBA

Monitoring Recommendations:

Disposal/Waste Treatment:

OSHA standard 29 CFR 1910. 106 applies

Health Hazards and First Aid:

Skin - wash w/soap and water; eyes - flush w/water; remove to fresh air if overcome

Symptoms: Acute: Eye and mucous membrane irritant, CNS depressant, ingestion causes gastrointestinal upset

Chronic: More severe than above, hyperplasia of bone marrow

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HAZARD EVALUATION OF CHEMICALS

Chemical name: Beryllium	Date:
DOT Name/U.N. No.: Poison, Flammable Solid/DOT 1567	Job No.:

CAS Number: 7440-41-7

References Consulted (underline):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: Hawley's Condensed Chemical Dictionary

Chemical Properties: Synonyms: Hard, brittle, gray-white metal

Chemical Formula: Be Molecular Weight: 9.0121

Physical State: metallic solid Solubility (H_2O): Insoluble Boiling Point: 2,970°C

Flash Point: Not applicable Vapor Pressure/Density: Not applicable Freezing Point:

Specific Gravity: 1.85 Odor Characteristic: None Flammable Limits: Powdered is flammable in air

Incompatibilities: Reacts readily with some strong acids to produce hydrogen

Biological Properties:

TLV-TWA: 0.002 mg/m^3 PEL: 0.002 mg/m^3 Odor/Odor Threshold: None

IDLH: Human: Aquatic: Rat/Mouse:

Route of exposure: Inhalation of dust, skin contact with certain solutions of beryllium compounds

Carcinogen: IARC-2A, NIOSH, ACGIH, NTP Teratogen: Mutagen:

Handling Recommendations: (Personal protective measures) Wear chemical protective clothing, rubber or plastic gloves, approved respiratory protection.

Monitoring Recommendations: Air sampling and analysis by NIOSH Manual of Analytical Methods (7102)

Disposal/Waste Treatment: Disposal - In accordance with USEPA, USDOT, state and local regulations. Beryllium dust may be collected by vacuuming with an appropriate high-efficiency filtration system.

Health Hazards and First Aid: Coughing and acute pneumonitis from acute exposure to dust. Remove to fresh air and get medical attention. Skin or eye contact - flush immediately with large amounts of water. For skin - flush with soap and water.

Symptoms:

Acute: Acute pneumonitis, dermatitis (from compounds), granulomatosis ulcerations if imbedded in skin.

Chronic: Chronic pulmonary granulomatosis (berylliosis), allergic dermatitis to ? compounds.

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Material Safety Data

Emergency Phone Number: 314-982-5000

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Mallinckrodt makes no representations, or warranties, either express or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the information refers. Accordingly, Mallinckrodt will not be responsible for damages resulting from use of or reliance upon this information.

Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 43061.

NITRIC ACID, 70%

PRODUCT IDENTIFICATION:

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 70%

Formula CAS No.: 7697-37-2

Molecular Weight: 63.00

Chemical Formula: HNO_3

Hazardous Ingredients: Not Applicable

PRECAUTIONARY MEASURES

DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Do not get in eyes, on skin, or on clothing.
Avoid breathing mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY/FIRST AID

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician.
SEE SECTION 5.

DOT Hazard Class: Oxidizer

SECTION 1 Physical Data

Appearance: Clear, colorless to slightly yellow liquid.

Odor: Suffocating acrid.

Solubility: Infinite in water.

Boiling Point: 122°C (252°F)

Melting Point: -34°C (-29°F)

Specific Gravity: 1.41

Vapor Density (Air = 1): 2-3 approximately

Vapor Pressure (mm Hg): 62 @ 20°C (68°F)

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.

Fire Extinguishing Media:
If involved in a fire, use water spray.

Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

SECTION 4 Leak/Spill Disposal Information

Isolate or enclose the area of the leak or spill. Clean-up personnel should wear protective clothing and respiratory equipment suitable for toxic or corrosive fluids or vapors. Small Spills: Flush with water and neutralize with alkaline material (soda ash, lime, etc.). Sewer with excess water. Larger spills and lot sizes: Neutralize with alkaline material, pick up with absorbent material (sand, earth, vermiculite) and dispose in a RCRA-approved waste facility or sewer the neutralized slurry with excess water if local ordinances allow. Provide forced ventilation to dissipate fumes.

Reportable Quantity (RQ)(CWA/CERCLA) : 1000 lbs.

Ensure compliance with local, state and federal regulations.

AD

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0 Other: Oxidizer

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Splashes may cause severe burns and permanent eye damage.

Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggrevation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Inhalation (Rat) LC50: 244 ppm
(NO_2)/30M

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and cannisters that contain oxidizable materials, such as activated charcoal.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible.Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect from physical damage and direct sunlight. Isolate from incompatible substances. Protect from moisture.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose.

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Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 43061.

Addendum to Material Safety Data Sheet

REGULATORY STATUS

This Addendum Must Not Be Detached from the MSDS

Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS must include a copy of this addendum

(Chem.Key: NITRA)

Hazard Categories for SARA Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X	X			X

Product or Components of Product:	SARA EHS Sect. 302 RQ (lbs.)	SARA EHS Sect. 302 TPQ (lbs.)	SARA Section 313 Chemicals Name List	SARA Section 313 Chemicals Chemical Category	CERCLA Sec.103 RQ (lbs.)	RCRA Sec. 261.33
NITRIC ACID, 70% (7697-37-2)	1000	1,000	Yes	No	1000	No

SARA Section 302 EHS RQ: Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.
SARA Section 302 EHS TPQ: Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.
SARA Section 313 Chemicals: Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.
CERCLA Sec. 103: Comprehensive Enviromental Response, Compensation and Liability Act (Superfund). Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4
RCRA: Resource Conservation and Reclamation Act. Commercial chemical product wastes designated as acute hazards and toxic under 40 CFR 261.33

Material Safety Data Sheet

Required under USDL Safety and Health Regulations for Shipyard Employment (29 CFR 1915)

U.S. Department of Labor
Occupational Safety and Health Administration

OMB No. 1218-0074
Expiration Date 05/31/86

PREPARED 1/10/86

Section I

Manufacturer's Name: ALCONOX, INC.

Emergency Telephone Number: (212) 473-1300

Address (Number, Street, City, State, and ZIP Code): 215 PARK AVENUE SOUTH
NEW YORK, N.Y. 10003

Chemical Name and Synonyms: N.A.

Trade Name and Synonyms: ALCONOX

C6300-1, C6301-1, C6301-2,-3,-4,-5

Chemical Family: ANIONIC DETERGENT

Formula: N.A.

D51-.502

Section II - Hazardous Ingredients

Paints, Preservatives, and Solvents		%	TLV (Units)	Alloys and Metallic Coatings		%	TLV (Units)
Pigments	NONE			Base Metal	NONE		
Catalyst	NONE			Alloys	NONE		
Vehicle	NONE			Metallic Coatings	NONE		
Solvents	NONE			Filler Metal Plus Coating or Core Flux	NONE		
Additives	NONE			Others	NONE		
Others	NONE						

Hazardous Mixtures of Other Liquids, Solids or Gases

	%	TLV (Units)
NONE		

Section III - Physical Data

Boiling Point (°F)	N.A.	Specific Gravity (H_2O=1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Percent Volatile by Volume (%)	N.A.
Vapor Density (AIR=1)	N.A.	Evaporation Rate (_____=1)	N.A.

Solubility in Water: APPRECIABLE

Appearance and Odor: WHITE POWDER INTERSPERSED WITH CREAM COLORED FLAKES - ODORLESS

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	Lel	Uel
NONE	N.A.	N.A.	N.A.

Extinguishing Media: WATER, CO_2, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures: FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS

Unusual Fire and Explosion Hazards: NONE

Threshold Limit Value

NO DATA AVAILABLE - TREAT AS NUISANCE DUST

Effects of Overexposure

PROLONGED EXPOSURE TO DUST MAY IRRITATE MUCOUS MEMBRANES

Emergency First Aid Procedures

EYES - FLUSH WITH PLENTY OF WATER FOR 15 MINUTES, SKIN-FLUSH WITH PLENTY OF WATER. INGESTION - DRINK LARGE QUANTITIES OF WATER TO DILUTE MATERIAL. GET MEDICAL ATTENTION FOR DISCOMFORT.

Section VI - Reactivity Data

Stability	Unstable		Conditions to Avoid: NONE
	Stable: X		

Incompatability (Materials to Avoid): AVOID STRONG ACIDS

Hazardous Decomposition Products: MAY RELEASE CO_2 GAS ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid: NONE
	Will Not Occur: X		

Section VII - Spill or Leak Procedures

Steps to be Taken in Case Material is Released or Spilled: MATERIAL FOAMS PROFUSELY, SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method: SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT

Section VIII - Special Protection Information

Respiratory Protection (Specify Type): DUST MASK

Ventilation	Local Exhaust: NORMAL		Special: N.A.	
	Mechanical (General): N.A.		Other: N.A.	

Protective Gloves: USEFUL - NOT REQUIRED	Eye Protection: USEFUL - NOT REQUIRED

Other Protective Equipment: NOT REQUIRED

Section IX - Special Precautions

Precautions to be Taken in Handling and Storing: SHOULD BE STORED IN A DRY AREA TO PREVENT CAKING

Other Precautions: NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

MALLINCKRODT

Material Safety Data Sheet

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

Emergency Telephone Number: 314-982-5000

ISOPROPYL ALCOHOL

PRODUCT IDENTIFICATION:

Synonyms: 2-propanol; sec-propyl alcohol; isopropanol

Formula CAS No.: 67-63-0

Molecular Weight: 60.10

Chemical Formula: $(CH_3)_2$ CHOH

Hazardous Ingredients: Isopropyl alcohol

PRECAUTIONARY MEASURES

WARNING! FLAMMABLE LIQUID. HARMFUL IF SWALLOWED OR INHALED. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION.

Keep away from heat, sparks and flame.
Keep container closed.
Use with adequate ventilation.
Avoid breathing vapor.
Wash thoroughly after handling.
Avoid contact with eyes, skin and clothing.

EMERGENCY/FIRST AID

If swallowed, give water to drink. Induce vomiting if medical help is not immediately available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. In all cases call a physician.
SEE SECTION 5.

DOT Hazard Class: Flammable Liquid

SECTION 1 Physical Data

Appearance: Clear, colorless liquid.

Odor: Rubbing alcohol.

Solubility: Infinite in water.

Boiling Point: 82°C (180°F).

Melting Point: -89°C (-128°F).

Specific gravity: 0.79

Vapor Density (Air = 1): 2.1

Vapor Pressure (mm Hg): 33 @ 20°C (68°F)

Evaporation Rate: (n-BUAC = 1) 2.83

SECTION 2 Fire and Explosion Information

Fire:
Flammable Liquid
Flashpoint: 12°C (53°F). (closed cup).
Autoignition temperature: 399°C (750°F).
Flammable limits in air, % by volume:
lel: 2.0; uel: 12.0.

Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion.

Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures. Vapors can flow along surfaces to distant ignition source and flash back.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage. Heat and sunlight can contribute to instability.

Hazardous Decomposition Products:
Toxic gases and vapors such as carbon monoxide may be released in a fire involving isopropyl alcohol.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Heat, flame, strong oxidizers, acetadehyde, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfuric acid combination, potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, oleum and perchloric acid.

SECTION 4 Leak/Spill Disposal Information

Remove all sources of ignition. Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapors. Small spills may be absorbed on paper towels and evaporated in a fume hood. Allow enough time for fumes to clear hood, then ignite paper in a suitable location away from combustible materials. Contain and recover liquid for reclamation when possible. Larger spills and lot sizes can be collected as hazardous waste and atomized in a suitable RCRA approved combustion chamber, or absorbed with vermiculite, dry sand, earth or similar material for disposal as hazardous waste in a RCRA approved facility.

Ensure compliance with local, state and federal regulations.

AD

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
May cause irritation of the nose and throat. Exposure to high concentrations has a narcotic effect, producing symptoms of drowsiness, headache, staggering, unconsciousness and possibly death.

Ingestion:
May cause drowsiness, unconsciousness, and death. Gastrointestinal pain, cramps, nausea, vomiting, and diarrhea may also result. The single lethal dose for a human adult = about 250 mls (SAX Sixth Edition).

Skin Contact:
Has a defatting action of the skin that can cause irritation. May cause irritation with a stinging effect and burning sensation.

Eye Contact:
Vapors may irritate the eyes. Splashes may cause severe irritation, possible corneal burns and eye damage.

Chronic Exposure:
Prolonged contact with skin may cause mild irritation, drying, cracking, or contact dermatitis may develop.

Aggrevation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
Give water to drink. Induce vomiting if medical help not is immediately available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:
Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Get medical attention if irritation develops or persists.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1986)

Oral rat LD50: 5840 mg/kg. Skin rabbit LD50: 13 gm/kg. Inhalation rat LC50: 16000 ppm/8H. Mutation references cited Aquatic Toxicity rating TLm96: 1000-10 ppm.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
400 ppm (TWA), 500 ppm (STEL)

-ACGIH Threshold Limit Value (TLV):
400 ppm (TWA), 500 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded a full facepiece chemical cartridge respirator may be worn, in general, up to the maximum use concentration specified by the respirator supplier. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from oxidizing materials. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment.

MALLINCKRODT

Material Safety Data Sheet

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

Emergency Telephone Number: 314-982-5000

Addendum to Material Safety Data Sheet

REGULATORY STATUS

This Addendum Must Not Be Detached from the MSDS

Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS must include a copy of this addendum

(Chem.Key: ISALC)

Hazard Categories for SARA Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X	X	X		

Product or Components of Product:	SARA EHS Sect. 302 RQ (lbs.)	SARA EHS Sect. 302 TPQ (lbs.)	SARA Section 313 Chemicals Name List	SARA Section 313 Chemicals Chemical Category	CERCLA Sec.103 RQ (lbs.)	RCRA Sec. 261.33
ISOPROPYL ALCOHOL (67-63-0)	No	No	Yes	No	No	No

C-31

SARA Section 302 EHS RQ: Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.
SARA Section 302 EHS TPQ: Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.
SARA Section 313 Chemicals: Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.
CERCLA Sec. 103: Comprehensive Enviromental Response, Compensation and Liability Act (Superfund). Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4
RCRA: Resource Conservation and Reclamation Act. Commercial chemical product wastes designated as acute hazards and toxic under 40 CFR 261.33

APPENDIX D

MAP OF HOSPITAL ROUTE


FORMER RAMEY AFB
SOUTH GATE
Punta
Borinquen
BORINQUEN
CAM
Camaceyes
US
RESERVATION
FERROCARRIL
DEL
VIA
CANAL
DE
Cerro
Facilidad de Radio
(WAPA)TV
Planta de
Filtración
Aljibe
BM
42.5
125.1
Hospital
Canteras
Aguadilla
CONSTRUCCION
A CARRILLES
467
107
456
75.3
141.2
D-3
TAMARINDO

APPENDIX E

E & E EMPLOYEE TRAINING SUMMARY

E & E EMPLOYEE TRAINING SUMMARY								
Employee Name/ Employee Number	40-Hour Training			8-Hour Refresher			APR FIT Test[d]	
	Duration	Start/End Dates	Performed By	Duration	Start/End Dates	Performed By	Start/End Dates	Performed By
Doug Heatwole[a] 2527	40 hrs	8/12/89 8/17/89	E & E	8 hrs.	1/16/97	E & E	1/16/97	E & E
John Williams[b] 3229	40 hrs.	2/23/91 2/27/91	E & E	8 hrs.	1/16/97	E & E	1/16/97	E & E
Debra Bowman[c] 2184	40 hrs.	8/1/88- 8/5/88	E & E	8 hrs.	10/17/96	E & E	10/17/96	E & E
Kevin Hayes 3601	40 hrs.	8/1/93 8/6/93	E & E	8 hrs.	10/17/96	E & E	10/17/96	E & E
Perry Kelso 2267	40 hrs.	10/17/88 10/21/88	E & E	8 hrs.	10/17/96	E & E	10/17/96	E & E

Key at end of table.

E & E EMPLOYEE TRAINING SUMMARY

Employee Name/ Employee Number	First Aid			CPR		
	Duration	Start/End Dates	Performed By	Duration	Start/End Dates	Performed By
Doug Heatwole[a] 2527	4 hrs.	2/7/97	Red Cross	4 hrs.	2/6/97	Red Cross
John Williams[b] 3229	4 hrs.	9/9/96	Red Cross	4 hrs.	9/11/96	Red Cross
Debra Bowman[c] 2184	4 hrs.	1/30/97	Red Cross	4 hrs.	1/30/97	Red Cross
Kevin Hayes 3601	4 hrs.	1/30/97	Red Cross	4 hrs.	1/30/97	Red Cross
Perry Kelso 2267	4 hrs.	8/23/96	Red Cross	4 hrs.	8/23/96	Red Cross

[a] Project manager.
[b] Field team leader.
[c] Site safety officer.
[d] All APRs are MSA brand Ultra-twin, full face respirators.

The above-name individuals have received the training as shown above according to Federal Standard 29 CFR 1910.120.

Name: Debbie Bowman

Signature: Debra J. Bowman

Title: Regional Health and Safety Coordinator

APPENDIX F

E & E EMPLOYEE PHYSICAL EXAMINATION SUMMARY

E & E EMPLOYEE PHYSICAL EXAMINATION SUMMARY				
Employee Name/ Employee Number	**Examination Type**	**Examination Date**	**Restrictions on Fitness for Respirator Use**	**Restrictions on Fitness for Other Activities**
Doug Heatwole 2527	Annual	5/29/96	None	None
John Williams 3229	Annual	8/21/96	Eyeglass Inserts	None
Kevin Hayes 3601	Annual	2/22/96	Eyeglass Inserts	None
Debra Bowman 2184	Annual	1/13/97	None	None
Perry Kelso 2267	Annual	2/16/96	Eyeglass Inserts	None

Attending Physician Statement:

I have, according to Federal Standard 29 CFR 1910.120 and .134, reviewed the medical data of the above-named individuals, and, except as noted, these individuals are fit for activities on hazardous waste sites.

Signature: 

Name: Richard Lee, M.D. - Medical Director

Address: Ecology and Environment, Inc.

368 Pleasant View Drive

Lancaster, N.Y. 14086

APPENDIX G

SUELOS TECH, EMPLOYEE TRAINING SUMMARY, AND EMPLOYEE PHYSICAL EXAMINATION SUMMARY

STC EMPLOYEE TRAINING SUMMARY						
Employee Name & S.S.	40-Hours Training			8-Hours Training		
	Duration	Start/End Dates	Performed by	Duration	Start/End Dates	Performed by
Osea Garcia 580-74-4175	40 hrs	09/10/88	Terravac	8 hrs	3/22/96	Health and Safety Consult
Samuel Nieves 582-25-2892	40 hrs	05/13/96	Heyda Colón			
José Nieves 581-39-0706	40 hrs	05/23/96	Ing. Gil Pérez	8 hrs	3/22/96	Health and Safety Consult

TC

STC EMPLOYEE TRAINING SUMMARY						
Employee Name & S.S.	First Aid			CPR		
	Duration	Start/End Dates	Performed by	Duration	Start/End Dates	Performed by
Samuel Nieves 582-25-2892	4 hrs.	May/1996	Red Cross	4 hrs.	May/1996	Red Cross

- All APRs are survivair brand respirators.
- The above-name individuals have received the training a shown above according to Federal Standard 29 CFR 1910.120.

Name José A. Ramos-Ocasio

Signature

Tittle Drilling Services - Health & Safety Officer

STC

STC EMPLOYEE PHYSICAL EXAMINATION SUMMARY				
Employee Name & S.S.	**Examination Type**	**Examination Date**	**Restrictions on Fitness for Resirator Use**	**Restrictions on Fitness for Use Other Activities**
Samuel Nieves 582-25-2892	Annual	07/22/96	N/A*	N/A
José Nieves 581-39-0706	Annual	07/22/96	N/A*	N/A

*- Smoker instructed to quit.

Attending Physical Statement:

I have, according to Federal Standard 29 CFR 1910.120 and 134, physically examined and reviewed the medical data of the above-named individuals, and, except as noted, these individuals are fit for activities on hazardous waste sites.

Signature : _____

Name : _____ EDWIN E. PAGAN
Caribbean Medical Testing
Lic. 7971

Address : Caribbean Medical Testing
Rio Piedras, P.R.

THE FINAL DECISION FOR EMPLOYMENT IS RESPONSIBILITY OF THE COMPANY WHO REFERS THE PATIENT AND NOT OF CARIBBEAN MEDICAL TESTING CENTER OR ITS EMPLOYEES.

TC

STC EMPLOYEE PHYSICAL EXAMINATION SUMMARY				
Employee Name & S.S.	**Examination Type**	**Examination Date**	**Restrictions on Fitness for Resirator Use**	**Restrictions on Fitness for Use Other Activities**
Osea García 580-74-4175	Annual	07/22/96	N/A	N/A

Attending Physical Statement:

I have, according to Federal Standard 29 CFR 1910.120 and 134, physically examined and reviewed the medical data of the above-named individuals, and, except as noted, these individuals are fit for activities on hazardous waste sites.

Signature : _____

Name : Alfredo Santa Ana 9124

Address : Caribbean Medical Testing
Rio Piedras, P.R.

STC

SOIL TECH CORPORATION
RESPIRATOR FIT TEST RECORD

A. Employee: Osed García Date: 2/16/96
Employee No: 580-74-4175
Employee Job Title/Description Foreman

B. Employer: **Soil Tech Corporation**
Loacation/ Address: **Amur & Dulna Sts. Repto Landrau**
Rio Piedras, Puerto Rico 00927

C. Respirator Selected: Survivair 2000
Manufacturer : ~~TC-23C-287~~ Survivair 2600-00
NIOSH Approval Number: TC-23C-287

D. Conditions which could affect respirator fit:

X Clean Shaven	__ Facial Scar
__ 1-2 Day Beard Growth	__ Dentures Absent
__ 2+ Days Beard Growth	__ Glasses
X Moustache	__ None

Comments: _____

E. Fit Checks:

Negative Pressure:	X Pass	__ Fail	__ Not Done
Positive Pressure:	X Pass	__ Fail	__ Not Done

F. Fit Testing:
Quantitative: Fit Factor <10
Qualitative:

Isoamyl Acetate		Irritant Smoke	
__ Pass	__ Fail	X Pass	__ Fail

Comments: _____

G. Employee Acknowledgement of test results:
Employee Signature : Osed García Date: 2/16/96
Test Conducted By: _____ Date: 2/16/96

DISCLAIMER

The above respirator fit test was performed on and bu the persons listed. The results indicate the performance of the listed respiratory protective device, as fitted on the employee named on this record under controlled conditions. Fit testing as performed, measures the ability of the respiratory protective device to provide protection to the individual tested. Improper use, maintenance, or application of this or any other respiratory protective device will reduce or eliminate protection.

OLF/h&s/forms/rev2/16/96

STC

SOIL TECH CORPORATION
RESPIRATOR FIT TEST RECORD

A. Employee: Jose' J. Nieves Date: 2/16/96
Employee No: 581-39-0706
Employee Job Title/Description Driller

B. Employer: **Soil Tech Corporation**
Loacation/ Address: **Amur & Dulna Sts. Repto Landrau**
Rio Piedras, Puerto Rico 00927

C. Respirator Selected: Survivair 2000
Manufacturer : Survivair 260000
NIOSH Approval Number: TC-23C-267

D. Conditions which could affect respirator fit:

__ Clean Shaven	__ Facial Scar
X 1-2 Day Beard Growth	__ Dentures Absent
__ 2+ Days Beard Growth	__ Glasses
X Moustache	__ None

Comments:

E. Fit Checks:

Negative Pressure:	X Pass	__ Fail	__ Not Done
Positive Pressure:	X Pass	__ Fail	__ Not Done

F. Fit Testing:
Quantitative: Fit Factor 410
Qualitative:

Isoamyl Acetate		Irritant Smoke	
__ Pass	__ Fail	X Pass	__ Fail

Comments:

G. Employee Acknowledgement of test results:
Employee Signature : Date: 2-16-96
Test Conducted By: Date: 2/14/96

DISCLAIMER

The above respirator fit test was performed on and bu the persons listed. The results indicate the performance of the listed respiratory protective device, as fitted on the employee named on this record under controlled conditions. Fit testing as performed, measures the ability of the respiratory protective device to provide protection to the individual tested. Improper use, maintenance, or application of this or any other respiratory protective device will reduce or eliminate protection.

OLF/h&s/forms/rev2/16/96

STC

SOIL TECH CORPORATION
RESPIRATOR FIT TEST RECORD

A. Employee: Samuel Nieves Date: 2/16/96
Employee No: 582-25-2892
Employee Job Title/Description Driller

B. Employer: **Soil Tech Corporation**
Loacation/ Address: **Amur & Duina Sts. Repto Landrau**
Rio Piedras, Puerto Rico 00927

C. Respirator Selected: Survivair 2000
Manufacturer : Survivair 2500
NIOSH Approval Number: TC-23C-287

D. Conditions which could affect respirator fit:

X Clean Shaven	__ Facial Scar
__ 1-2 Day Beard Growth	__ Dentures Absent
__ 2+ Days Beard Growth	__ Glasses
__ Moustache	__ None

Comments:

E. Fit Checks:

Negative Pressure:	X Pass	__ Fail	__ Not Done
Positive Pressure:	X Pass	__ Fail	__ Not Done

F. Fit Testing:
Quantitative: Fit Factor 410
Qualitative:

Isoamyl Acetate		Irritant Smoke	
__ Pass	__Fail	X Pass	__Fail

Comments:

G. Employee Acknowledgement of test results:
Employee Signature: [signature] Date: 16/2/96
Test Conducted By: [signature] Date: 2/16/96

DISCLAIMER

The above respirator fit test was performed on and bu the persons listed. The results indicate the performance of the listed respiratory protective device, as fitted on the employee named on this record under controlled conditions. Fit testing as performed, measures the ability of the respiratory protective device to provide protection to the individual tested. Improper use, maintenance, or application of this or any other respiratory protective device will reduce or eliminate protection.

OLF/h&s/forms/rev2/16/96

STC

G-10

HEALTH & SAFETY TRAINING GROUP

PRESENT THIS CERTIFICATE TO

Jose Nieves

(S.S 581-39-0706)

has completed the requirements of
the 8-hours annual refresher training in
"Health and Safety for Hazardous Waste Operations
and Emergency Response" as required by
OSHA 29 CFR 1910.120

Caguas, Puerto Rico — *March 22, 1996*

Heyda Colón
Health & Safety Consultant

EnvironmentalResourceTechnologies
Program Sponsor

G-11

Certificado de Participacion

Otorgado a

JOSE NIEVES COLLAZO (581-39-0706)

"HEALTH AND SAFETY FOR HAZARDOUS WASTE OPERATION AND EMERGENCY RESPONCE" 8 HR. ANNUAL REVIEW OSHA 29 CFR 1910.120

Dado en SAN JUAN, PUERTO RICO, *hoy día* 25 *de* FEBRERO *de 19* 95

Hayda Colón Torres

HEALTH AND SAFETY CONSULTANT

G - 12

Certificado de Reconocimiento

Otorgado a

JOSE J. NIEVES (581-39-0706)

HEALTH AND SAFETY FOR HAZARDOUS WASTE OPERATION / 8 HR. ANUAL REVIEW

Dado en SAN JUAN, PUERTO RICO *. hoy día* 29 *de* ENERO *de 19*94

Heyda Colón

HEALTH AND SAFETY CONSULTANT

Certificado

Otorgado a

JOSE J. RIEVES

HA HAZARDOUS WASTE OPERATIONS 40 HR. TRAINING

Dado en SAN JUAN, *hoy día* 23 *de* MAYO *de 19* 92

Gil Peytes Jesús

HEALTH & SAFETY TRAINING GROUP

PRESENT THIS CERTIFICATE TO

Osea Garcia

(S.S. 580-74-4175)

has completed the requirements of the 8-hours annual refresher training in "Health and Safety for Hazardous Waste Operations and Emergency Response" as required by OSHA 29 CFR 1910.120

Caguas, Puerto Rico — *March 22, 1996*

Heyda Colón
Health & Safety Consultant

EnvironmentalResourceTechnologies
Program Sponsor

G-15

Certificado de Participacion

Otorgado a

OSEA GARCIA (580-74-4175)

"HEALTH AND SAFETY FOR HAZARDOUS WASTE OPERATION AND EMERGENCY RESPONCE" 8 HR. ANNUAL REVIEW OSHA 29 CFR 1910.120

Dado en SAN JUAN, PUERTO RICO, *hoy día* 4 *de* MARZO *de 19* 95

Heyda Colón Lucca

HEALTH AND SAFETY CONSULTANT

G-16

Certificado de Reconocimiento

Otorgado a

OSEA GARCIA (580-74-6175)

HEALTH AND SAFETY FOR HAZARDOUS WASTE OPERATION / 8 HR. ANUAL REVIEW

Emitido en SAN JUAN, PUERTO RICO *, hoy día* 29 *de* ENERO *de 19*94

Hayda Colón
HEALTH AND SAFETY CONSULTANT

Certificado de Participacion

Otorgado a

OSEA GARCIA (580-74-4175)

HEALTH AND SAFETY FOR HAZARDOUS WASTE OPERATION / 8 HR ANUAL REVIEW

Dado en SAN JUAN, PUERTO RICO *, hoy día* 16 *de* ENERO *de 19*93

Heyda Colón

HEALTH AND SAFETY CONSULTANT

NAPATYCO NUM. 600

G-17

Certificado

Otorgado a

OSHA GARCIA SERRANO

OSHA 1910.120

CURSO DE OPERACIONES CON DESPERDICIOS PELIGROSOS

Dado en SAN JUAN *PuertoRico,*

hoy día 3 *de* AGOSTO *de 19*91

Gil Pz De Jesus

Certificado

Terra Vac otorga el presente a

Osea García

por haber completado satisfactoriamente el curso de

MANEJO DE SUBSTANCIAS PELIGROSAS Y RESPUESTAS A EMERGENCIAS AMBIENTALES

en cumplimiento con CFR 1910.120.

El dia 10 de *Sept.* de 1988 Duracion: 40 Horas

TERRA VAC
San Juan
Puerto Rico

Presidente

Instructor

HEALTH & SAFETY TRAINING GROUP

PRESENT THIS CERTIFICATE TO

Samuel Nieves

(S.S. 582-25-2892)

has completed the requirements of the 40-hours training in "Health and Safety for Hazardous Waste Operations and Emergency Response" as required by OSHA 29 CFR 1910.120

Caguas, Puerto Rico — *May 13 to 17, 1996*

Heyda Colón
Course Director

ERTEC
Program Sponsor

Rafael Reyes
CPR & First Aid Instructor
American Red Cross

APPENDIX H

CARIBBEAN AERIAL SURVEYS, INC., EMPLOYEE TRAINING SUMMARY, AND EMPLOYEE PHYSICAL EXAMINATION SUMMARY

ROSSER LOWE

EMPLOYEE TRAINING SUMMARY

Employee Name and Employee Number	40 Hour Training			8 Hour Refresher			APR Fit Test	CPR/ First Aid
	Duration	Date	By	Duration	Date	By	MSA Comfo. II Respirator	
Kelly K. Comstock 31562	40 hours	10/95	Georgia Tech	8 hours	6/96	Knight Env. Consult.	6/96	6/96
Thomas R. Dowell 32242	40 hours	1/91	Georgia Tech	8 hours	6/96	Georgia Tech	6/96	1/97
Mark D. Gropp 32975	40 hours	1/91	Georgia Tech	8 hours	6/96	Knight Env Consult.	6/96	6/96
L. Del Sundgren 35280	40 hours	12/89	Georgia Tech	8 hours	6/96	Knight-Env Consult.	6/96	1/97
W.B. Turner	40 hours	1/91	Georgia Tech	8 hours	6/96	Georgia Tech	6/96	7/97

*Safety Officer

The above named individuals have received training as shown above according to 29 CFR 1910.120.

Name: William J. Daniel III, RLS
Title: Principal Manager and Company Safety Officer

Signature: D. Dee for wjd

1/30/97

ROSSER LOWE

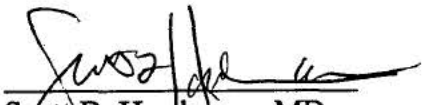
EMPLOYEE PHYSICAL EXAMINATION SUMMARY

Employee Name and Employee Number	Examination Type	Examination Date	Restrictions on Fitness and Other Activities	Attending Physician
Kelly K. Comstock 31562	periodic	1/4/96	none	Dr. Henderson
Thomas R. Dowell 32242	periodic	1/17/97	none	Dr. Henderson
Mark D. Gropp 32975	periodic	4/26/96	none	Dr. Henderson
L. Del Sundgren 35280	periodic	1/15/97	No exposure to liver toxins.	Dr. Henderson
W.B. Turner 35571	periodic	1/15/97	none	Dr. Henderson

*Safety Officer

Attending Physician Statement:

I have, according to Federal Standard 29 CFR 1910. 120 and 134, physically examined and reviewed the medical data of the individuals marked as noted, and these individuals are fit for activities on hazardous waste sites.

Signature: 

Name: Scott D. Henderson, MD, FAAFP, FACOM
Medical Director
Address: 17 Dunwoody Park Drive
Suite 115
Atlanta, Georgia 30338
Phone: (404) 671-9009
Fax: (404) 671-1968

1/30/97

APPENDIX I

E & E CERTIFIED INDUSTRIAL HYGIENIST BIOGRAPHY

THOMAS G. SIENER, CIH **Certified Industrial Hygienist**

EDUCATION:

B.S., Biology, Purdue University

EXPERIENCE:

A Certified Industrial Hygienist with 22 years' experience, Mr. Siener is the manager of E & E's industrial hygiene/air quality group. He approves the selection of site health and safety officers and reviews their performance and air quality monitoring activities. He has directed major, multisite industrial hygiene programs; managed numerous surveys involving the sampling, quantification, and characterization of indoor and outdoor airborne pollutants; evaluated exposures to chemical and physical agents; developed air monitoring programs; and provided technical guidance for the development of recommendations and engineering controls to reduce exposure. A specialist in the preparation of site-specific safety plans, he routinely provides quality assurance for industrial hygiene-related activities in the United States and overseas.

On behalf of E & E's standby contract with the New York State Department of Environmental Conservation (NYSDEC), Mr. Siener reviewed/approved site-specific safety plans, led development of air monitoring and industrial hygiene procedures, and directed/performed safety and industrial hygiene field audits. As site safety auditor for E & E's remedial investigation/feasibility study (RI/FS) for the Madison Wire/Orban Industries site, he conducted industrial hygiene sampling for volatile organic compounds, in order to confirm the cause of high organic vapor analyzer readings. He provided health and safety support for the RI/FS for the Wellsville-Andover Landfill and for the five-year operation and maintenance program at the Dewey Loeffel Landfill. Throughout New York State, Mr. Siener also provided health and safety reviews and audits for numerous NYSDEC Phase II investigations at hazardous waste sites.

For the City of New York, he provided industrial hygiene/toxicological leadership during RI activities and the cleanup of mercury contamination at approximately 100 underground waterline valve chambers that were scattered throughout seven New York boroughs and the Catskill region. Mr. Siener conducted site inspections, evaluated the results of laboratory analyses, conducted hazard assessments, established health and safety protocol, led the development of site-specific safety plans and emergency procedures, trained cleanup contractor personnel in the safety procedures, and headed the E & E industrial hygiene team that monitored all on-site cleanup contractor activities.

Mr. Siener provided health and safety and industrial hygiene oversight for E & E field investigations of 22 separate hazardous waste sites at the 2,002-acre Norton Air Force Base in California, in support of the United States Air Force Installation Restoration Program.

APPENDIX J

PROJECT ORGANIZATION

PROJECT ORGANIZATION

The project organization for the execution of the former Ramey Air Force Base Sites is as follows:

Program Manager:	John D. Barksdale Ecology and Environment, Inc. 316 South Baylen St., Suite 540 Pensacola, Florida 32501 Phone: (904) 435-8925 Fax: (904) 435-9135
Project Manager:	Doug Heatwole Ecology and Environment, Inc. 316 South Baylen St., Suite 540 Pensacola, Florida 32501 Phone: (904) 435-8925 Fax: (904) 435-9135
Field Team Leader:	John E. Williams Ecology and Environment, Inc. 316 South Baylen St., Suite 540 Pensacola, Florida 32501 Phone: (904) 435-8925 Fax: (904) 435-9135
Site Safety Officer:	Debbie Bowman Ecology and Environment, Inc. 1950 Commonwealth Lane Tallahassee, Florida 32303 Phone: (904) 574-1400 Fax: (904) 574-1179
Suelos Tech, Inc.	Jose Ramos (Field Point of Contact) Suelos Tech, Inc. A-1 Amur Street Reparto Landrau Rio Piedras, Puerto Rico 00921 Phone: (809) 792-8900
Caribbean Aerial Surveys, Inc.	Oscar Caraquillo (Field Point of Contact) Caribbean Aerial Surveys, Inc. 1222 Amerito Miranda Ave. Rio Piedras, Puerto Rico 00921 Phone: (809) 783-4901

A list of potential team members is presented in Appendix E. Three E & E personnel will be required for the completion of fieldwork: a field team leader, and a site safety officer. The field team leader will serve as the point-of-contact for the USACE personnel. In addition, the previously mentioned field point of contact for Suelos Tech, Inc., and Caribbean Aerial Surveys, Inc., will serve as the USACE personnel contacts. Scheduling conflicts may necessitate the substitution of personnel from Appendix E for the field positions listed above. E & E will make every effort to inform USACE of field personnel changes once the fieldwork schedule has been established. E & E personnel not included in Appendix E will not be present on site without written approval from USACE.

APPENDIX K

HEAT STRESS PREVENTION AND TREATMENT

HEAT STRESS PREVENTION AND TREATMENT

Elevated temperatures are potentially hazardous, especially when work is conducted without appropriate precautions. The following sections describe heat stress prevention and the recognition and treatment of heat emergencies.

Effects of Heat

A predictable amount of heat is generated as a result of normal oxidation processes within the body. If heat is liberated rapidly, the body cools to a point at which the production of heat is accelerated, and the excess heat brings the body temperature back to normal.

Interference with the elimination of heat leads to its accumulation and to the elevation of body temperature. This condition produces a vicious cycle in which certain body processes accelerate and generate additional heat. Afterward, the body must eliminate not only the heat that is normally generated but also the additional quantities of heat.

Most body heat is brought to the surface by the bloodstream and escapes to cooler surroundings by conduction and radiation. If moving air or a breeze strikes the body, additional heat is lost by convection. When the temperature of the surrounding air becomes equal to or rises above the body temperature, all the heat must be lost by vaporization of the moisture or sweat from skin surfaces. As the air becomes more humid (contains more moisture), vaporization from the skin decreases. Weather conditions including high temperatures (90 to 100 degrees F), high humidity, and little or no breeze cause the retention of body heat. Such conditions or a succession of such days (a heat wave) increase the chances of a medical emergency due to heat.

Preventing Emergencies Due to Heat

When working in situations where the ambient temperatures and humidity are high, and especially in situations where protection levels A, B, or C are required, the site safety officer should:

- Ensure that all employees drink plenty of fluids (Gatorade or its equivalent);
- Ensure that rest periods are scheduled each hour so overheating does not occur (see tables 1 and 2); and
- Revise work schedules, when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 11:00 a.m. and 6:00 p.m. to nightfall).

When protective clothing is required, the suggested guidelines correlating ambient temperature and maximum wearing time per excursion are:

Ambient Temperature	Maximum Wearing Time per Excursion
Above 90 degrees F	15 minutes
85 to 90 degrees F	30 minutes
80 to 85 degrees F	60 minutes
70 to 80 degrees F	90 minutes

Table 1

ACGIH PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES (TLV)

Work/Rest Regimen	Work Load		
	Light	**Moderate**	**Heavy**
Continuous Work	86°F (30.0°C)	80°F (26.7°C)	77°F (25.0°C)
75% Work 25% Rest (each hour)	87°F (30.6°C)	82°F (28.0°C)	78°F (25.9°C)
50% Work 50% Rest (each hour)	89°F (31.4°C)	85°F (29.4°C)	82°F (27.9°C)
25% Work 75% Rest (each hour)	90°F (32.2°C)	88°F (31.1°C)	86°F (30.0°C)

NOTE: Values are given in °F (and °C) Wet Bulb Temperature. For unacclimatized workers, the permissible heat exposure TLV should be reduced by 2.5°C. See Table 2 for correction factors for clothing types.

Key:

ACGIH = American Conference of Governmental Industrial Hygienists.

Source: 1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists.

Table 2

TLV WBGT CORRECTION FACTORS IN °C FOR CLOTHING

Clothing Type	Clo Value	WBGT Correction
Summer work uniform	0.6	0
Cotton overalls	1.0	-2
Winter work uniform	1.4	-4
Water barrier, permeable	1.2	-6

Key:

Clo = Insulation value of clothing. One clo unit = 5.55 kcal/m^2/hr of heat exchange by radiation and convection for each °C of temperature difference between the skin and adjusted dry bulb temperature.

TLV = Threshold Limit Values.

WBGT = Wet bulb globe temperature.

Source: 1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists.

60 to 70 degrees F	120 minutes
50 to 60 degrees F	180 minutes

One method of measuring the effectiveness of an employee's rest-recovery regime is by monitoring the heart rate. The "Brouha guideline" is one such method and is performed as follows:

- Count the pulse rate for the **last** 30 seconds of the first minute of a 3-minute period, the **last** 30 seconds of the second minute, and the **last** 30 seconds of the third minute; and
- Double each result to yield beats per minute.

If the recovery pulse rate during the last 30 seconds of the first minute is 110 beats/minute or less, and the deceleration between the first, second, and third minutes is **at least** 10 beats/minute, then the work-recovery regime is acceptable. If the employee's rate is above the rate specified, a longer rest period will be required, accompanied by an increased intake of fluids. This method will be used to monitor for heat stress for employees at temperatures above 70° F.

Heat Emergencies

Heat Cramps. Heat cramps usually affect people who work in hot environments and perspire a great deal. Loss of salt from the body causes very painful cramps in leg and abdominal muscles. Heat cramps may also result from drinking iced water or other drinks either too quickly or in too large a quantity. The symptoms of heat cramps are:

- Painful muscle cramps in legs and abdomen;
- Faintness; and
- Profuse perspiration.

To provide emergency care for heat cramps, move the patient to a cool place. Give him or her sips of liquids such as Gatorade or its equivalent. Apply manual pressure to the cramped muscle. Move the patient to a hospital if there is any indication of a more serious problem.

Heat Exhaustion. Heat exhaustion also may occur in individuals working in hot environments and may be associated with heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is transported from the interior of the body to the surface by the blood. The skin vessels become dilated and a large amount of blood is pooled in the skin. This condition, plus the blood that is pooled in the lower extremities when in an upright position, may lead to an inadequate return of blood to the heart and eventual physical collapse. The symptoms of heat exhaustion are:

- Weak pulse;
- Rapid and usually shallow breathing;
- Generalized weakness;
- Pale, clammy skin;
- Profuse perspiration;
- Dizziness/faintness; and
- Unconsciousness.

To provide emergency care for heat exhaustion, move the patient to a cool place and remove as much clothing as possible. Have the patient drink cool water, Gatorade, or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allow chilling or overcooling. Treat the patient for shock and move him or her to a medical facility if there is any indication of a more serious problem.

Heat Stroke. Heat stroke is a profound disturbance of the heat-regulating mechanism and is associated with high fever and collapse. It is a serious threat to life and carries a 20% mortality rate. Sometimes this condition results in convulsions, unconsciousness, and even death. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age (over 40) increase the chance of heat stroke. Alcoholics are extremely susceptible. The symptoms of heat stroke are:

- Sudden onset;
- Dry, hot, and flushed skin;
- Dilated pupils;
- Early loss of consciousness;
- Full and fast pulse;
- Deep breathing at first, followed by shallow or faint breathing;
- Muscle twitching, growing into convulsions; and
- Body temperature reaching 105 to 106 degrees F or higher.

When providing emergency care for heat stroke, remember that it is a life-threatening emergency. Transportation to a medical facility should not be delayed. Move the patient to a cool environment, if possible, and remove as much clothing as possible. Ensure an open airway. Reduce body temperature promptly by dousing the body with water or, preferably, by wrapping the patient in a wet sheet. If cold packs are available, place them under the arms, around the neck, at the ankles, or any place where blood vessels that lie close to the skin can be cooled. Protect the patient from injury during convulsions.

APPENDIX L

E & E CORPORATE RESPIRATORY PROTECTION PROGRAM

RESPIRATORY PROTECTION PROGRAM

The following respiratory protection program has been prepared as prescribed in OSHA Safety and Health Standards, 29 CFR Part 1910.134; as well as on the basis of 30 CFR Part II, 10 CFR 20, and a thorough understanding of ANSI Standard Z88.2 "Practices for Respiratory Protection" (revised 1980). Supplementary guidance regarding compliance with appropriate and relevant respiratory protection for radioactive materials is provided in 10 CFR 20, Subpart H.

As required in these regulations, the Corporation shall be responsible for the establishment and maintenance of a respiratory protection program. Therefore, the Corporation shall provide respirators to its personnel when such equipment is necessary to protect the employees' health. The respirators provided by the Corporation shall be approved by the National Institute of Occupational Safety and Health/Mine Safety and Health Administration (NIOSH/MSHA) and shall be applicable/suitable for their intended use.

Likewise, the above regulations provide that employees of the Corporation shall use the provided respiratory protection equipment in accordance with instructions and training that are furnished. The corporate employee shall guard against damage to the respiratory equipment and shall report any malfunction of the respiratory equipment to the responsible person.

The purpose of this corporate policy document is to establish written SOPs to be followed by employees of the Corporation to optimize respiratory protection. These SOPs contain specific information needed to maintain an effective respirator program and are intended to meet the users' requirements for protection during responses to environmental incidents where dangerous atmospheres (i.e., harmful dust, fumes, sprays, mists, fogs, smokes, vapors, or gases) are not, or by definition cannot, be controlled by using effective administrative or engineering controls. The SOPs for the Corporation's respiratory protection program are written as enforceable policy for all persons who participate in projects involving potential or actual hazardous environments.

The SOPs cover the following topic areas:

- Administrative procedures for implementation of the Respiratory Protection Program.
- Guidelines for medical surveillance of respiratory equipment users as detailed in E & E's Corporate Health and Safety Program for Toxic and Hazardous Substances.
- Guidance for ensuring the proper selection of the approved respiratory equipment to provide protection against potential environmental emergency hazards.
- Respirator fit test (qualitative).
- Detailed instructions for training employees in the proper use and limitations of respirators.
- Issuance of respirators.
- Maintenance procedures, including cleaning and disinfection, drying, inspection, repair, and storage.
- Procedures for evaluating the respiratory protection program's effectiveness.

The formulation and implementation of the Corporation's respiratory protection program is not a simple or casual undertaking. The potential risks to life and health encountered during hazardous material operations can be extreme and require the utmost in respiratory protection procedural development and implementation. The complexity of the procedures in this program reflect the potential for encounters with highly contaminated environments.

1. Administrative Procedures for Implementation of a Respiratory Protection Program

The importance of the successful implementation of this respiratory protection program dictates the need to establish QA controls over the use of the SOPs presented herein. This QA function requires a definite chain of supervision. Therefore, the overall responsibility for the entire respiratory protection program is assigned to the CHSD. Each office will have one person designated as a safety coordinator, responsible for field-level QA

on the program, who will report directly to the CHSD. CHSD also will provide assistance in the overall implementation of the respiratory protection program in each office location.

All personnel acting as program QA representatives shall be trained and remain current on state-of-the-art techniques for the selection, use, maintenance, and storage of respirators provided for use in this program. Likewise, the designated safety coordinators periodically will review the respiratory protection program in order to eliminate deficiencies and improve program effectiveness.

The intent of this respiratory protection program, with the full support of the officers of the Corporation, is to provide the best possible respiratory protection for personnel who participate in work activities in areas where toxic air contaminants may be present. The program has been developed in accordance with the intent of 29 CFR Part 1910.134; 30 CFR Parts 11, 14, 14a; 10 CFR 20; and ANSI Z88.2 (1980). The SOPs have been developed to establish a respiratory program that will meet current needs, be implemented satisfactorily, and remain effective through continual examination.

2. Guidelines for Medical Surveillance of Respirator Users

The policy of the Corporation, in compliance with 29 CFR 1910.134 and Section 3.7 of ANSI Z88.2, is to ensure that no employee is assigned to tasks requiring the use of respirators until that employee has been found to be physically and psychologically fit to wear the designated respirators under working conditions. A physician, designated by the HSAC, will make this determination and will designate the working conditions under which each employee may use a respirator. The medical determination will be made annually and at other times, as deemed necessary by the HSAC, if the employee has been exposed accidentally to hazardous atmospheres.

The initial medical examination that will be performed by the designated physician in each office location will serve two purposes. First, as mentioned above, the examination will determine the respective employee's ability to work under hazardous conditions using the designated respiratory equipment. Second, the initial examination will provide baseline medical data against which physiological changes in the respective individual periodically will be assessed.

The periodic medical examinations, to be given at least annually after the initial baseline examination has been completed, will be used to determine whether respirator wearers have had any significant change in their pulmonary function. The frequency of the periodic examinations will be determined by the particular situations. The test performed during this examination will be tailored to the person and the situation of concern. The results of the tests then will be compared with data from the original baseline examination, to determine if the respirators used are adequate.

It should be noted that the HSAC will review the medical surveillance program periodically to determine its effectiveness. The progress of the program, as well as any determined amendments thereof, including respective timetables for implementation, will be reported in the minutes of these meetings.

3. Guidelines for Selection of Approved Respirators

OSHA 1910.134 states that respirators shall be selected on the basis of the hazards to which workers are exposed and that ANSI Z88.2 (1980) shall be used for guidance in the selection of respirators. OSHA also requires the use of approved or accepted respirators when available, based on 30 CFR Part II, 14, 14a. The selection of respiratory protective equipment for use during hazardous/toxic material operations has been guided by considerations of the hazards present, the risk to life and health, the nature of the equipment available, and the relative comfort and ease with which work may be performed while the protection is being worn. This section summarizes the criteria used for equipment selection, the conditions under

which each type of equipment is safe and why, and the equipment selected by the Corporation.

The procedures for the selection of the proper type of respirators for corporate use (see Attachment VI-C at the end of Tab VI) are based on the following criteria:

- The nature of the hazardous situation encountered;

- The type of respiratory hazard, including physical, chemical, radiological, and biological properties of the materials confronted; physiological effects on the body; ambient concentration of toxic materials or airborne radioactivity level; established permissible exposure limits or current time-weighted average for toxic materials; and the established immediately dangerous to life and health (IDLH) level for each toxic material present;

- The location of the hazardous area in relation to the nearest area having acceptable respirable air;

- The period of time for which respiratory protection must be provided;

- The type of work activities to be conducted by corporate employees in the hazardous area;

- The physical characteristics, functional capabilities, and limitations of the various types of respirators; and

- The workplace protection factor for each type of respirator to be used.

When a corporate employee responds to an environmental emergency situation or performs a field investigation, the employee is faced with two possible atmospheric contamination scenarios: unknown atmospheric contamination components and concentrations, and known atmospheric contamination components and concentrations.

a. Unknown Atmospheres

Initial responders to an environmental emergency at the scene of a spill incident or hazardous waste site seldom know in advance what toxic or hazardous substances may be present at the response location, what the atmospheric concentration(s) of the substances are, or whether an oxygen-deficient atmosphere exists. In these instances, it will be assumed that the unknown atmosphere has an IDLH concentration and/or is possibly oxygen-deficient. In such situations, 29 CFR 1910.120 and 1910.134 and ANSI Z88.2 (1980) require that only positive-pressure SCBA be used, unless otherwise indicated: e.g., by monitoring information or the nature of the released material (e.g., a solid).

Therefore, it is the policy of the Corporation that employees responding to environmental situations with unknown air contaminant concentrations shall use positive-pressure SCBAs. For this purpose, the Corporation has selected the MSA Model 401 Positive Pressure Demand Air Mask unit with composite (fiberglass and aluminum) air cylinder. This model is NIOSH/MSHA-approved; is lightweight (26 lb.); incorporates the use of a full facepiece; and has a composite air cylinder, containing 45 cubic feet of respirable air at 2,216 pounds per square inch (psi), that provides for a 30-minute-use air capacity.

b. Known Atmospheres

For some environmental response situations at either material spills or hazardous waste sites, all of the contaminants and their concentrations are known because adequate ambient sampling has been conducted and the specific oxygen content in the work area is known. In these situations, OSHA regulations and ANSI Z88.2 (1980) guidelines specifically prescribe allowable respiratory protective devices. Those atmospheric situations, the prescribed levels of respiratory protection, and the type of respirators that the Corporation has selected for the specific situation are as follows:

i. **Atmospheres that Are Oxygen-Deficient** (less than 19.5% O_2). OSHA requires that respirators used in these atmospheres must provide an independent source of respirable air: i.e., SCBAs, SCBA/air line supplied-air respirator combinations, etc. When an employee i aware that an oxygen-deficient atmosphere exists or is possible, the employee will use a positive-pressure SCBA. Because of the nature of the work and the employee's work activities during hazardous environmental situations, the Corporation has elected to use the MSA Model 401 Positive Pressure Demand Air Mask.

ii. **Atmospheres Having IDLH Concentrations.** As specified in ANSI Z88.2, which defines IDLH and toxic contaminants such as fumes, dusts, vapors, gases, and radioactive elements, these atmospheres are characterized by a lack of oxygen (<19.5%) and/or high concentrations of toxic materials. Consequently, only respirators that provide an independent source of respirable air under positive pressure can be used. If data derived during the background and site characterization phases of field operations indicate that IDLH atmospheres are present or are possible, only a positive-pressure, supplied-air respirator system will be used by employees of the Corporation. Because of the nature of the work and employee work activities required during hazardous material operations, the Corporation has elected to use the MSA Model 401 Positive Pressure Demand Air Mask.

iii. **Atmospheres that Do Not Have IDLH Concentrations.** In atmospheres that contain adequate oxygen (19.5% O_2 or more); contain contaminants that have good warning properties (taste, smell, irritation); and are not considered IDLH because of the presence of toxic contaminants, air-purifying respirators can be used in conjunction with continuous monitoring of the actual work location.

iv. **Atmospheres for Which Insufficient Hazard Identity Information is Available.** If the preliminary site evaluation does not produce sufficient information to identify hazards or suspected hazards of the site or

in the case of an emergency response until the individual in charge of the Incident Command System determines through the use of air monitoring that a decreased level of respiratory protection is appropriate, positive-pressure SCBA will be used.

v. **Atmospheres Containing Radioactive Gases and Particulates.** The need for respiratory protection should be evaluated when airborne radionuclide concentrations exceed 25% of the derived air concentration (DAC) specified in Appendix B to 10 CFR 20.1001-20.2401, Table 1, Column 3. Additional guidance is provided in 10 CFR 20, regarding appropriate methods to control internal radiation exposure in order to comply with appropriate and relevant occupational dose limits. Airborne radionuclide concentrations are determined through air sampling or monitoring. If there are known or suspected radioactive airborne gases or particulates, air samples should be collected and concentrations determined prior to work start-up and periodically thereafter as specified in the site safety plan. Appropriate respiratory protection devices include APRs (with cartridges suitable for removing the radionuclide(s) of interest) and supplied-air equipment. The equipment should be selected to maintain internal exposures in compliance with the occupational dose limits listed in Section VIII of this document and in accordance with guidance concerning other airborne hazards discussed in this section (e.g., oxygen-deficient or IDLH atmospheres, other airborne contaminants).

vi. **Atmospheres Containing Asbestos.** On asbestos projects, the following requirements apply. Employees shall select the appropriate MSHA- and NIOSH-approved respirator that provides adequate protection against the airborne asbestos concentration as follows:

Airborne Asbestos Concentration	Required Respirator
Not in excess of 2 f/cc (50 x PEL)	Full facepiece APR equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 x PEL)	Any powered APR equipped with high-efficiency filters. Any supplied-air respirator operated in continuous flow modes.
Not in excess of 200 f/cc (1,000 x PEL)	Full facepiece supplied-air respirator operated in pressure demand mode.

Half-mask APRs are not allowed during asbestos fiber exposure since facepiece leakage is exhibited. Powered APRs will be provided to all employees that request them.

For work in atmospheres containing airborne lead, cadmium, and/or asbestos fibers, all employees shall have the option to wear powered air-purifying respirators (PAPR) at their request, in lieu of air-purifying respirators (APR), at their request.

APR types include 1/4, 1/2, and full face masks with cartridge or canister. Canister/cartridge filter media are designed to remove particulates, vapors and gases, pesticides, and particulate/gas/vapor and radionuclide combinations. Only NIOSH/MSHA-approved cartridges/canisters will be used. Furthermore, only cartridges/canisters manufactured to be worn with the APR will be used.

NIOSH/MSHA-approved APRs are manufactured in 1/4, 1/2, and full face mask models, each having varying advantages and disadvantages. Advantages and disadvantages are concerned primarily with workplace protection factors, degree of fit, comfort, and the possible need for eye protection. All existing data indicate that, for the maximum protection, a good face-to-respirator fit, and maximum eye protection, the full face mask APR is by far the best. Consequently, this type of APR will be used exclusively by employees of the Corporation.

In the selection of the appropriate APR, OSHA requires that--except in special situations--annual fit-testing procedures be used. Special situations include

work in areas with airborne lead, cadmium, or asbestos fibers. At a minimum, a qualitative fit test must be performed to determine if a proper respirator-to-face seal can be achieved with a negative-pressure respirator. The results of this fit test shall be used to select the specific types, makes, and models of negative-pressure respirators for use by each employee.

OSHA also requires that an emergency escape mask be provided for all employees working in atmospheres where APRs are used if the possibility exists that an increase in the toxic-contaminated atmosphere will exceed use limitations. When using the selected air-purifying cartridge/canisterrespirator, each employee will carry an approved emergency escape mask as required by OSHA. For this purpose, the Corporation has selected the MSA Custom Air V Escape Respirator and the ELSA five-minute emergency escape mask. These units have been designed and will be used only to get the carrier out of a hazardous situation. The hood-type masks facilitate safety and rapid donning and provide continuous airflow. Both units are approved by NIOSH/MSHA.

Therefore, when employees of the Corporation conduct hazardous material operations in areas where the atmosphere encountered contains adequate oxygen, contains contaminants with good warning properties, and is not considered IDLH because of the presence of toxic contaminants, it is the policy of the Corporation that the personnel will use only NIOSH/MSHA-approved air-purifying cartridge/canister respirators.

Because of the wide variety of facial characteristics of the employees working in corporate programs and the wide array of respirator manufacturers, no specific make or model will be issued by the Corporation without a proper fit test of the individual employee. The Corporation requires that each employee who uses an APR undergo qualitative fit testing using an irritant smoke (stannic chloride). Using this test, the employee will be tested for proper fit wearing the selected air-purifying cartridge/canister respirator from MSA. In unusual situations, an alternate supplier such as Scott, Norton, Willson, or Racal may be used. As a further requirement, the Corporation

will allow use of only NIOSH/MSHA-approved full face air-purifying cartridge/canister respirators. This type of mask has been selected because it affords a much better face-to-mask seal for the varying range of facial characteristics than does a 1/2 or 1/4 face mask; provides, if properly fitted, a less likely chance of a leak during the required field activities; generally is more comfortable; is less likely to be dislodged during use; usually can carry cartridges/canisters offering greater protection than those on a 1/2 or 1/4 face mask unit; and provides a higher protection factor (PF) than either a 1/2 or 1/4 face mask.Once the individual has selected a properly fit-tested, approved, full face mask air-purifying cartridge/canister respirator, only NIOSH/MSHA-approved cartridges for the selected make and model will be used. The canister/cartridge types to be used will include particulate filters, vapor- or gas-removing filters, pesticide filters, combination particulate gas vapor and radionuclide filters, and high-efficiency filters.

In atmospheres where the encountered contaminants do not possess good warning properties or for which an approved cartridge/canister is not available, it is the policy of the Corporation that only positive-pressure demand supplied air be used.

4. **Respirator Fit Test (Qualitative)**

For employees who enter and work in an atmosphere that is known to contain adequate oxygen (19.5% O_2 or more), that is known to contain contaminants with good warning properties, and that is not considered IDLH because of the presence of toxic contaminants, the Corporation is committed to providing NIOSH/MSHA-approved air-purifying cartridge/canister respirators with full face masks. The Corporation has identified several manufacturers (Willson, Norton, MSA, Scott, Racal) who produce such respirators suitable for program use. Each company manufactures one or more full face mask air-purifying cartridge/canister respirator. Each make and model has a slightly different fit. Although each manufacturer designs its facepieces to fit as broad a cross section of the working population as possible, no respirator marketed will fit everyone. Conditions that affect a good facepiece fit include growth

of beard, sideburns, a skull cap that projects under the facepiece, temple pieces on glasses, facial scars, facial injuries, and presence or absence of dentures. Therefore, the Corporation has selected several manufacturers so that each employee can take advantage of the different fitting characteristics of each to find a respirator that fits properly. The availability of selection from various manufacturers also allows the wearer to choose a respirator that is reasonably comfortable while providing good protection. It is in the process of matching the respirator to the individual user that a fit-testing procedure is required. Fit testing is required by OSHA regulations (29 CFR Part 1910.134), which state that each person who wears a respirator shall have it properly fitted, test its facepiece-to-face seal, and wear it in a test atmosphere. Therefore, each corporate respirator user will undergo a fit test to determine the wearer's ability to obtain a satisfactory fit with a negative-pressure respirator. The fit test will be used to select the specific type, make, and model of negative-pressure respirator to be used by the wearer.

The following policies also will be adhered to in the fitting and use of respirators:

a. Fit testing for positive-pressure supplied-air respirators presently is not required, as described in OSHA 29 CFR 1910.134.

b. Respirators of any type (air-purifying or positive-pressure demand supplied air) will not be used by employees of the Corporation if a good facepiece-to-face seal cannot be achieved. This means that no facial hair or glasses can be worn that will interfere with the attainment of a good seal. Beards are not allowed.

c. Persons requiring eyeglasses shall be provided with specially mounted inserts inside the full face mask of the air-purifying or SCBA respirators. Under no circumstances will contact lenses be worn while using full face mask respirators.

d. If it is found that, because of facial or medical characteristics, an employee cannot obtain a good facepiece-to-face seal either with the APR or positive-pressure supplied air, that employee will not use that equipment or enter an atmosphere that requires the potential use of that equipment.

e. An employee shall be allowed to use only the specific make(s) and model(s) of full face APRs for which the employee has obtained a satisfactory fit as a result of the qualitative fit-testing procedures. Under no circumstances shall an employee be allowed to use any respirator for which the employee previously has not been tested or for which the results of the fit test indicate that a satisfactory fit has not been obtained.

In fulfilling its commitment to comply with the fit-testing requirement, the Corporation will institute qualitative fit-testing procedures for employee selection of APRs. The Corporation has selected a qualitative rather than a quantitative fit-testing program because the following two-stage, cross-checking, qualitative procedure will afford the necessary QA that the user of an air-purifying cartridge/canister respirator is properly fitted and has an effective facepiece-to-face seal, thus providing the required protection in a hazardous atmosphere.

Stage 1 of the Corporation's qualitative fit-test procedure involves a simple respirator negative- and positive-pressure sealing check for facepiece fit. Stage 2 involves the exposure of the respirator wearer to a test atmosphere and includes two separate atmosphere tests to double-check the adequacy of the fit of the respirator for the wearer.

During any fit test, the respirator headstraps must be as comfortable as possible. Overtightening of the straps sometimes will reduce or increase facepiece leakage, but the wearer may not be able to tolerate the mask for long.

a. Stage 1: Pressure Sealing Checks on APRs

i. **Negative-Pressure Sealing Check.** The wearer can perform this test in the field or office after donning the APR. The test is performed by closing off the inlet opening of the respirator cartridge(s)/canister(s) by covering with the palm of the hand(s) to prevent the passage of air through the cartridge/canister, inhaling gently, and holding the seal for at least 10 seconds. If the facepiece collapses slightly and no inward leakage of air into the facepiece is detected, the wearer can reasonably assume that the fit of the respirator is satisfactory.This test is used only as a gross determination of fit when the respirator is to be used in relatively toxic atmospheres. Nonetheless, this test shall be used each time and just prior to entering any potentially toxic atmosphere.

ii. **Positive-Pressure Sealing Check.** This test is preferred after donning the APR that contains an exhalation and inhalation valve. The test is conducted by closing off the exhalation valve and exhaling gently. The fit of a respirator equipped with a facepiece is considered to be satisfactory if a slight positive pressure can be built up inside the facepiece for at least 10 seconds without detection of any outward leakage of air between the sealing surface of the facepiece and the respirator wearer's face.

This test also is to be used only as a gross determination of fit when the respirator is to be used in relatively toxic atmospheres. This test shall be used just prior to entering any toxic atmosphere.

Both positive- and negative-pressure sealing checks can be used on the MSA Model 401 Positive Pressure Demand Air Mask to determine the gross fit characteristics.

b. Stage 2: Exposure of Respirator Wearer to a Test Atmosphere

A person wearing an APR will be exposed to stannic chloride, an irritant smoke. The APR will be equipped with an air-purifying cartridge/canister that effectively removes the test agent from respired air. If the respirator wearer is unable to detect penetration of the test agent into the respirator, the respirator wearer has achieved a satisfactory fit.

This test involves exposing the respirator wearer to an irritating smoke produced by commercially available smoke tubes. These are sealed glass tubes, approximately 12 cm long by 1 cm in diameter, filled with pumice impregnated with stannic chloride. When the tube ends are broken and air is passed through the tube, the material inside reacts with the moisture in the air to produce a dense, highly irritating smoke.

As a qualitative means of determining respirator fit, this test has a distinct advantage because the wearer usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of the wearer's giving a false indication of proper fit thus is reduced. Because the smoke is very irritating, it also can cause problems for the test applicators or other persons in the same room. Therefore, it is advisable that the room where the testing is to be conducted have good ventilation and that the test administrator wear respiratory protection as well.

The irritant smoke test may be conducted by using a large plastic bag as a test hood. The bag may be hung from the ceiling over a coat hanger suspended by twine. A small hole will be made in the top portion of the bag so that the irritant smoke can be dispensed into the bag once the test subject has entered the bag.

The APR to be used in this test must be equipped with a high-efficiency filter.

The irritant smoke fit test will be performed as follows:

i. The wearer puts on the respirator normally, taking care not to tighten the headstraps uncomfortably. Once the respirator is on, the subject enters the suspended bag so that the head and shoulders are well inside the bag hood.

ii. Once the subject is inside the bag, the tester begins to add the irritant smoke in small quantities, pausing between puffs from the applicator and listening for a reaction.

iii. If the wearer detects no leakage, the tester increases the smoke density, still remaining alert to the wearer's reactions.

iv. At this point, if no leakage has been detected, the wearer cautiously begins head movements, exercises, and reading a special paragraph as prescribed by OSHA. The tester should remain especially alert and be prepared to stop producing smoke immediately and remove the subject from the bag.

v. If leakage is detected at any time, the tester should stop the smoke and let the wearer out of the bag to readjust the facepiece or head-strap tension. The tester then should start the test at the second step.

vi. If, after all of the movements and exercises, the wearer is unable to detect penetration of the irritant smoke into the respirator, the respirator wearer has a satisfactory fit and the subject is removed from the test atmosphere.

5. **Detailed Instructions for Training Employees in the Proper Use and Limitations of Respirators**

Based on its thorough understanding of 29 CFR Part 1910.134, 30 CFR Parts II, 14, 14a, and ANSI Z88.2 (1980), the Corporation has selected the appropriate respiratory equipment for use in various hazardous atmospheres

that might be encountered during an employee's response to incidents involving hazardous materials. The equipment selection factor and the proper use of this equipment are equally important to the success of the respiratory protection program. Proper use can only be ensured by carefully training all employees in the selection, use, and maintenance of the provided respiratory equipment. This requirement can only be satisfied by the establishment and implementation of a training program.

The Corporation's respiratory protection training requirements are designed to be very thorough and complete because of the possibility that employees may enter highly toxic atmospheres in the course of their field activities. Corporate training procedures are divided into three phases: initial respiratory protection training, annual refresher training, and special field-oriented training.

The elements of the training program will be consistent throughout for each corporate employee who will be using the respiratory equipment specified in the corporate respiratory protection program. However, there is a further variation from these minimum required elements that will apply to individuals who have been designated as office safety coordinators. For these personnel, an additional degree of training is necessary because of the increased responsibilities of respirator selection, inspection, fit testing, record keeping, maintenance, and storage for which the safety coordinator ultimately is accountable.

a. Initial Respiratory Protection Training

Upon entry into the program, each employee will receive training from a qualified instructor to ensure the proper and safe use of the respiratory equipment. The initial training course will provide intensive and in-depth instruction during the basic training program. The course will include:

i. An explanation of respiratory protection needed (i.e., effective engineering controls are not feasible).

ii. An explanation of the nature, extent, and effects of the various respiratory hazards that employees may encounter (i.e., oxygen deficiency, gas and vapor contaminants, particulate contaminants, or a combination thereof, and whether or not the resulting atmosphere is IDLH).

iii. An explanation of why and how a particular type of respirator is chosen for protection against a specific respiratory hazard.

iv. An explanation of the pertinent regulations concerning respirator use (i.e., 29 CFR 1910.134, 29 CFR 1910.120, 30 CFR Part II, 10 CFR 20 Subpart H, and ANSI Z88.2)

v. An explanation of the use, limitations, and capabilities of each respirator type that has been selected for use.

vi. Thorough instruction in respirator donning, checking for fit, and wearing.

vii. Thorough instruction and exercise in how each respirator should be dismantled, cleaned, inspected, reassembled, and stored.

viii. A thorough discussion of how to recognize and handle an emergency situation (i.e., regulator malfunction).

ix. Instruction in any special use or application of a particular respirator, as needed.

x. A thorough explanation of the Corporation's respiratory protection program.

xi. An opportunity for each user to handle the respective respirators; learn how to put them on and wear them properly; check the seals; and wear them in a safe atmosphere over a long familiarization period of at least two hours, or until the instructor and the user are confident

that the user knows the apparatus well enough to use it safely and wear the apparatus in a test atmosphere.

xii. Instruction and an opportunity to be qualitatively fit-tested in the respective respirator to be issued to and used by the individual wearer.

xiii. Instruction in rescue techniques.

xiv. Instruction in the corporate SOPs.

b. Annual Refresher Training Sessions

It is the policy of the Corporation that employees who will use the provided respiratory equipment shall receive annual respiratory training refresher sessions. These sessions will be directed by the safety coordinators. The sessions will provide employees with constant reinforcement and updating of the material presented in the initial respiratory protection training course. It also is the responsibility of each employee to participate in exercises that will resemble work activities similar to those encountered during an environmental emergency response or field investigation.

The office safety coordinator will receive assistance and guidance from the CHSD for annual training session development. All training sessions will involve a coordinated effort to provide the best possible training in state-of-the-art, real-world respiratory protection to be used during hazardous material operations.

c. Special Safety Coordinator Training

Training over and above that given to the respirator user is necessary and therefore mandatory for all company-designated safety coordinators. This additional training must ensure that the safety coordinator has received:

i. In-depth instruction in respirator selection criteria for any anticipated or unanticipated respiratory hazard event (this should include proper cartridge and/or canister selection and hazard evaluation techniques).

ii. An in-depth review of the applicable rules regulating respirator use.

iii. In-depth training in calculating respiratory canister/cartridge use time for specific hazardous atmospheres.

iv. A thorough discussion of the applicability and use of Threshold Limit Values and/or permissible exposure limits to include calculating techniques for mixtures, short-term exposure limits, and ceiling values.

v. The training of respirator wearers.

vi. Instruction in the necessary record-keeping requirements (i.e., date of issuance, inspection dates, repair dates, exercise dates, retaining dates, etc.).

vii. Training in respirator inspection techniques.

viii. Instruction in basic respiratory protection practices.

ix. Instruction in issuance criteria for respirators.

x. Training in respiratory hazard monitoring criteria and techniques.

xi. Instruction in the procedures and techniques to be used in administering qualitative fit tests to users.

xii. A thorough understanding of the structure and operation of the corporate respiratory protection program.

While, on the surface, these training requirements appear to be extensive and time-consuming, the general respirator training can be accomplished in two days or less. However, it must be emphasized that, regardless of the amount of time spent on training, if the respirator user is not sufficiently motivated to accept the fact that respiratory protection is needed and that the issued respirators must be properly maintained and worn, the training is of no value. Therefore, it is mandatory that the safety officer be especially cognizant of any changes in user attitude at all times, both within the office and in the field.

6. Issuance of Respirators

The Corporation believes in the practice of assigning to each employee his or her own complement of respiratory equipment. This is necessary for public hygiene and proper fit applicability. It also facilitates maintenance and care requirements because, when an employee is assigned his or her own respirator that the employee must depend on in a toxic/hazardous situation, the needs for equipment care, maintenance, and readiness are more easily stressed. The Corporation will assign a full face mask air-purifying cartridge respirator (after proper fit testing) to each employee.

The MSA SCBA units will not be assigned to individual employees because it is unlikely that all employees will be required to wear these units at one time. Instead, units will be assigned to appropriate offices under the specific care of the office equipment coordinator and, secondarily, under the care and of the employees who use them.

An array of approved particulate, gas and vapor, combination, and high-efficiency cartridges/canisters will be provided to each office. These also will be under the care of the office equipment coordinator. Cartridges/canisters will be provided to fit all makes and models of APRs that are being used by employees in the office.

It is the policy of the Corporation that all respiratory protection equipment assigned to an employee shall be permanently marked as that individual's equipment. For this purpose, tape with the user's name written on it shall be affixed to the equipment. The marking on the equipment shall in no way interfere with the equipment's performance.

Records of all equipment issued will be maintained in the offices. These records will include the date of initial issuance, the dates of reissue, and a listing of all repairs.

7. **Respirator Maintenance, Inspection, Cleaning, and Storage Procedures**

An integral part of the Corporation's respiratory protection program is the provision of a conscientiously applied maintenance program with regard to all respiratory equipment used by company personnel. It is the responsibility of each designated employee to ensure that each piece of respiratory apparatus that the employee is to use is inspected for defects before each use; cleaned and sanitized after use; repaired, when necessary, by a qualified individual; and properly stored to retain its original shape and effectiveness.

a. Cleaning and Sanitization

Each respirator will be cleaned and sanitized after each use. This will be done by the person to whom the respirator has been issued, only after the employee has received thorough training in the proper procedure.

The cleaning and sanitizing of the units will be accomplished as follows:

i. Break down the apparatus to its components as described in the manufacturer's schematic display that accompanies the unit when purchased. (This step also provides the opportunity to thoroughly inspect each component for any defects, excessive wear and tear, etc.). Destroy and discard any previously used canisters/cartridges.

ii. Thoroughly wash, rinse, and dry the facepiece and mask components in a cleaning and sanitizing solution such as MSA Cleaner-Sanitizer, which has been prepared according to the manufacturer's directions.

b. Inspection for Defects

Inspection of the respirator probably is the most important component of the respiratory maintenance program. By conscientiously inspecting the unit, the user will identify damaged or malfunctioning components before they are used in a hazardous atmosphere. The policy of the Corporation is that all respiratory equipment will be thoroughly inspected before the apparatus is used and during the cleaning process. Furthermore, it is the responsibility of the office equipment coordinator to maintain respiratory apparatus in ready status and to keep a maintenance and inspection log, noting the date, findings, and any required repairs.

The Corporation has developed an inspection report form (see Attachment VI-A at the end of Tab VI) to serve this purpose. The equipment coordinator must note the model type, the user of the apparatus, the inspection date, defects, repair requirements, the name of the individual who repaired the unit, and when the unit was repaired. Detailed inspection procedures are outlined in Attachment VI-B at the end of Tab V. These procedures are implemented prior to the equipment's use and during cleaning, and are based on the type of apparatus (i.e., SCBA or air-purifying).

The inspection of respirators will include thorough checks for tightness of all connections; the condition of the respiratory inlet and outlet coverings, head harness and assembly, valves, and connecting tubes; the end-of-service life indicators and shelf-life dates on all filters, canisters, and cartridges; and the regulators, alarms, and other warning systems. All rubber and elastomeric parts will be checked for pliability, proper sealing, and any sign of deterioration. Each composite air cylinder will be checked

to ensure its integrity and readiness for use. Each composite air cylinder will be hydrostatically tested every three years.

c. **Maintenance and Repair**

The policy of the Corporation is that all replacement of parts and the repair of all respiratory apparatus be performed only by persons properly trained and certified in respirator assembly and defect correction techniques. Reducing or admission valves and regulators will be returned to the manufacturer or to a trained and certified technician for repair/adjustment.

SUBSTITUTION OF ANY PART OF THE RESPIRATOR ASSEMBLY BY ANY OTHER BRAND OR TYPE OF RESPIRATOR PART IS STRICTLY FORBIDDEN. SUCH ACTION WILL INVALIDATE THE APPROVAL OF THE DEVICE AND COULD SIGNIFICANTLY COMPROMISE THE HEALTH OR LIFE OF THE USER.

It is the responsibility of each designated office safety coordinator to maintain an up-to-date record of all repairs, adjustments, and replacements of parts, including notation of the date, apparatus make and model, part number, and technician's name.

d. **Storage of Equipment**

All respiratory equipment will be stored in a manner that will protect it against dust, sunlight, excessive heat, extreme cold, excessive moisture, damaging chemicals, and mechanical damage. APRs will be stored by each user with the individual's field gear. Each respirator should be stored in a plastic bag and clearly labeled to identify the individual to whom it has been issued. As OSHA requirements suggest, respirators should be stored in the cartons in which they came, although other suitable means are acceptable when damage can still be prevented during shipment.

8. Procedures for Evaluating Respiratory Protection Program Effectiveness

The policy of the Corporation, in compliance with 29 CFR 1910.134 and ANSI Z88.2, is to regularly inspect and evaluate the effectiveness of the Corporation's respiratory protection program, in order to ensure that all persons involved are being provided with the best respiratory protection possible. As further assurance of this degree of protection, respiratory equipment users will be monitored periodically as part of the QA audit program. The respiratory protection program will be evaluated periodically by the HSAC and CHSD and reported upon in the minutes of their meeting.

The CHSD and the office safety coordinators will perform frequent spot inspections of respirator use to ensure that the proper types of respirators are being selected for the job, that individuals who are required to wear respirators have received proper training, that respirators are inspected and maintained properly, that respirator storage is satisfactory, that respiratory hazards are monitored, that the respirators being used are in good operating condition, and that medical and biochemical surveillance of respirator users is being carried out. Furthermore, it is the responsibility of the CHSD and the office safety coordinators to consult periodically with the respirator users about their acceptance of the respirators as it relates to comfort, interference with vision and communication, restriction of movement, resistance to breathing, interference with job performance, and general confidence in the respirators' effectiveness for protection. This information will be duly documented and analyzed to ensure the respirator users' continued ability to wear the respirators issued.

Data obtained from the periodic inspections of respirator use, medical surveillance, and the wearers' comments will be reviewed and analyzed to evaluate the continued effectiveness of the respiratory protection program. Any evidence of excessive exposure to a hazardous atmosphere will be followed up, a determination as to why improper protection was used will be made, and appropriate action will be taken to remedy the problem.

VN3900_P0033

FINAL

PROJECT MANAGEMENT PLAN FOR COMPLETION OF A SITE INVESTIGATION AT LANDFILL AREAS 1 AND 2, FORMER RAMEY AIR FORCE BASE, AGUADILLA, PUERTO RICO

Contract No. DACA21-93-D-0034
Delivery Order No. 0021

February 1997

Prepared for:

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1. INTRODUCTION

The purpose of this Project Management Plan (PMP) is to document the planned overall approach by Ecology and Environment, Inc., (E & E) to complete a Site Investigation of Landfill Areas 1 and 2 at the former Ramey Air Force Base (AFB), Aguadilla, Puerto Rico. This work is being conducted under Contract No. DACA21-93-D-0034, for the United States Army Corps of Engineers (USACE), South Atlantic Division, Savannah District. The objective of the project is to identify the presence or absence of soil and/or groundwater contamination and to determine the extent of contamination from Department of Defense (DOD) sources at the two former landfill areas.

All work will be performed in accordance with all applicable federal, commonwealth, and local regulations and guidelines. These include: USACE regulations and guidelines provided in ER 1110-1-263, EM 1110-1-4000, and Appendix B of ER 385-1-92, and the Commonwealth of Puerto Rico regulations and guidelines pursuant to Public Policy Environmental Act (Law No. 9 and 87).

The Project Management Plan includes a description of E & E's management approach to the project, as well as qualifications of the personnel who will be directing and performing this work. The technical approach for the work performed at the site is detailed in the site-specific work plan.

Section 2 of the Project Management Plan identifies the sites to be investigated on the former Ramey AFB property. Section 3 presents an overall program schedule and discusses progress reports. Section 4 presents and discusses E & E's overall corporate organizational

structure as well as the organizational structure that E & E has developed for management of the former Ramey AFB project. Section 5 discusses E & E's general approach to project management and details how this general approach will be implemented in managing the former Ramey AFB site investigation.

2. SITE BACKGROUND AND SETTING

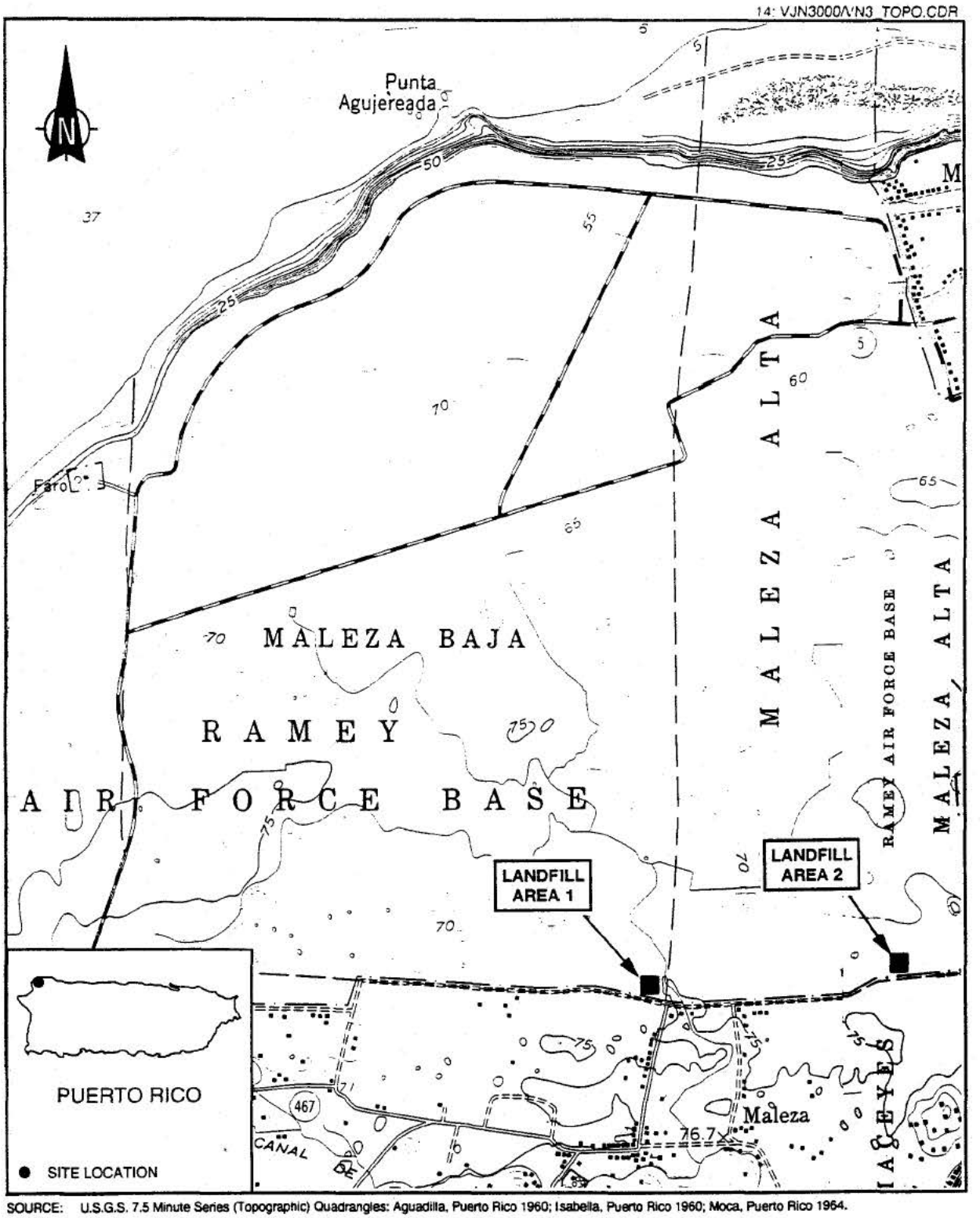
2.1 DESCRIPTION

2.1.1 Former Ramey Air Force Base

The former Ramey Air Force Base occupied approximately 4,357 acres north of the city of Aguadilla, on the extreme northwestern tip of the island of Puerto Rico (see Figure 2-1). The U.S. government acquired the property between 1939 and 1963 and utilized the site as a fully operational Air Force base until its deactivation in 1973 (see Figure 2-2). On March 1, 1974, ownership of most of the property was transferred to the Puerto Rican Industrial Development Company. Since March 1974, numerous land parcel transfers have occurred between U.S. government agencies, the U.S. government and private companies, and the U.S. government and local government agencies. This area is now operated by the Puerto Rican Port Authority as a municipal airport and industrial park, except for approximately 125 acres that are still utilized by the U.S. government as a U.S. Coast Guard installation (USACE 1992).

2.1.2 Landfill Area 1

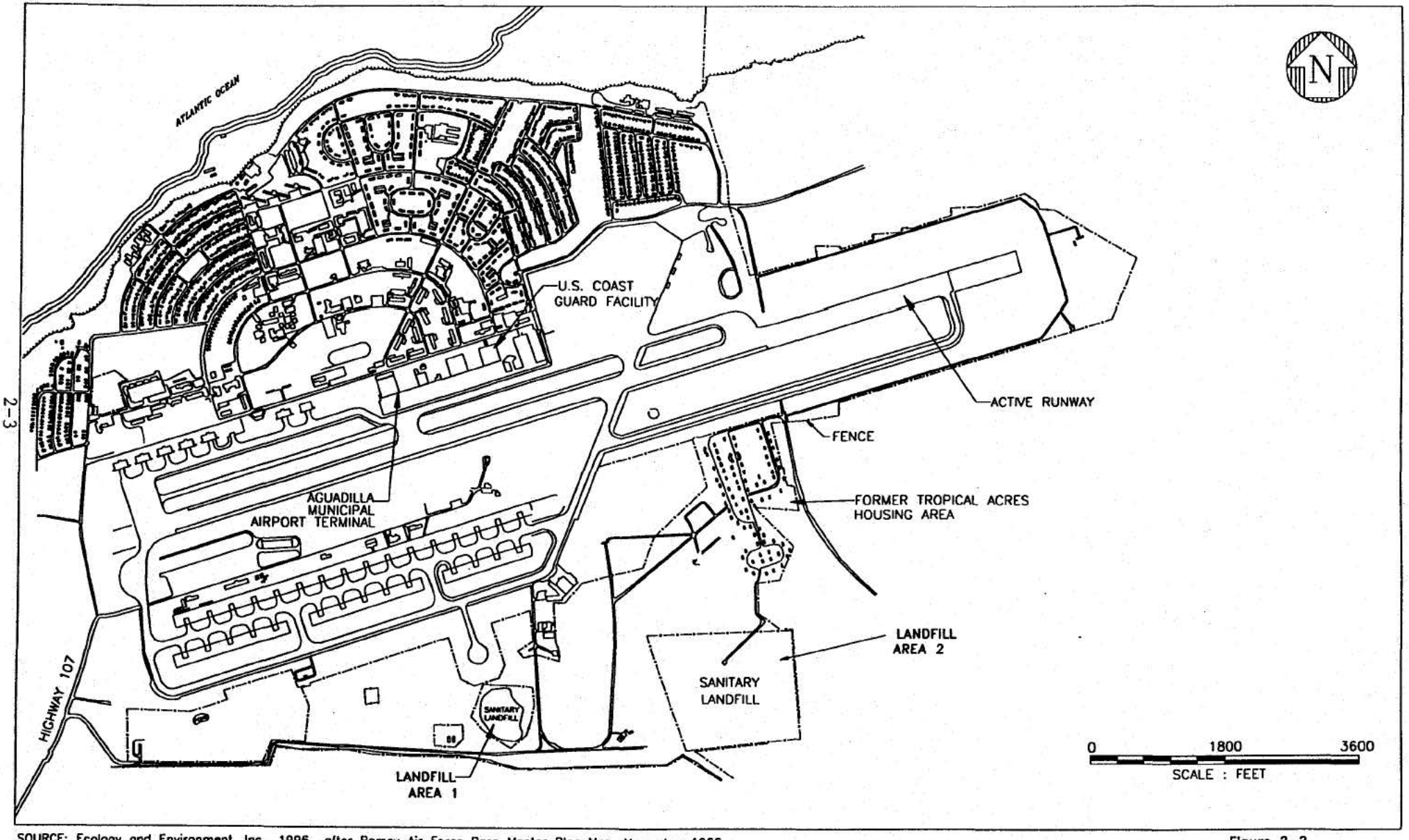
Landfill Area 1 is located adjacent to, and south of, the airfield runway (see Figure 2-3). Area 1 is approximately 18 acres in area (USACE, 1996). Site features include a large (approximately five acres) sinkhole up to 25 feet deep, a fossilized coral reef forming a 30-foot high, 3-acre hill, and a broad, fenced area of heavy undergrowth, high grass, and trees. The hill is situated in the northern portion of the site. The site generally slopes at approximately 5° to the west, toward the sinkhole. Surface drainage of the site is into the sinkhole. Topographic relief at the site is approximately 100 feet. The site is reportedly used to graze cattle. Evidence that the site was used as a landfill includes abundant construction



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Aguadilla, Puerto Rico 1960; Isabella, Puerto Rico 1960; Moca, Puerto Rico 1964.

Figure 2-1 LOCATION MAP – LANDFILL AREAS 1 AND 2 AT THE FORMER RAMEY AIR FORCE BASE, AGUADILLA, PUERTO RICO

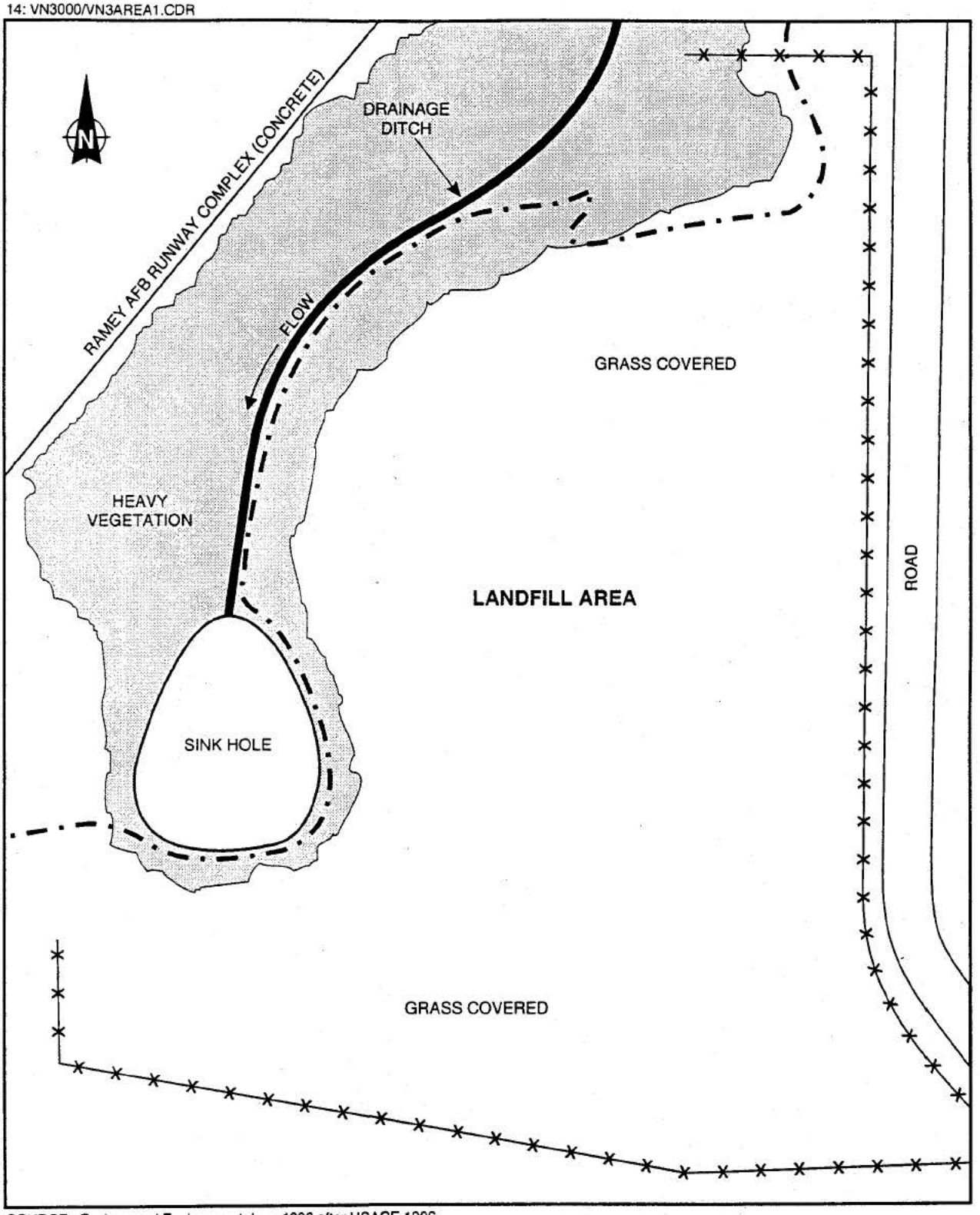
VN3S0038.DWG



SOURCE: Ecology and Environment, Inc., 1996., after Ramey Air Force Base Master Plan Map, November 1966.

Figure 2–2
HISTORICAL SITE VICINITY MAP
LANDFILL AREAS 1 and 2
AT THE FORMER
RAMEY AIR FORCE BASE
AGUADILLA, PUERTO RICO

14: VN3000/VN3AREA1.CDR



SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE
0 200 400 Feet

KEY:
Fence
Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)
Tree Line

Figure 2-3 SITE PLAN MAP – LANDFILL AREA 1
FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

debris observed at and near the ground surface, and construction debris and scrap metal observed inside the sinkhole. Various medical wastes have also been observed inside the sinkhole, including intravenous bags and tubing, and syringes. Medical wastes appeared to have come from broken fabric bags buried with other debris. The southern end of the bottom of the sinkhole is covered by soil and undergrowth. In the northern end of the sinkhole exposed heavily weathered limestone was observed, and a potential karst limestone pipe, which likely drains the sinkhole, was observed. This feature was choked with large pieces of metal debris, limestone boulders, and logs. The sinkhole reportedly receives stormwater runoff from the runway via a drainage ditch. Evidence of storm water flow was observed, and debris caught in tree branches indicated the water level inside the sinkhole has exceeded eight feet in the past. USACE also reported standing water in the sinkhole during a December 1995 site visit (E & E 1996e).

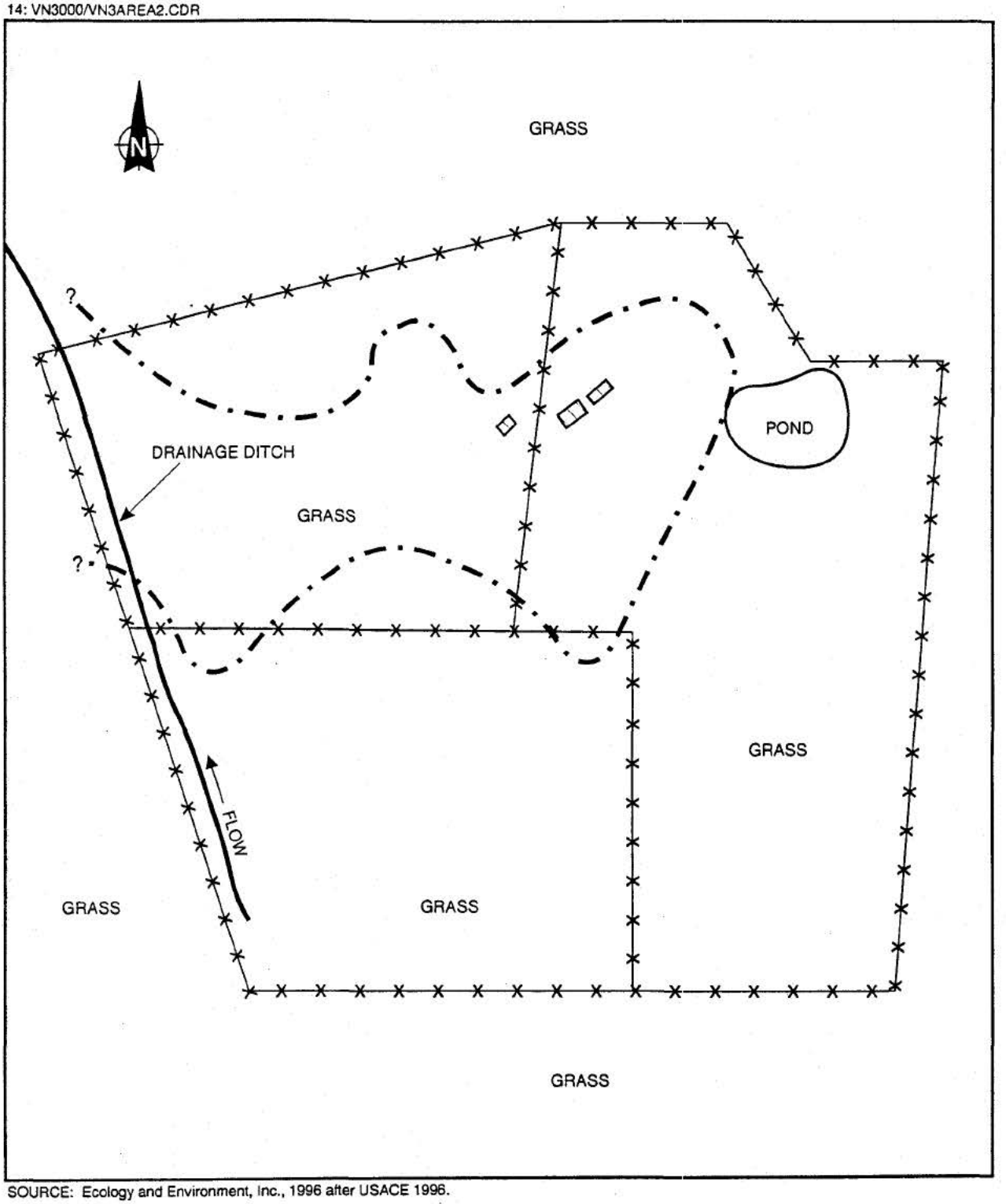
USACE conducted a geophysical survey of Landfill Area 1 in February 1996, which identified subsurface anomalies which are expected to indicate areas where landfill material is buried. The survey results indicate subsurface anomalies extend beyond the extent of the USACE survey (See Appendix A of the work plan). This suggests the extent of the landfill boundaries is still unknown (USACE 1996a; USACE 1996b).

USACE accompanied E & E on a site visit April 16, 1996. Observations of site conditions are included in the above site description. E & E also conducted a file review in Puerto Rico, and a document search summary is included in Appendix B of the work plan (E & E 1996g).

2.1.3 Landfill Area 2

Landfill Area 2 is located south of the former "Tropical Acres" housing area. The site is approximately 65 acres in area, and is currently used to graze cattle (USACE 1996; E & E 1996). The site is generally flat-lying, grass-covered, and sectioned with barb-wire fencing. Site features include several concrete building foundations, a newly constructed watering pond for cattle, and a shallow drainage ditch running along the northwestern margin of the site (see Figure 2-4). Evidence that the site was used as a landfill includes garbage and debris observed along the eroded sides of the drainage ditch. It is reported that the landfill received municipal, household garbage from the former, adjacent housing development. Several building foundations were observed at the site. These foundations were overgrown,

14: VN3000/VN3AREA2.CDR



SOURCE: Ecology and Environment, Inc., 1996 after USACE 1996.

SCALE
0 400 800 Feet

KEY:
Fence
Building Foundations
Approximate Landfill Boundary (as determined by the March 1996 USACE Geophysical Survey)

NOTE: Approximate boundary of landfill has not been delineated to the Northwest.

Figure 2-4 SITE PLAN MAP – LANDFILL AREA 2 FORMER RAMEY AFB, AGUADILLA, PUERTO RICO

and appeared to be of an age and design consistent with former DOD activity at the former Ramey Air Force Base (USACE 1996, E & E 1996).

USACE conducted a geophysical survey of Landfill Area 2 in February 1996, which identified subsurface anomalies which are expected to indicate areas where landfill material is buried. The survey results indicate subsurface anomalies extend beyond the extent of the USACE survey (see Appendix A of the work plan). This suggests the extent of the landfill boundaries is still unknown (USACE 1996a; USACE 1996b).

USACE accompanied E & E on a site visit April 16, 1996. Observations of site conditions are included in the above site description. E & E also conducted a file review in Puerto Rico, and a document search summary is included in Appendix B of the work plan (E & E 1996e).

2.2 REGIONAL GEOLOGY/HYDROGEOLOGY

2.2.1 Hydrogeology

Landfill Areas 1 and 2 occur within the Northern Coastal physiographic region of the island of Puerto Rico. The Northern Coast slopes gently from the foothills, which mark the Cordillera Central Mountain region, to the Atlantic Ocean. Surficial deposits consist of sand, silt and limestone clays, overlying a dissected paleo surface, the remnants of which stand above the lowlands as isolated *mogotes*, or limestone hills (Rodriquez - Martinez 1995; Tucci/Martinez 1995).

The sites and vicinity are underlain by Quaternary-age sand deposits. These deposits are characterized as unstratified, fine- to medium-grained quartz sand, and light- to moderate-brown clays. These unconsolidated materials are between 0 and 100 feet thick (USGS, 1969).

The surficial deposits are underlain by the Micocene-age Aymamon Limestone, which outcrops at Landfill Area 1. The Aymamon is typified by tropical karstic topography, including sinkholes and mogotes, both of which occur at Landfill Area 1. Dissolutioning of the Aymamon is generally very active in the intermogotal areas in the vicinity of the site. The Aymamon is characterized as a very dense, conchoidally fracturing limestone of white, light gray, buff and rose colors. The formation is estimated to be up to 1,000 feet thick beneath the site (Rodriquez-Martinez 1995; Tucci/Martizez 1995).

The Miocene-age Aquada Limestone underlies the Aymamon Limestone. The Aquada is characterized as a hard, thick-bedded to massive calcarenite and dense limestone

interbedded with chalky limestone and marl, commonly containing some quartz grains. The formation is estimated to be up to 1,000 feet thick beneath the site (Rodriquez-Martinez 1995).

2.2.2 Aquifer Description

Most groundwater in the site vicinity occurs within the water-table aquifer that extends throughout the North Coast Province. An underlying artesian aquifer, which is an important source of water in North-Central Puerto Rico, becomes fragmented and unproductive in the site vicinity (Tucci/Martinez 1995).

The water-table aquifer extends from the water-table surface to the top of the freshwater/saline-water interface. This is not a sharp interface, but rather a gradational zone 75 to 115 feet thick. The water-table aquifer is composed of the Aymamon and Aquada limestones, although some alluvial deposits are present in the uppermost portion of the aquifer in some coastal areas. The Aymamon is the most important part of the aquifer beneath the site because the Aquada lies below the freshwater/saline-water interface (Tucci/Martinez 1995).

2.2.3 Aquifer Characteristics

Estimated hydraulic conductivities within the Aymamon Limestone range from 57 to 570 feet per day and diminishes with depth. This diminishing is likely related to the maximum effective depth to which karstification will occur within the aquifer. Estimates of transmissivity in the site vicinity are sparse because no rigorous aquifer tests have been conducted in the area. Continuous streamflow and groundwater-level data were not obtained until 1985. Available transmissivity estimates for the freshwater zone of the water table aquifer range from 200 to more than 280,000 square feet per day. Transmissivity values this high probably reflect cavernous porosity and enhanced dissolutioning along bedding planes, joints, and fractures. The Aymamon in the site vicinity is also mostly a grainstone-packstone and coral boundstone with as much as 25 percent total porosity (Rodriquez-Martinez 1995; Tucci/Martinez 1995).

Groundwater is expected to be encountered from 100 to 150 feet below ground surface (BGS). The flow direction in the water table aquifer would be expected to be generally to the northwest, toward the Atlantic Ocean coastline.

2.2.4 Aquifer Use

The Puerto Rico Aqueduct and Sewer Authority (PRASA) reports that domestic water supply in the vicinity of the site is obtained from several surface water reservoirs located between 5 and 10 miles south and southeast, and upgradient of the site. All of the former Ramey Air Force Base is supplied by PRASA, and no indication of private supply wells for domestic use could be found during the site visit and file review (PRASA 1983; E & E 1996g).

3. SCHEDULES, PROGRESS REPORTS, AND SUBMITTALS

3.1 PROGRESS REPORTS

A site-specific schedule (progress chart) for the former Ramey AFB site is included in Figure 3-1. The progress chart has been prepared and will be maintained using project scheduling software. The progress chart will be updated to reflect modifications and other approved changes in scheduling and will be submitted in a reproducible form for approval by the USACE Project Manager by the tenth day of each month.

In addition to an updated progress chart, E & E will submit a monthly status report and an updated Project Executive Summary sheet to the Savannah District Project Manager by the tenth day of each month. The status report will be submitted in letter format and will outline the progress during the past month and the projected work effort for the next month.

3.2 SUBMITTALS

E & E will submit all documents listed in Figure 3-1 to the addresses shown in Table 3-1. All other documents will be submitted to the USACE Savannah District only. All submittals for review will contain a cover letter stating the project title and contract number, E & E and USACE points of contact telephone numbers, and the dates by which the comments are to be received by the USACE. Submittals to regulatory reviewers will be shipped by registered mail or other method, as long as a signed receipt indicating appropriate delivery can be obtained. Transmittal letters shall be addressed to David Roulo (CESAS-PM-H). All major submittals (i.e., draft, prefinal, and final) will be signed and certified by the program manager and a registered Professional Geologist. All Site Safety and Health Plans (SSHPs) will be certified by a Certified Industrial Hygienist (CIH).

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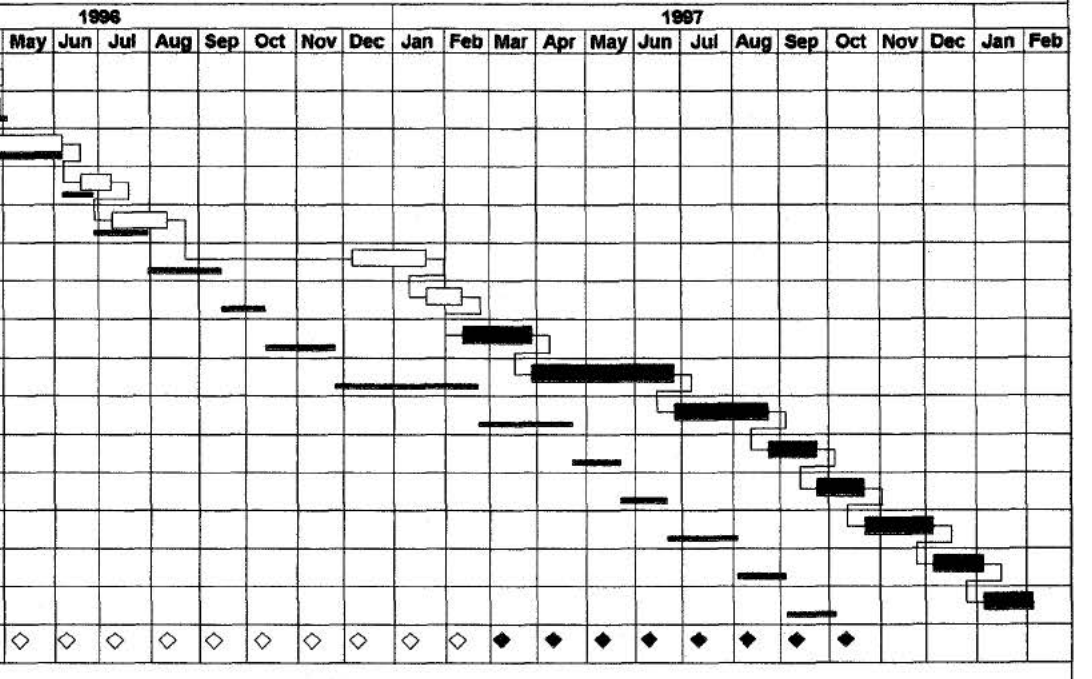
Figure 3-1: Project Schedule - Site Investigation at Landfill Areas 1 and 2
Former Ramey Air Force Base, Aguadilla, Puerto Rico

Current Date: 02/07/97

#	Task Name	Sched Start	Sched Fin
1	Notice to Proceed	04/22/96	04/22/96
2	Gantt Chart (E & E)	04/22/96	04/29/96
3	Draft SI Workplan (E & E)	04/22/96	06/06/96
4	Draft Workplan Review (USACE)	06/19/96	07/08/96
5	Prefinal SI Workplan (E & E)	07/09/96	08/12/96
6	Prefinal Workplan Review (USACE/EQB)	12/06/96	01/21/97
7	Final SI Workplan (E & E)	01/22/97	02/12/97
8	Workplan Approval (USACE/EQB)	02/13/97	03/27/97
9	Conduct Field Work (E&E)	03/28/97	06/25/97
10	Draft SI Report (E&E)	06/26/97	08/22/97
11	Draft Report Review (USACE)	08/25/97	09/23/97
12	Prefinal SI Report (E & E)	09/24/97	10/22/97
13	Prefinal Report Review (USACE/EQB)	10/23/97	12/04/97
14	Final SI Report (E & E)	12/05/97	01/05/98
15	Report Approval	01/06/98	02/04/98
16	Monthly Progress Reports	05/10/96	10/10/97



Critical
Critical Milestone
Free Float
Delay
Noncritical
Noncritical Milestone
Total Float (+)
Effort %Complete
Complete
Complete Milestone
Total Float (-)
Summary
Summary Milestone
Baseline
External
External Milestone
Non-Resource

Key:

USACE U.S. Army Corps of Engineers
EQB Puerto Rico Environmental Quality Board
E & E Ecology and Environment, Inc.
SI Site Investigation

Baseline denotes original schedule

Table 3-1

DOCUMENT SUBMITTAL ADDRESSES FOR THE SITE INVESTIGATION OF LANDFILLS 1 AND 2 AT FORMER RAMEY AIR FORCE BASE AGUADILLA, PUERTO RICO

Addressee and Mailing Address	Copies of Work Plan/Report		
	Draft	Prefinal	Final
Commander U.S. Army Corps of Engineers Missouri River Division ATTN: CEMRD-ET-HT (D. Williams) 12565 West Center Road Omaha, Nebraska 68144-3869	4	4	4
Commander U.S. Army Corps of Engineers ATTN: CESAD-PM-H (S. Ernst) 77 Forsyth St., SW, Room 313 Atlanta, Georgia 30335-6801	1	1	1
Commander U.S. Army Corps of Engineers South Atlantic Division Laboratory ATTN: CESAD-EN-FL (B. Willis) 611 South Cobb Drive Marietta, Georgia 30060-3112	0	0	1
Commander U.S. Army Corps of Engineers ATTN: CESAS-PM-H (D. Roulo) 100 W. Oglethorpe Street Savannah, Georgia 31402-0889	4	4	4
Commander U.S. Army Corps of Engineers ATTN: CESAJ-DP-S (R. Bridgers) P.O. Box 4970 Jacksonville, Florida 32232-0019	3	3	2
Commonwealth of Puerto Rico Office of the Governor Environmental Quality Board ATTN: Genaro Torres Leon Chief, Superfund Program P.O. Box 11488 Santurce, Puerto Rico 00910	0	2	4
TOTAL	12	14	16

4. PERSONNEL

This section presents the management structure for E & E's work at the former Ramey AFB site and elaborates upon the relationships between levels of responsibility, roles and duties anticipated for assigned positions, and resources available to carry out various tasks.

4.1 CORPORATE ORGANIZATION

E & E's management philosophy is program-oriented and matrix management-structured. Multi-disciplinary technical project teams, who receive technical direction from different areas and levels within the corporate organization (according to the nature of the project undertaken), are formed within this management structure.

The Ramey AFB project staff will form a semi-autonomous group within E & E's regional office structure, with the authority to commit technical staff for the project. E & E's principal-in-charge, Mr. Jack Wilcox; program manager, Mr. John Barksdale; project engineer, Mr. Alberto Morales; and project manager, Mr. Doug Heatwole will maintain formal as well as informal lines of communication between the USACE project manager, E & E's quality assurance (QA) officer, and E & E's technical support staff. Figure 4-1 shows E & E's project organization for the former Ramey AFB site and illustrates the relationships between E & E's project groups and "external" groups, whose functions will be to assist with the direction and monitoring of project activities.

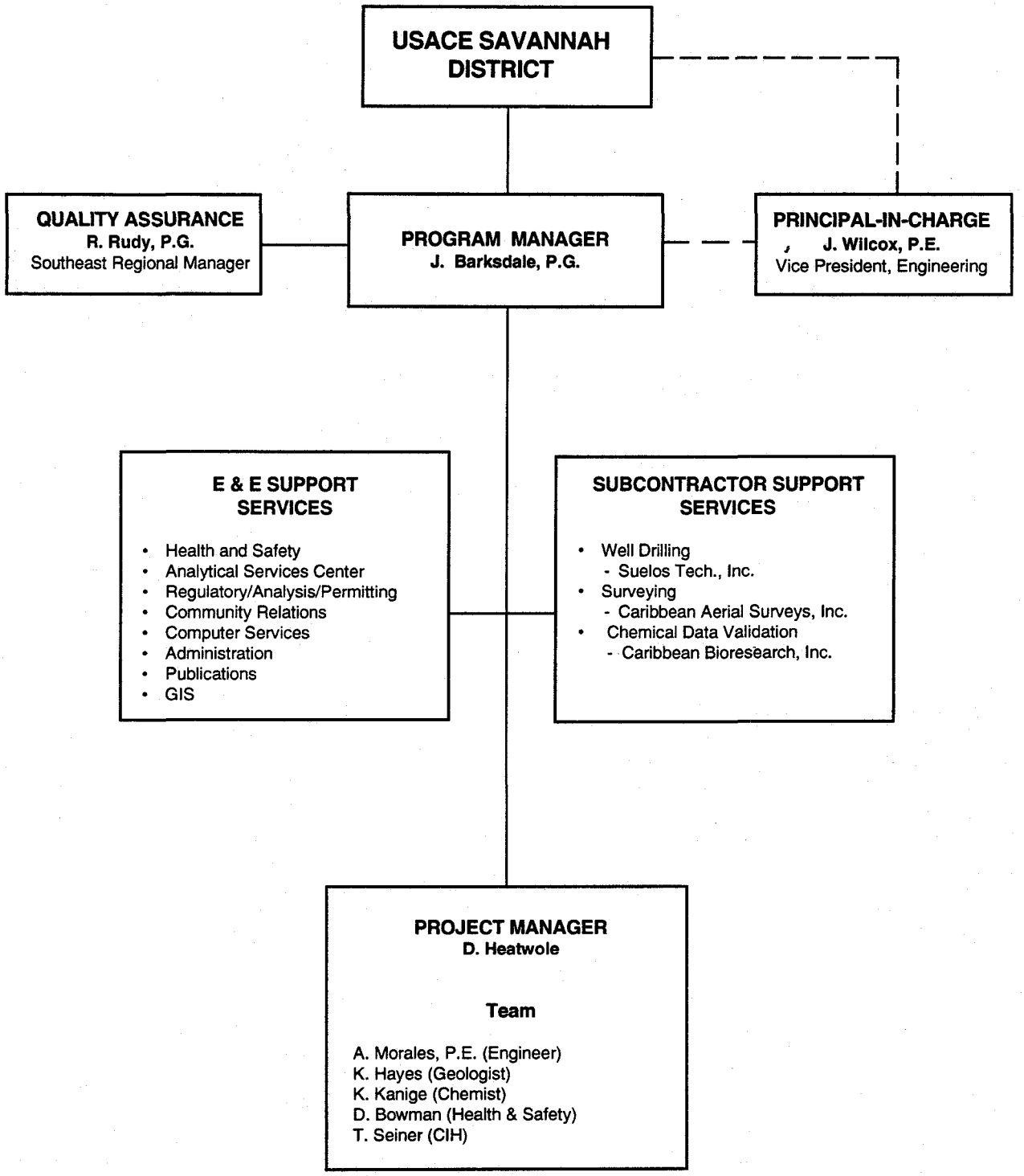


Figure 4-1 PROJECT ORGANIZATION – FORMER RAMEY AIR FORCE BASE, AGUADILLA, PUERTO RICO

4.2 PROGRAM ORGANIZATION AND QUALIFICATIONS OF PERSONNEL

The organizational structure that E & E has developed for this project ensures the cost-effective use of key personnel as well as maintenance of close communication and coordination with the USACE project manager. Based on E & E's experience with similar programs, this organizational structure is designed to accommodate multiple task assignments and can be adjusted in response to changing project needs.

The key project personnel are the principal-in-charge, program manager, project manager, and the QA officer. Key personnel and their responsibilities are described briefly below. Resumes for E & E team members as well as subcontractor personnel are provided in Appendix A.

4.2.1 E & E Key Personnel

Principal-in-Charge

Jack Wilcox, a registered professional engineer, will serve as principal-in-charge. He will have overall responsibility for ensuring that the Ramey AFB project meets USACE objectives and E & E quality standards, and that E & E's full corporate resources are made available to the project, as needed. He also will serve, as necessary, as an intermediary between the USACE project manager and E & E corporate management and assist the program manager in problem resolution/corrective action implementation.

Program Manager

John Barksdale, a registered professional geologist, will serve as program manager. He will report directly to the USACE project manager and provide the major point of control to ensure that the project's technical, financial, and scheduling objectives are achieved.

Project Engineer

Alberto Morales, a professional engineer registered in the Commonwealth of Puerto Rico, will serve as the project engineer. Mr. Morales will ensure that all work is conducted in accordance with all applicable Commonwealth of Puerto Rico laws and regulations, and affix his professional engineer's seal to the work plan and report for the project.

Project Manager

Doug Heatwole will serve as the project manager for the former Ramey AFB site. Mr. Heatwole will lead the day-to-day activities including team management, field operations, and report development.

QA Officer

Rick Rudy, a Registered Professional Geologist, will ensure that quality standards for both field work and laboratory work are strictly enforced. He will constantly interface with the principal-in-charge, program manager, and project manager concerning any problems that may arise.

Certified Industrial Hygienist

Tom Siener, a CIH, will oversee the development and implementation of the health and safety documents required for this project.

On-site Safety and Health Officer

Debra Bowman will serve as the on-site safety and health officer for the Ramey AFB project. She will ensure that the requirements of the SSHP are met during all field activities.

Technical Staff

Work assignments will be staffed out of E & E's Pensacola and Tallahassee offices, with support staff made available from other offices to meet any unexpected staffing needs. Additional technical support is available from E & E's offices in the region, including Pensacola, Tallahassee, Miami, Kansas City, Baton Rouge, Houston, and Dallas. Other E & E offices will be utilized, as needed, to meet specialized requirements of individual site projects. Resumes of senior-level technical staff are provided in Appendix A.

E & E's Analytical Service Center (ASC) in Buffalo will provide laboratory services as specified in the contract.

4.2.2 Subcontractor Key Personnel

Project Manager, Suelos Tech, Inc.

Jose Ramos will be E & E's primary contact at Suelos Tech, Inc., for the former Ramey AFB project. Mr. Ramos will be responsible for managing and scheduling drilling crews, as well as ensuring that drilling projects meet schedule and budget requirements. Mr. Ramos has completed the 40-hour Occupational Safety and Health Administration (OSHA) training course.

Drilling Supervisor, Suelos Tech, Inc.

Osea Garcia, a registered driller in the Commonwealth of Puerto Rico, will be the drilling supervisor for Suelos Tech, Inc., Mr. Garcia will lead field drilling operatons and ensure, through coordination with the E & E project manager, that all drilling activities meet USACE specifications outlined in the Geologic Data Acquisition Plan (GDAP E & E 1996d) and work plan (E & E 1996b). Mr. Garcia has completed the 40-hour OSHA Training Course.

Project Manager, Caribbean Aerial Surveys, Inc.

Lemuel Ortiz-Rosario, registered land surveyor (RLS) in the Commmonwealth of Puerto Rico, will be responsible for coordinating field surveys of the former landfills. Mr. Ortiz-Rosario will manage and schedule survey crews and will ensure that the survey meets schedule and budget requirements. Mr. Ortiz-Rosario has completed the 40-hour OSHA Training Course.

Party Chief Surveyor, Caribbean Aerial Surveys, Inc.

Oscar Caraquillo will be responsible for leading field survey crews. Mr. Caraquillo will process data in the field and will assist in the desktop interpretation of field data. Mr. Caraquillo has completed the 40-hour OSHA Training Course.

Data Review, Caribbean Bioresearch, Inc.

To satisfy Commonwealth of Puerto Rico requirements, all site data must be reviewed by a Puerto Rico licensed chemist. Analytical data obtained during this site investigation will be submitted to Caribbean Bioresearch, Inc., in San German, Puerto Rico. Zulma Nazario Velez, a Puerto Rico licensed chemist, will be responsible for the review and approval of analytical data obtained during the site investigation.

5. MANAGEMENT APPROACH

This section outlines the approach E & E will use to manage the former Ramey AFB project work assignment.

5.1 OVERVIEW OF MANAGEMENT CONTROL PROCESS

Work assignments from the USACE project manager will be assigned to an E & E project manager who will report directly to E & E's program manager. The project manager will define project tasks, prepare schedules and budgets, request personnel from the appropriate administrative manager, coordinate with support services such as publications and the ASC, and be responsible for quality control on the project. Resumes of senior technical personnel are presented in Appendix A.

After personnel assignments have been made for a work assignment, the project manager will be responsible for the daily technical direction of personnel assigned to the project. The project manager will maintain daily contact with the program manager. Weekly meetings and progress reports to the program manager and principal-in-charge will keep higher-level management apprised of project status, as well as any potential critical situations that could require immediate program and/or corporate decisions.

5.2 MANAGEMENT CONTROL REQUIREMENTS

Work assignments will be managed within initial budgets and schedules agreed to by E & E and the USACE project manager by dividing the scope of work into standard tasks. E & E may break these tasks further into subtasks. If standard methodology cannot be used

to define a particular task, the project manager will consult with the program manager regarding the selection of methods for a non-standard task.

All expenditures for this project will be approved by the program manager or principal-in-charge. The project manager will authorize any modifications to tasks or subtasks, with the concurrence of the program manager and the USACE project manager. The project manager has direct responsibility for authorizing, monitoring, and controlling all work and the expenditure of funds and hours, as well as for the successful completion of the work, including budget and schedule requirements. This will be accomplished through the development and implementation of a work breakdown structure (WBS) management plan for the site.

5.3 WORK BREAKDOWN STRUCTURE

The WBS technique provides the technical and organizational foundation for subdividing project work, scheduling project tasks, and monitoring expenditures. The technique consists of a breakdown of the USACE-approved work plan by task and subtask. The major end products are identified, and successively subdivided until the total effort is defined by manageable tasks assignable to a project team or team member. The WBS is used to assign responsibilities for each work element, establish schedules and milestones, allocate resources, track costs against estimates, assess the status of the project effort, evaluate work performance, and determine the necessity for revision of the project effort in response to changed conditions.

Under the WBS, work is identified by a six-character letter/number code, called the project number. Two letters identify the client, and four numbers designate the project, task, and subtask, as shown below:

VN3000	Client
VN3000	Project
VN3010	Task
VN3011	Subtask

One of the major objectives of the WBS system is to give the program manager and project managers a tool for cost control, with the flexibility to allow for expansion in both depth and scope as the need for greater work detail arises.

5.4 TASK BUDGETS

The WBS management plan will include a budget breakdown by major tasks or WBS levels. Weekly costs will be calculated from the actual costs recorded for each week and printed out through the computerized Project Management System (PMS). This will allow the project manager to track budgeted hours and dollars against actual expenditures to assess progress on a weekly basis and allow the project manager to make corrections to the schedule as needed.

5.5 PROJECT MANAGEMENT SYSTEM

E & E's PMS is an interactive computer software system used to track projects. PMS is a tool for project managers, company administrators, senior management staff, and clients to track weekly costs and hours against projections. For this project, the project administrator, a senior-level cost analyst, will enter the particulars for each task assignment issued by the USACE on E & E's Digital Equipment Corporation (DEC) computer system, essentially initiating the task work. At the same time, the administrator will enter the names of the program manager and project manager, and the contract rates. The project administrator then will enter all WBS elements, including budgeted hours (based on the USACE-approved work plan), costs, planned beginning and ending dates, and projections of planned work. Every week, the project manager will update the projections of planned labor hours and retrieve the calculated project costs from the PMS. Project managers are required to record the financial, scheduling, and technical status of their work assignments each week on the PMS. The information recorded by the project manager will be reviewed and coordinated by the program manager, and then submitted in the monthly progress report to the USACE project manager.

5.6 PRE-PROJECT ACTIVITIES

Upon receipt of a delivery order from the USACE project manager, E & E will commence with the project start-up and WBS development and implementation. Technical support staff will be assigned by the project managers and program manager based on current individual workloads and technical expertise required. The project manager will develop the PMS for each project and estimate required labor hours for scheduling purposes. Support

group requests are also made in the pre-project period. For major reports, the publications group will be notified as early as possible of the scheduled deadline for submission. Prior to project start-up, project documentation procedures will be implemented to maintain an accurate record of all activities performed during project execution.

In addition, pre-project activities will generally include research on current site conditions and a site visit prior to the development of the work plan. The research activities will include review and evaluation of existing records, studies, and data concerning the site available in the files of local, state, and federal agencies. A document search report listing the information discovered will be presented in the work plan. The purpose of the site visit will be to gather information regarding significant features (e.g., trenches, pits, buildings, fencelines) for the preparation of site maps.

5.7 WORK PLANS

E & E will prepare a work plan (E & E 1996b) for completion of all work conducted at the former Ramey AFB site in accordance with the requirements of the USACE, the Commonwealth of Puerto Rico, and the applicable scope of work. The work plan will discuss the rationale of proposed and planned actions and will include a Data Management Plan (DMP; E & E 1996c), Geologic Data Acquisition Plan (GDAP; E & E 1996d), Chemical Data Acquisition Plan (CDAP; E & E 1996e), a SSHP (E & E 1996f), and this PMP. The draft work plan will be submitted to the USACE according to the schedule provided in Figure 3-1 for review. Upon receipt of comments from the USACE concerning the draft work plans, E & E will prepare a prefinal work plan for review by the USACE. Review comments will be incorporated into the final work plan. Upon approval of the final work plan by USACE and the Commonwealth of Puerto Rico Environmental Quality Board (EQB), the field work tasks can begin.

5.8 PROJECT OPERATIONS

Following approval of the work plan, actual technical work will be implemented. This will include all aspects associated with performing each phase of work.

5.8.1 Project Planning

The project manager will project labor requirements and schedule appropriate technical personnel needed to complete the project on time. The project manager's request will be channeled through corporate management during weekly labor request meetings. These meetings are held to coordinate short-term (1- to 2-week) labor assignments and schedule technical requests for specific projects.

Because most of the delivery orders for this contract will involve laboratory analysis of samples, E & E's ASC will be informed of projected sample analysis requirements by the project manager. The need for special analyses and short turnaround times will be made known well in advance of delivery of samples to the laboratory. In addition, the project manager will notify the USACE QA Laboratory (South Atlantic Division Laboratory) two weeks prior to sample shipment regarding delivery of QA samples. The delivery of the samples will be coordinated with the laboratory and the project manager will call the laboratory 24 to 48 hours prior to shipment to confirm the shipment schedule.

Drilling and other subcontracting needs also will be coordinated by the project manager during the early stages of project start-up. Subcontracts (discussed below) will be developed for special services and scheduled by the field coordinator.

Regular bimonthly staff meetings will be conducted with the program manager, the project managers, and key members of the field teams. These meetings will primarily address critical issues, project status, problem areas, scheduling, and action items of the previous meeting.

5.8.2 Subcontracting Procedures

E & E's subcontracting program utilizes a comprehensive list of vendors, generic contracts, and standard policies and procedures developed for hazardous substance management and remediation programs. Subcontracting (e.g., drilling, surveying and mapping, geophysical hydropunch and special investigations) will be coordinated and directed by the project manager in accordance with E & E standard subcontracting procedures and will be subject to government approval. Only the contract types enumerated in the Federal Acquisition Regulations (FAR), Subchapter D, Part 16, are developed and used for all subcontractors for the USACE program. Selection of contract type is based on factors such

as: scope of work to be performed, adequacy of specifications, technical capability, prior service experience, and urgency of requirements. Generally, one of the following types of subcontracts is used:

- Corporate Purchase Order;
- Firm Fixed Price;
- Time and Materials; and
- Letter Agreement.

If subcontracting is needed, a technical statement of work and cost estimate will be prepared and discussed with the USACE project manager. Any special provisions or evaluation criteria by which subcontractor bids or proposals may be judged will be included. Solicitations of all substantial subcontracts are normally sent out to four or five firms selected on the basis of previous similar work experience, proximity to the area of work, and health and safety qualifications. Ten working days are allowed for preparation of responses. This process may be enhanced through the use of verbal solicitations to meet urgent USACE schedule requirements.

The project manager, program manager, and, if appropriate, the senior project geologist or engineer, in coordination with the USACE project manager, will review the technical merit of each bid and proposal in accordance with the evaluation criteria contained in the bid package. Reference checks will be made, and, for those potential subcontractors determined to be technically qualified, costs will be evaluated for accuracy and reasonableness. Selection will be based on technical qualifications and previous similar work experience, prior experience with similar materials, appropriately trained (e.g., Occupational Safety and Health Administration [OSHA]) personnel, and costs.

After selection of a subcontractor, a subcontract information package is prepared for USACE project manager review and approval. Subcontracts will be reviewed for approval with the USACE project manager. Upon receipt of the approved subcontract package from the project manager, the corporate subcontracting manager will execute and issue the subcontract.

The project manager will monitor the technical performance of subcontractors to ensure that subcontractors adhere to work plans and specified health and safety protocols, excessive materials are not used, and unnecessary delays do not occur. Daily logs of progress and expenditures will be maintained and tracked for invoice validation.

Cost tracking by site will be performed on a weekly basis for all subcontracting activities. The project manager will review and approve all invoices for content and detail before forwarding them to the program manager for payment authorization. The PMS allows for incorporation of subcontractor cost and schedule data in an efficient manner.

5.8.3 Quality Control and Quality Assurance

Three distinct approaches will be used to ensure product quality under this project. The QA program, the Quality Control (QC) program, the work plan, the CDAP, and GDAP will be used to complement each other in implementing a comprehensive system for data generation, and product preparation, review, and approval. The CDAP, GDAP, and work plan will assist the project team in obtaining information and data at the desired level of confidence.

In-house QA is the responsibility of the project manager, the program manager, the principal-in-charge, and the QA officer. The QA officer is responsible directly to higher company management.

QC responsibility lies primarily with the project manager. The project manager is the individual closest to the job, and, as such, is the person most capable of controlling the overall quality of the work product.

5.8.4 Field Operations Support Functions

The project manager is responsible for specifying and requesting equipment necessary for each field operation under the former Ramey AFB site program. The project manager, assisted by the site safety coordinator (SSC) and the equipment coordinator, determines the types and amounts of equipment needed to execute the fieldwork, based on the work plan, SSHP, and CDAP. The SSC must approve the field coordinator's proposed list of safety equipment before field operations at a site may begin. The equipment required for work

under the USACE, for the former Ramey AFB project will be classified as either expendable or non-expendable. The project manager will audit for proper use of equipment.

Chemical analyses will be performed at E & E's ASC (see Figure 5-1) in Buffalo, New York. The ASC has been certified by the USACE, Missouri River Division to perform analysis for federal Superfund remedial design/construction projects and the DOD Environmental Restoration Program.

E & E's ASC is staffed by full-time scientists and technicians and equipped with state-of-the-art instrumentation for the full range of water, air, biota, and soil quality parameters. Laboratory work will be performed in accordance with guidelines and protocol established by United States Environmental Protection Agency (EPA), Commonwealth of Puerto Rico, the American Society for Testing and Materials (ASTM), and/or the USACE. Methods will be developed for other tests that may be required for site-specific conditions, and undergo the same rigorous QA/QC checks as established procedures. QA and QC programs are conducted for instruments and analytical procedures and are discussed in the CDAP.

5.8.5 Health and Safety Procedures

The project manager is assisted by a health and safety officer responsible for overseeing the health and safety program in conjunction with this project. More information concerning the safety and health program for this contract, is contained in the project SSHP.

5.8.6 Additional Support Services

Additional technical and management support functions may be required in certain situations. These services are tasked on a case-by-case basis, and are most often assigned individually to support on-going efforts for the various work phases at each site. Five basic task items that fall into this category are: remedial oversight support, community relations support, data management support, analytical support, and other technical support (e.g., publications).

The publications support staff in the E & E Pensacola and Tallahassee offices will provide primary technical review, editing, and graphics needed to complete reports and other deliverables. The corporate publications group will be available to provide any additional

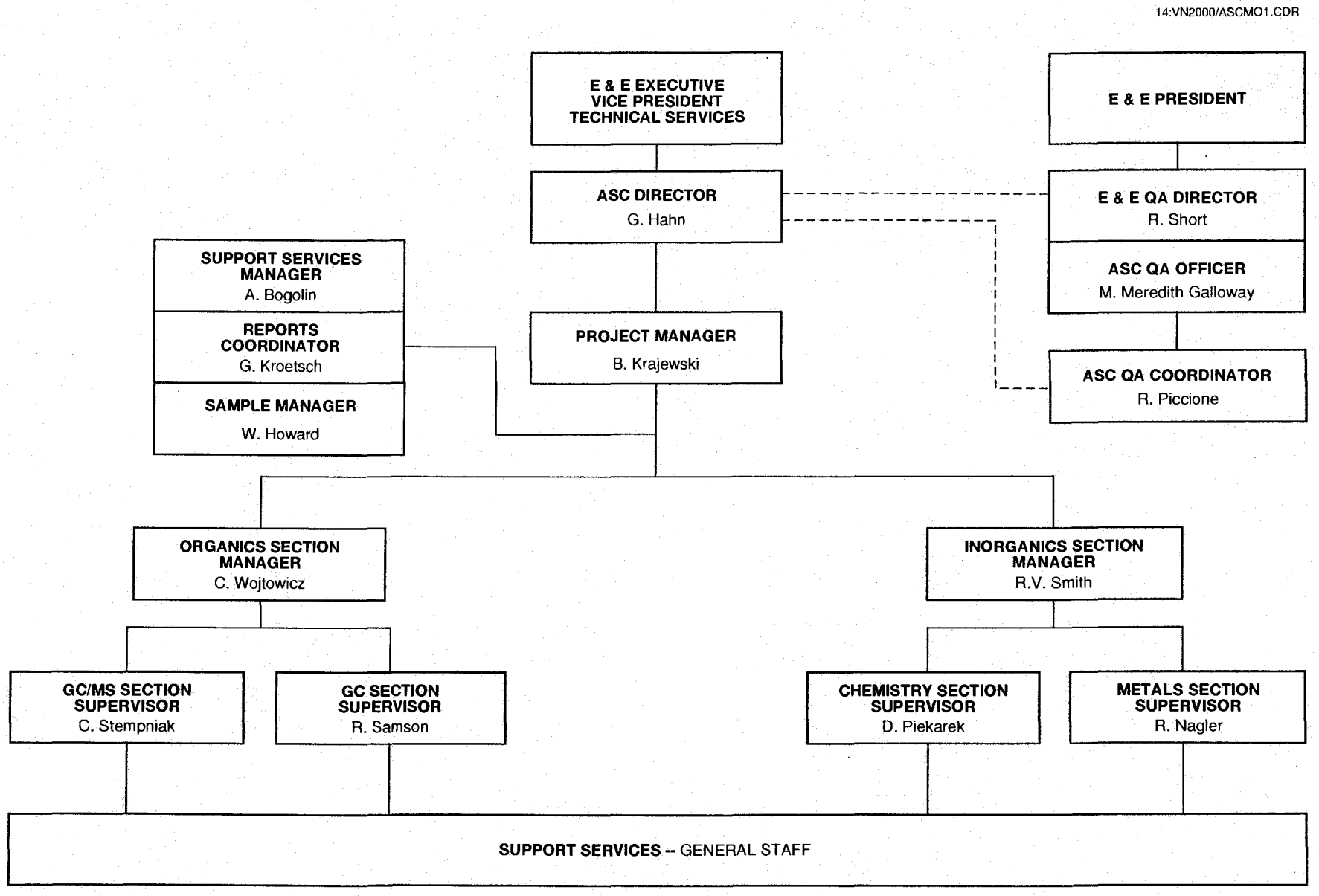


Figure 5-1
E & E ANALYTICAL SERVICES CENTER MANAGEMENT ORGANIZATION

support required through E & E's nationwide computer network.

Other support services include drafting/blueprint development, computer services/programming/software applications, computer-assisted drafting and design (CADD) services, geographical information systems (GIS), and literature/information computer searches.

5.8.7 Report Approval Process

E & E will prepare a site investigation report for the former Ramey AFB site that summarizes the activities and results of the investigation tasks performed. The site investigation report will be structured according to requirements as specified in the scope of work (SOW). The draft site investigation report will be submitted to the USACE according to the schedule provided in Figure 3-1 for review. Upon receipt of comments from the USACE, E & E will prepare a pre-final report, which will be submitted to the USACE and Puerto Rico EQB for review. Review comments received by USACE from internal review and the Puerto Rico EQB will be incorporated into the final report.

5.9 COORDINATION AND POINTS OF CONTACT

The project manager will be responsible for maintaining a close liaison with the USACE project manager. The USACE project manager will provide coordination of work with other agencies. The points of contact for the former Ramey AFB site are listed below.

USACE, Savannah District

Ted Hightower, Chief, HTRW	912/652-5300
FAX	912/652-5311 or 912/652-6012
David Roulo, Project Manager	912/652-5945
Frank de la Sierra, Chief, Environmental and Support for Others Branch	912/652-5166
Wes Smith, Project Technical Manager	912/652-6060

USACE, Jacksonville

Robert Bridgers	904/232-3085

Ecology and Environment, Inc.

John Barksdale, Program Manager	904/435-8925
FAX - Pensacola	904/435-9135
Doug Heatwole, Project Manager	904/435-8925
FAX - Pensacola	904/435-9135

5.10 MEETINGS AND CONFERENCES

E & E will be represented at all meetings and conferences by personnel familiar with the work to be discussed. Subcontractor personnel will be included when necessary. Generally, three or fewer E & E personnel will attend meetings and conferences unless prior permission is obtained from the USACE project manager.

E & E will record the minutes of each conference; prepare, sign, and distribute the minutes to all attendees; and after review of the minutes, resolve annotated comments to the satisfaction of the USACE. The minutes will include the date, place, and a list of attendees, including organization and telephone number. Minutes will be distributed within 10 days after the conference date.

5.11 CONFIRMATION NOTICES

E & E will provide a record of discussions, verbal directions, and telephone conversations participated in by E & E or its representatives on matters related to this contract and work. These records will be entitled "confirmation notices," will be numbered sequentially, and will fully identify participants, subject matter, and conclusions reached. Confirmation notices will be provided to the USACE project manager and the technical manager in the monthly progress reports.

5.12 USACE REVIEW OF PROGRESS AND TECHNICAL ADEQUACY

E & E will be prepared to cooperate fully with representatives of the contracting officer during reviews of the progress and technical adequacy of the former Ramey AFB project. E & E understands that these reviews will not preclude the completion of all contract requirements.

5.13 MAINTAINING AND RELINQUISHING PROJECT RECORDS

Upon completion of the former Ramey AFB project, E & E will submit to the USACE, Savannah District, a complete set of project records. These records will include all correspondence, memorandums, trip reports, confirmation notices, sampling plans, test results, submittals, photographs, and any other records or documents generated during performance of the former Ramey AFB project.

5.14 NOTIFICATION OF SITE VISITS

E & E will notify the USACE project manager, by telephone, 10 days prior to any proposed site visits or immediately upon decision to visit a site. A confirmation call will be made immediately prior to the site visit.

5.15 RELEASE OF INFORMATION

E & E will not publicize nor release in any manner information or data regarding any projects on which they may be working or negotiating with this office, nor discuss prior to public release by this office, a project, any future design of the project, or any planning with anyone not directly concerned with the project. Any inquiries about the project shall be referred to the contracting officer, the USACE project manager, or the USACE technical manager. However, the above restrictions are not intended to interfere with notification of federal, state, and local agencies, which is required by applicable laws regarding releases of hazardous materials and substances and other such materials covered therein. To this end, it is E & E's obligation to be familiar with applicable federal, state, and local laws, regulations, and procedures regarding such reporting. Such notifications also will be made when there is a reasonable likelihood of harm to persons on or around the project area resulting from a release of potentially dangerous materials. Where time permits, E & E will coordinate such notifications with the USACE project manager.

6. REFERENCES

Ecology and Environment, Inc., 1996a, Site reconnaissance performed on April 16-19, 1996 by John Barksdale and John Williams.

_____, 1996b, *Work Plan for the Completion of a Site Investigation at Landfill Areas 1 and 2, Former Ramey Air Force Base, Aguadilla, Puerto Rico*, prepared for the USACE—Savannah District.

_____, 1996c, *Data Management Plan for Completion of a Site Investigation at Landfill Areas 1 and 2, Former Ramey Air Force Base, Aquidilla, Puerto Rico,* prepared for the USACE—Savannah District.

_____, 1996d, *Geologic Data Acquisition Plan for Completion of a Site Investigation at Landfill Areas 1 and 2, Former Ramey Air Force Base, Aquidilla, Puerto Rico,* prepared for the USACE—Savannah District.

_____, 1996e, *Chemical Data Acquisition Plan for Completion of a Site Investigation at Landfill Areas 1 and 2, Former Ramey Air Force Base, Aquidilla, Puerto Rico,* prepared for the USACE—Savannah District.

_____, 1996f, *Site Safety and Health Plan for Completion of a Site Investigation at Landfill Areas 1 and 2, Former Ramey Air Force Base, Aguadilla, Puerto Rico,* prepared for the USACE—Savannah District.

_____, 1996g, *Project Field Logbook, Landfill Areas 1 and 2 at the Former Ramey Air Force Base, Aguadilla, Puerto Rico.*

Puerto Rico Aqueduct and Sewer Authority (PRASA), 1983, Water Supply Systems Maps for Aguadilla, Puerto Rico.

U.S. Army Corps of Engineers, Savannah District, March 1996, *Scope of Work for the Completion of Site Investigations at Two Landfill Areas, Former Ramey Air Force Base, Aguadilla, Puerto Rico.*

_____, 25 March 1996b, *Geophysical Survey Memorandum.*

_____, 15 April 1992, *Site Survey Summary Sheet for DERP-FUDS Site No. I0ZPR087900, Rafael Hernandez Airport (Former Ramey AFB).*