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Phase I RFI Data Summary Report for the 9 SWMUs and 3 AOCs Identified in the RCRA Consent Order

Former Atlantic Fleet Weapons Training Facility
Vieques Island, Puerto Rico

NAVFAC
Naval Facilities Engineering Command

Prepared for

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Executive Summary

This purpose of this Data Summary Report is to summarize the field activities and data collected for 12 sites investigated during a Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the former Atlantic Fleet Weapons Training Facility (AFWTF), located on the eastern half of Vieques, Puerto Rico. The Data Summary Report is intended as a status report, until the Phase I RFI Report can be completed using the background soil inorganics data. Once the background soil inorganics investigation has been completed, the background data will be compared to the site-specific data collected during the Phase I RFI to assist in evaluating the nature and extent of soil inorganics contamination. Therefore, the Data Summary Report will not be revised; rather, the Draft Phase I RFI Report (CH2M HILL, June 2004b) will be revised with the information from the background comparison and submitted as Draft Final. In addition, the revised Phase I RFI Report will include data conclusions and recommendations, which are not part of this Data Summary Report.

The purpose of the Phase I RFI was to meet the requirements of a RCRA 3008(h) Consent Order to determine the nature and the extent of potential releases of hazardous wastes, solid wastes, and/or hazardous constituents from former Navy activities at these sites in Vieques. The Phase I RFI was conducted by CH2M HILL under Navy Contract N62470-02-D-3052, Navy Comprehensive Long-Term Environmental Action Navy (CLEAN III), District III. The Consent Order (RCRA-02-99-7301) between the U.S. Environmental Protection Agency (EPA) and the Navy went into effect on January 20, 2000. EPA's jurisdiction to issue the Consent Order derives from authority vested in EPA by Section 7003 of the RCRA, as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, which also mandate compliance by generators of solid and/or hazardous waste.

On May 1, 2003, the Navy ceased training exercises on AFWTF. Following termination of training operations on Vieques, the 14,573 acres of the former AFWTF were transferred to the jurisdiction of the Department of the Interior (DOI). The property must be managed by DOI as part of the National Wildlife Refuge System, pursuant to section 1049 of the Nation Defense Authorization Act for Fiscal Year 2002 (Public Law 107–107). In addition, the former Live Impact Area (LIA), a 900-acre area, must be managed as a wilderness area without public access (Public Law 106–398; Public Law 107–107). Other former operational areas of the former AFWTF comprise the 2,500-acre Surface Impact Area (SIA), the 11,000-acre Eastern Maneuver Area (EMA), and the 200-acre Eastern Conservation Area (ECA).

The 12 sites addressed in the Phase I RFI comprise nine Solid Waste Management Units (SWMUs) and three Areas of Concern (AOCs) on the former AFWTF. These sites are located in the EMA and the SIA. The sites included in the Phase I RFI per the Consent Order are:

- SWMU 1 – Camp García Landfill (Camp García)
- SWMU 2 – Fuels Off-Loading Site (Camp García)
- SWMU 4 – Waste Areas of Building 303 (Camp García)

- SWMU 5 – Spent Battery Accumulation Area (Observation Post 1 [OP-1], Inner Range, Former AFWTF)
- SWMU 6 – Waste Oil and Paint Accumulation Area (Seabees Area, Camp García)
- SWMU 7 – Waste Oil Accumulation Area (outside Building 303, Camp García)
- SWMU 8 – Waste Oil Accumulation Area (OP-1, Inner Range, Former AFWTF)
- SWMU 10 – Sewage Treatment Lagoons (Camp García)
- SWMU 12 – Solid Waste Collection Unit Area (OP-1, Inner Range, Former AFWTF)
- AOC A – Diesel Fuel Fill Pipe Area (OP-1, Inner Range, Former AFWTF)
- AOC F – Rock Quarry (Camp García)
- AOC G –Chlorination Building at Sewage Lagoons (Camp García)

Of these 12 sites, portions of SWMU 4 and SWMU 6, SWMU 7, SWMU 10, , and AOC F were investigated during June 2000 when the Navy was transferring operations from the former Naval Ammunition Support Detachment (NASD) on west Vieques to the AFWTF. Results of that investigation are also presented in this report.

Three munitions response sites (the Waste Explosive Ordnance Detonation Area [SWMU 3], the Explosive Ordnance Firing Range [SWMU 9], and the Non-Explosive Ordnance Firing Range [SWMU 11]), which are located in the former military range area, were specifically excluded from any corrective action requirements during the RFI per the Consent Order. These three SWMUs are described in a Preliminary Range Assessment (PRA) Report (CH2M HILL, 2003a). Environmental sampling at SWMU 3 will be completed as specified in the Draft Final Closure Plan for the Open Burn/Open Detonation (OB/OD) Site (CH2M HILL, 2004a). SWMU 9 and SWMU 11, along with several other munitions response sites (MRSs), will be investigated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) following completion of munitions clearance activities.

The scope of the Phase RFI includes the following objectives:

- Determine whether or not releases of hazardous wastes, solid wastes, or hazardous constituents have occurred from each SWMU and AOC identified in the Consent Order by sampling appropriate environmental media (soil, groundwater, surface water, and/or sediment) and comparing the analytical results to screening criteria protective of human health and environmental receptors.
- Recommend sites either for further investigation as part of a Full RFI to further assess potential environmental contamination or for no further action (NFA).

As noted previously, the Data Summary Report is provided as a status report, whose objective is to describe the data collection activities and summarize the constituent concentrations detected. The Phase I RFI Report, to be prepared following completion of the background investigation, will satisfy the objectives above.

The field investigation of the 12 SWMUs and AOCs identified in the Consent Order included sampling and analysis of 128 surface soil, 41 subsurface soil, and 10 groundwater samples. Analysis of the samples included RCRA Appendix IX constituents and explosives. At certain sites suspected of containing munitions, a munitions and explosives of concern (MEC) avoidance survey was also conducted prior to performance of any intrusive work to ensure safe working conditions. At SWMU 1, the Camp Garcia Landfill, a geophysical survey was conducted to identify buried waste areas to focus the soil sampling in these areas.

This report summarizes the field activities performed to collect the above samples at the 12 SWMUs and AOCs and summarizes the constituents detected in all samples. Table ES-1 summarizes the number of samples by media collected at each SWMU and AOC.

TABLE ES-1
Number of Site Samples Collected per Sampling Media
Data Summary Report, Vieques, Puerto Rico

Site	Sampling Event	Sampled Media	Total Metals	Dissolved Metals	VOCs	SVOCs	Pesticides	Herbicides	PCB	Explosives	Perchlorate	Dioxins	Cyanide, Sulfide	TCLP (VOC, SVOC, metals)	BTEX/MTBE, TPH DRO, Naphthalene, Lead	TPH
SWMU 1	2004 Phase I RFI	Surface Soil	50		50	50	50	50	50	50	50	5	5			
		Groundwater	5	5	5	5	5	5	5	5	5	2	2			
SWMU 2	2004 Phase I RFI	Surface Soil	12		12	12	12	12	12	12	12	4	4			
		Subsurface Soil			2	2						1	1			
SWMU 4	2000 Sampling Event	Surface Soil	12		12	12	12	12	12							
	2004 Phase I RFI	Subsurface Soil			1	1										
SWMU 5	2004 Phase I RFI	Surface Soil	4		4	4	4	4	4	4	4	1	1			
SWMU 6/7	2000 Sampling Event	Surface Soil	10		10	10	10	10	10							
SWMU 8	2004 Phase I RFI	Surface Soil	5		5	5	5	5	5	5	5	1	1			
SWMU 10	2000 Sampling Event	Surface Soil											4	4		
		Subsurface Soil											4[a]	4		4
	2000 WWTW Sample	Waste Water	1	1	1	1							1			1
	2004 Phase I RFI	Surface Soil	16		16	16	16	16	16	16	16	7	7			
		Subsurface Soil	16		16	16	16	16	16	16	16	4	4			
		Groundwater	5	5	5	5	5	5	5	5	5	2	2			
SWMU 12	2004 Phase I RFI	Surface Soil	5		5	5	5	5	5	5	5	1	1			
AOC A	2003 Sampling Event	Subsurface Soil													10	
ACO F	2000 Sampling Event	Surface Soil	5		5	5	5	5	5							
AOC G	2004 Phase I RFI	Surface Soil	5		5	5	5	5	5	5	5	1	1			

[a] - Subsurface soil sample was analyzed for cyanide only.

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List of Acronyms

AFWTF	Atlantic Fleet Weapons Training Facility
AMSL	Above mean sea level
AOC	Area of Concern
AST	Aboveground fuel storage tank
ASTM	American society for Testing & Materials
AVGAS	Aviation gasoline
bls	below land surface
BTEX	Benzene, ethylbenzene, toluene, and xylenes
btoc	ft below top of casing
CCME	Canadian Council of Ministers of the Environment
CCP	Comprehensive Conservation Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Procedure
cm	centimeters
COC	Chain-of-custody
DO	dissolved oxygen
DOI	Department of the Interior
DQE	Data Quality Evaluation
DRO	Diesel Range Organics
DV	Data validation
ECA	Eastern Conservation Area
ECO	Ecological screening criterion protective of ecological receptors
EM	Electromagnetic
EMA	Eastern Maneuver Area
EPA	U.S. Environmental Protection Agency
ERL	effects range-low
ESA	ecological screening evaluation
ft	foot or feet
gpd	gallons per day
gpm	gallons per minute
GPS	global position system
GRO	Gasoline Range Organics
HHRA	Human Health Risk Assessment
HRGC/HRMS	High-resolution gas chromatographjy/high-resolution mass spectrometry
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IDW	Investigation-derived waste
IR	Installation Restoration
LANTDIV	Atlantic Division

LAW	Light anti-craft weapons
LCS	Laboratory Confirmation Sample
LIA	Live Impact Area
LUMP	Land Use Management Plan
m	meters
MEC	Munitions and explosives of concern
MHSPE	Ministry of Housing, Spatial Planning, and Environment
mm	millimeters
MOGAS	Unleaded gasoline
MOU	Memorandum of Understanding
MRS	Munitions Repose Site
MS/MSD	Matrix Spike/Matrix Spike Duplicate
msl	mean sea level
MWP	Master Work Plan
NAPR	U.S. Naval Activity Puerto Rico
NASD	Naval Ammunition Support Detachment
NAVFACENGCOM	Naval Facilities Engineering Command
NFA	no further action
NPL	National Priority List
NSRR	U.S. Naval Station Roosevelt Roads
NTU	nephelometric turbidity unit
OB/OD	open burning/open detonation
OP-1	Observation Post 1
ORP	oxidation reduction potential
OVA	Organic vapor analyzer
OVM	Organic Vapor Meter
PCB	polychlorinated biphenyl
PCBD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuron
PEL	Progress Environmental Laboratories
PR	Preliminary Review
PRA	Preliminary Range Assessment
PRASA	Puerto Rico Aqueduct and Sewer Authority
PREQB	Puerto Rico Environmental Quality Board
PVC	polyvinyl chloride
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RTK	Real-Time Kinematic
SIA	Surface Impact Area
SOP	Standard operating Procedures
SSWP	Site-Specific Work Plan
SVOC	Semi-volatile organic compound
SWMU	Solid Waste Management Unit
TCLP	Toxicity characteristic leaching procedure

TM	Technical Memorandum
TOC	top of casing
TPH	Total Petroleum Hydrocarbon
TPH DRO	TPH Diesel Range Organics
USCS	Unified Soil Classification System
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UXO	unexploded ordnance
VNTR	Vieques Naval Training Range
VOC	volatile organic compound
VSI	Visual Site Inspection
WGS84	World Grid System of 1984

SECTION 1

Introduction

1.1 Background

This purpose of this Data Summary Report is to summarize the field activities and data collected for 12 sites investigated during a Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the former Atlantic Fleet Weapons Training Facility (AFWTF), also known as the former U. S. Navy Vieques Naval Training Range (VNTR), in Vieques, Puerto Rico. The Data Summary Report is intended as a status report, until the Phase I RFI Report can be completed using the background soil inorganics data. Once the background soil inorganics investigation has been completed, the background data will be compared to the site-specific data collected during the Phase I RFI to assist in evaluating the nature and extent of soil inorganics contamination. Therefore, the Data Summary Report will not be revised; rather, the Draft Phase I RFI Report (CH2M HILL, June 2004b) will be revised with the information from the background comparison and submitted as Draft Final. In addition, the revised Phase I RFI Report will include data conclusions and recommendations, which are not part of this Data Summary Report.

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On May 1, 2003, the Navy ceased training exercises on AFWTF. Following termination of training operations on Vieques, the 14,573 acres of the former AFWTF were transferred to the jurisdiction of the Department of the Interior (DOI). The property must be managed by DOI as part of the National Wildlife Refuge System, pursuant to section 1049 of the Nation Defense Authorization Act for Fiscal Year 2002 (Public Law 107–107). In addition, the former Live Impact Area (LIA), a 900-acre area, must be managed as a wilderness area without public access (Public Law 106–398; Public Law 107–107). Other former operational areas of the former AFWTF comprise the 2,500-acre Surface Impact Area (SIA), the 11,000-acre Eastern Maneuver Area (EMA), and the 200-acre Eastern Conservation Area (ECA).

The 12 sites addressed in the Phase I RFI comprise nine Solid Waste Management Units (SWMUs) and three Areas of Concern (AOCs) on the former AFWTF. These sites are located in the EMA and the SIA. Figure 1-1 shows the geographic location of Vieques in relation to mainland Puerto Rico and the surrounding islands. Figure 1-2 shows the locations of the areas of investigation within the EMA and SIA.

The sites included in the Phase I RFI per the Consent Order are:

- SWMU 1 – Camp García Landfill (Camp García)
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1.1.1 Objectives of the Investigation

The scope of the Phase RFI includes the following objectives:

- Determine whether or not releases of hazardous wastes, solid wastes, or hazardous constituents have occurred from each SWMU and AOC identified in the Consent Order by sampling appropriate environmental media (soil, groundwater, surface water, and/or sediment) and comparing the analytical results to screening criteria protective of human health and environmental receptors.

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As noted previously, the Data Summary Report is provided as a status report, whose objective is to describe the data collection activities and summarize the constituent concentrations detected. The Phase I RFI Report, to be prepared following completion of the background investigation, will satisfy the objectives above.

1.1.2 Organization of the Report

The Data Summary Report is organized as follows:

Section 1, Introduction, provides background information regarding the Phase I RFI, summarizes the purpose of the investigation, describes the location and environmental history of the facility, discusses previous investigations, and provides information concerning the physical setting of the facility.

Section 2, Field Investigation Procedures, summarizes the field investigation and data collection activities.

Sections 3 through 13 summarize the investigations performed at the 12 SWMUs and AOCs at the former AFWTF during June 2000, April 2003 (AOC-A), and January/February 2004. Each section includes the objectives of the Phase I RFI, a site description, results of previous investigations, summary of field activities, and summary of laboratory results.

Section 14, References, lists the documents cited in preparation of this report.

1.1.3 Previous Investigations

Several investigations were performed prior to the Phase I RFI.

The *Department of the Navy Environmental Impact Statement, Continued Use of the AFWTF Inner Range* (Tippetts, et al., 1979) presents history of military use and types and quantities of munitions used on AFWTF.

The *Initial Assessment Study, Naval Station Roosevelt Roads, Puerto Rico* (Greenleaf/Telesca, 1984) identified and assessed sites posing potential threats to human health or the environment as a result of potential contamination from past site operations. East Vieques sites SWMU 1 and SWMU 2 were assessed.

The *Phase II RCRA Facility Assessment of the Naval Ammunition Facility (NASD), Vieques, Puerto Rico* (Kearney/Brown & Associates, 1988) summarized the results from the Preliminary Review (PR) and Visual Site Inspection (VSI) phases of the RCRA Facility Assessment (RFA) at the former AFWTF. SWMUs 1, 2, 4, 5, 6/7, 8, 10, and 12, as well as AOCs F and G, were discussed in this report (although some were described with different nomenclature).

The *Revised RCRA Facility Assessment Report,* prepared by the Land Pollution Control Area, Hazardous Waste Bureau, of the Puerto Rico Environmental Quality Board (PREQB) in 1995, revised the earlier RFA submitted by A.T. Kearney, Inc., in 1988. This report was intended to identify the SWMUs and AOCs that could have potential releases or a history of hazardous waste releases at the former AFTWTF. SWMUs 1, 2, 4, 5, 6/7, 8, 10, and 12, as

well as AOCs A, F, and G, were discussed in this report (although some were described with different nomenclature).

A document entitled *Results of The Hydrogeologic Investigation, Vieques, Puerto Rico* (Baker Environmental, 1999) presented the results of hydrogeologic investigations completed in August 1999 at the EMA, an ecological screening evaluation (ESA), and a Baseline Human Health Risk Assessment (HHRA) for soil and groundwater exposure pathways.

The *Draft Air Photo Analysis of EMA/AFWTF* (ERI, 2000) documented activity at nine known SWMUs and three AOCs.

The *Draft Environmental Baseline Survey, Vieques Naval Training Range, Vieques, Puerto Rico* (Naval Facilities Engineering Command, 2003) documented the environmental condition of the property and categorized areas within the site as either "Clean" or "Requires Further Investigation." All SWMUs and AOCs discussed in the Phase I RFI were discussed in this report.

The *Final Draft Preliminary Range Assessment Report Vieques Naval Training Range, Vieques Island Puerto Rico* (CH2M HILL, 2003a) presented a summary of the types and quantities of munitions used on Vieques and a history of the military operations. Results of a preliminary field reconnaissance and a relative risk ranking of each site were presented.

1.2 Physical Characteristics of the Former AFWTF Study Area

This section summarizes the environmental setting of the former AFWTF, including site location, land use, climate, topography, surface water, geology, and hydrogeology.

1.2.1 Location

Vieques has a land area of approximately 33,000 acres. This island is located on the Antillean Island Arc separating the Caribbean Sea from the Atlantic Ocean, and is approximately 7 miles southeast of the eastern coast of the island of Puerto Rico (Figure 1-1). Vieques is approximately 21 miles long (east to west) and 4.5 miles wide (north to south).

The former AFWTF is located on the eastern one-third of the island. For the purposes of the EPA Consent Order and the Phase I RFI, the former AFWTF includes the SIA, LIA, and ECA (comprising 3,600 acres), as well as the adjacent and wholly contiguous EMA, comprising 11,000 acres. The former AFWTF was under the command of U.S. Naval Station Roosevelt Roads (NSRR), now referred to as U.S. Naval Activity Puerto Rico (NAPR). On May 1, 2003, the former AFWTF came under jurisdiction of the DOI. Figure 1-2 shows the locations of the EMA, SIA, LIA, ECA, and Camp García on east Vieques.

1.2.2 AFWTF History

Military training at AFWTF was initiated in the EMA and SIA in the mid-1950s and continued until the facility was closed in 2003. Marine forces simulated amphibious assault operations over suitable beachheads that included Blue, Green, Purple, Red, and Yellow beaches. These simulated assaults involved pre-assault operations, ship-to-shore movement, assault, consolidation, and withdrawal. While amphibious assaults were conducted with blank ammunition, Marine forces would conduct live firing on ranges in the EMA with

weapons that included pistols, rifles, machine guns, grenades, tanks, artillery, recoilless rifles, and mortars. Large-scale artillery exercises were completed in which large-scale artillery was fired from gun positions in the EMA toward targets in the SIA and LIA (Tippetts, et al., 1979).

During 1966, six ranges were established in the EMA along the Northern Coast Road where Engineers Road ends. These ranges remained operational through February 1999, when they were deactivated. The EMA also provided maneuvering space and ranges for the training of Marine amphibious units and battalion landing teams in exercises of amphibious landings, small arms fire, artillery and tank fire, shore fire control, and combat engineering tasks.

The ranges included the following:

- Range 1: Small Arms Range using service rifles, pistols, and machine guns
- Range 2: Small Arms Range using pistols and shotguns
- Range 3: Rifle Grenade Range (40mm) and small arms
- Range 4: Anti-armor/Antipersonnel Live Fire Tracking Range using 3.5-inch rockets and light anti-craft weapons (LAWs)
- Range 5: Hand Grenade Range using various types of grenades
- Range 6: Demolition and small arms range

AFWTF began developing facilities in the LIA in 1964 when it established a gunnery range used for air-to-ground ordnance delivery and naval gunfire training. By the 1970s, the LIA maintained several targets for aerial bombing, including old tanks and vehicles which were used as mock-ups, two bulls-eye targets, and a strafing target. In addition, several point and area targets upon which ships could practice naval gunfire support were established in the LIA. Unserviceable military munitions were periodically received from the former NASD on the west end of Vieques for demolition at the OB/OD area at the LIA. The locations of the ranges, targets, and gun positions are shown on Figure 1-3.

An aerial photograph analysis of the EMA and SIA (CH2M HILL, 2003a) indicated that as many as nine ranges and up to 30 gun emplacements and positions may have existed historically at the EMA, and that up to nine gun positions and eight observation post areas, which potentially may have been used for mortar or artillery gun training, existed at the SIA component of the former AFWTF. These locations are illustrated in Figure 1-3.

The MRSs at AFWTF that potentially contain munitions and explosives of concern (MEC) will be investigated under CERCLA following the completion of the national priority list (NPL) listing of the facility.

1.2.3 Land Use

Conservation Zones were established at AFWTF in accordance with a 1983 Memorandum of Understanding (MOU) between the Commonwealth of Puerto Rico and the Navy. Four Class I Conservation Zones were established as part of the 1983 MOU and five Class II Conservation Zones were established as part of the Navy's Land Use Management Plan. Under former Navy operational guidelines, Class I areas could not be used for purposes

other than conservation, were protected from damaging activities, and were managed to protect and maintain their natural value. Class II areas were managed to protect various environmentally sensitive habitats and natural areas. Certain restricted military and civilian uses were permitted in these Class II areas.

The Conservation Zones are illustrated in Figure 1-4 and include:

- The Punta Este Conservation Zone, which is located on the southeastern end of the LIA and consists primarily of drought-resistant scrub that no longer can be found in Puerto Rico except on former Navy property on Vieques.
- The Cayo Conejo Conservation Zone, a small island located southwest of the LIA in the Bahia Salina del Sur area. This area is an important nesting habitat for the endangered brown pelican and one of the last nesting areas for this species in Puerto Rico.
- The Ensonada Honda Conservation Zone, which lies between Blue and Yellow Beaches on the southern coast of Vieques. This area has the best example of lowland forest growth on Vieques and is also home to a variety of extensive mangrove populations that appear to be healthy and expanding.
- The South Coast Bays Conservation Zone, located on the southern coastline of Vieques directly south of the Camp García area and western portions of the EMA. Two bays at this location, Bahia Tapon and Puerto Mosquito, have bioluminescent properties and are valuable tourism resources for the island.

The Navy integrated these zones into its Land Use Management Plans (LUMP) for Vieques, most recently updated in 1996. The intent of the conservation zones is preservation of these unique areas as important components of the overall environmental health of Vieques.

Since the transfer of the property from the Navy to DOI on April 30, 2003, the 14,573 acres of the former AFWTF are to be managed by DOI as part of the National Wildlife Refuge System, pursuant to Section 1049 of the Nation Defense Authorization Act for Fiscal Year 2002 (Public Law 107–107). In addition, the 900 acres of the former LIA will be managed as a wilderness area without public access (Public Law 106–398; Public Law 107–107).

Following the property transfer, the Blue Beach and Red Beach areas of the former AFWTF were opened for recreational use by the public. However, the easternmost two-thirds of the former AFWTF are restricted from public access because of the potential hazards associated with MEC.

DOI is developing a Comprehensive Conservation Plan (CCP) for the Vieques National Wildlife Refuge that will outline its concept for managing the refuge. The environmental restoration of the former AFWTF will be based upon relative risk to human health and the environment and the future land use identified in the CCP.

1.2.4 Climate

The climate of Vieques is characterized as warm and humid (tropical-marine), with frequent showers occurring throughout the year. The easterly trade winds blowing across the island year-round moderate the temperature on Vieques throughout the year, resulting in an annual mean temperature of 79°F to 80°F. The island's average rainfall is approximately 36 inches, with extremes of 25 inches in the east and 45 to 50 inches in the west (PREQB, 1995).

1.2.5 Topography and Surface Water

The topography of Vieques consists generally of hills and valleys throughout the entire island. The western side of the island consists of gently rolling hills with a deeper soil profile than the eastern side, which consists of more exposed, rugged terrain. The highest point on the western side is approximately 1,000 feet above mean sea level (msl) at Monte Pirata. The highest point on the eastern side is approximately 420 feet above msl at Cerro Matias. The coastal areas contain generally level terrain made up of primarily lagoons and mangrove swamps. The OB/OD locations within the LIA are relatively level areas containing irregular drainage patterns as a result of former bombing exercises (PREQB, 1995). Figure 1-2 shows the topography of the former AFWTF.

The streambeds found on Vieques flow either to the north or to the south until they reach the sea. Vieques does not have any perennial surface drainage; approximately 90 percent of the rainfall is lost to evaporation, based on statistic data from the U.S. Virgin Islands. Of the remaining 10 percent, approximately 5 percent infiltrates into the ground to recharge the aquifer, and 5 percent becomes surface runoff. The surface runoff from the 12 sites addressed in this report generally flows south toward the sea.

1.2.6 Geology

Vieques was formed from sedimentary and volcanic and other igneous rocks. The island bedrock is mostly granodiorite, quartz diorite, and some lava. In the central portion of the former AFWTF, the bedrock is exposed and weathered. Because of the weathering of the bedrock, gravel, sands, and finer particles wash downhill during storms. Over the years, this material has gathered in valleys near the ocean, forming alluvial deposits. The alluvial sedimentary deposits generally consist of a mixture of gravel, sand, silt, and clay. The distribution of the geologic formations in eastern Vieques is illustrated on Figure 1-5. The upland areas are underlain by three rock types: Upper Cretaceous volcanic rocks such as Andesite, Upper Cretaceous or Lower Tertiary intrusive rocks such as granodiorite, and Upper Tertiary and Quaternary sedimentary rocks such as limestone (Figure 1-5). The lowland areas are unconsolidated sediments of Quaternary age, consisting of alluvial deposits, beach and dune deposits, and swamp and marsh deposits (CH2M HILL, February 2001).

The Upper Cretaceous rocks in the upland areas appear to be the oldest exposed rocks on Vieques. These rocks are believed to have been deposited in a marine environment, as was the case with rocks of the same age on the island of Puerto Rico.

Limestone of the upper Tertiary age is found in peninsulas extending into the sea from the southern and eastern coasts of Vieques. Limestone of the Tertiary-Miocene age is also found along these coasts, and is commonly referred to as Puerto Ferro limestone. Quaternary age deposits are typically found in the valleys and coastal areas. These deposits include beach, swamp, and alluvial deposits. Areas of sand, swamp, and salt mud occur in the coastal areas.

Rocks are primary sources of the constituents that make up the unconsolidated deposits and that are found in soil. Most rocks are formed from elements such as oxygen, silicon, aluminum, iron, magnesium, calcium, potassium, and sodium (USGS, 1997). Specifically, the common bedrock types found on Vieques (granodiorite and quartz diorite) typically are composed of approximately 61 to 66 percent silicon dioxide, 16 to 17 percent aluminum

oxide, 2 to 3 percent ferric oxide, 2 to 4 percent ferrous oxide, 1 to 3 percent magnesium oxide, 3 to 6 percent calcium oxide, 3 to 4 percent sodium oxide, and 2 to 3 percent potassium oxide (Travis, 1955). Chemical and physical processes break down the rocks and form minerals that are characteristic of the parent material. Human influences, such as agricultural processes, can also contribute to the constituents found in the soil..

1.2.7 Soils

The soil on Vieques is a direct product of the island's bedrock which, as indicated previously, consists mostly of granodiorite, quartz diorite, some volcanic lavas, and marine sedimentary deposits such as limestone. Soils on Vieques are primarily residual, because of both climatic conditions (i.e., weathering) and parent rock type. The eastern side of the island has poorly developed soil due to the relatively impermeable volcanic rock and relatively low precipitation.

Based on the generalized geology of Vieques Island map (Torres-Gonzalez, 1989) five general categories, based on geologic origin, are present in eastern Vieques:

1. Qa - Alluvial deposits (sand, silt, and clay)
2. Qb - Beach and dune deposits (calcite, quartz, volcanic rock fragments and minor magnetite)
3. TI - Marine sedimentary rocks (report indicated variable limestones)
4. Kv - Sandstone, siltstone, conglomerate, lava, tuff, and *tuffaceous breccia*
5. KTd - Plutonic rock made up largely of granodiorite and quartz diorite

Figure 1-5 shows the extent of each geologic zone in relation to the installation restoration (IR) sites. A review of IR site locations shows that SWMUs 4, 6, 7, and 10, and AOC G are located in geologic zones identified as KTd. SWMU 2, 5, 8, 12, AOC A, and AOC F are located in geologic zones identified as Kv. SMWU 1 is located in geologic zones Kv and Qa.

1.2.8 Groundwater

The groundwater on eastern Vieques occurs in both the unconsolidated alluvial deposits and the bedrock. A groundwater aquifer within alluvial deposits called the Valle de Esperanza is located beneath the southern portion of the island near Camp García (Figure 1-6). As discussed previously, approximately 5 percent of the annual precipitation infiltrates through the ground and supplies the aquifers. The Valle de Esperanza aquifer previously supplied drinking water to Camp García and OP-1. The Puerto Rico Aqueduct and Sewer Authority (PRASA) provided the water through of a series of 16 wells that pumped approximately 450,000 gallons of water per day (gpd). These wells are no longer active, however, because the water supply was replaced with the installation of a water line from Puerto Rico to Vieques in 1978. Vieques is now supplied by surface water from the main island of Puerto Rico.

The U.S. Geological Survey (USGS) performed a groundwater study on Vieques, including tests on the wells near Esperanza. The results indicated that the groundwater contained high concentrations of sodium bicarbonate. Because of its high sodium content, the groundwater in the Valle de Esperanza aquifer is not suitable for extended irrigation use.

The high levels of sodium result from sea spray infiltrating into the ground, and saltwater entering the groundwater supply as a result of excessive groundwater withdrawal (Torres-Gonzalez, 1989).

Bedrock in the upland areas of the former AFWTF is predominantly unweathered, highly impermeable granodiorite; the porosity is very low, and the potential for groundwater development is limited. In the vicinity of Camp García toward the coast, clayey alluvium overlies the granodiorite. Samples from wells in the Camp García area show mostly saline water in the clayey alluvium. Historical data show that prior to the development of the well field in Esperanza Valley in 1945, groundwater levels in the Camp García area were approximately 10 feet (ft) below land surface (bls). From 1961 to 1965, water level declines from 2 to 20 ft were recorded in three wells in the area. Well yields also declined from approximately 35 gallons per minute (gpm) to approximately 10 gpm (Torres-Gonzalez, 1989).

During a hydrogeologic investigation in August 1999 (Baker, 1999), monitoring wells were installed along the western perimeter of the AFWTF. During the study, depth to groundwater ranged from approximately 36 ft bls in the alluvial deposits in the valleys to a depth 131 ft bls in the bedrock within the hills along the northern portion of the site. Figure 1-7 shows the transect of the hydrogeologic cross sections of the western perimeter area portrayed in Figures 1-8 and 1-9. The bedrock potentiometric surface is located at an elevation significantly higher that the elevations where groundwater was first encountered during drilling of the bedrock wells and piezometers. Also, groundwater occurrence within the bedrock formation is associated with secondary porosity features (i.e., fractures and joints). These data indicate that the fractures and joints within the bedrock store the groundwater and that the recharge areas for the fractures and joints are at higher elevations than the portions intersected by the wells and piezometers. This also indicates that the primary porosity of the bedrock formation is low enough to limit groundwater occurrence and movement to secondary porosity features (i.e., fractures and joints).

The groundwater elevation data for the bedrock indicate that a groundwater flow divide exists within the bedrock at the approximate mid point of the island north of Camp García. (Figure 1-10). Generally, groundwater north of monitoring well NW-3 flows north toward the Atlantic Ocean and groundwater south of NW-3 flows south toward the Caribbean Sea (Baker, 1999).

1.2.9 Ecological Resources

1.2.9.1 Vegetation

Vegetative cover on the eastern third of Vieques consists of heavy, dense vegetation dominating most available land area. The canopy consists primarily of deciduous trees with the non-native mesquite dominating the species distribution. A number of tree species are thorny and low-lying brush is present throughout. Tall grasses are interspersed within the thorny tree and brush landscape. The majority of the island's vegetation, with the exception of populated areas in the center of the island, tends to form a complete ground cover.

Twelve distinct community types have been delineated and described on the AFWTF. These include bare ground disturbed by human activities, open sandy beach and adjacent beach vegetation in salt spray zone, shallow salt/sand flat, open-water lagoon, mangrove

communities, evergreen scrub of drought-resistant shrubs on rocky coasts and limestone formations, mixed woodland of deciduous formations on inner hills and slopes, forest scrub along drainages in mangrove forests, forested, sparse thorn scrub, thick thorn scrub, and grassland that is slowly changing back to thorn scrub (NAVFACENGCOM, 2003).

1.2.9.2 Conservation Zones

As previously stated, four Conservation Zones have been established to protect the natural resources in those areas which are illustrated in Figure 1-4. These zones are described in Section 1.2.3.

1.2.9.3 Wildlife

Because of its island ecosystem, neither abundance nor diversity of terrestrial vertebrates is found on Vieques. The ocean barrier impedes natural dispersion. Some 25 orders of insects, represented by 5,066 species, are present on Vieques. Eight species of crustaceans and six species of mollusks are known to occur in the nearshore coastal habitat of Vieques. At least 22 amphibious and reptilian species have been reported on Vieques: 3 frog types, the marine toad, 11 lizards and geckos, the worm snake, the ground snake, 1 freshwater turtle, and 4 sea turtles. Approximately 120 species of land birds have been reported on the island, along with 39 species of lagoon birds and 13 species of seabirds. While some of these birds breed on Vieques, others are non-breeding residents, winter migrants, or accidental strays. Bats are the most numerous group of mammals on Vieques and one species, the red fruit bat, is reported to be the only surviving endemic mammal on the island. All other mammals, including house mice, rats, mongooses, domestic animals, wild horses, and feral cats and dogs, have been introduced by humans (The Environmental Company [TEC], 2002).

Coastal aquatic communities can include a large diversity of aquatic plants, fish, and invertebrates. Unique or protected habitats, such as bioluminescent bays and Conservation Zones, also occur along the coastline. Mangrove communities typically include black, red, and white mangroves, and support a diverse community of invertebrates, including snails (e.g., periwinkles, limpets), mussels, tree oysters, crustaceans (e.g., fiddler crabs, blue crabs, barnacles), anemones, jellyfish, and small or juvenile fish species (e.g., French grunts, parrotfish, mangrove snapper). Seagrass beds occur in calm waters and support various small invertebrates (e.g., polychaetes, amphipods, sea urchins, sponges) and fish (e.g., anchovies, silversides, flounder). Coral reefs occur in various sizes and locations and support a highly diverse community of invertebrates (e.g., hard corals, soft corals, sponges, shrimp, crabs, starfish, sea urchins) and fish (angelfish, damselfish, barracuda, snapper, grunts, wrasses).

1.2.9.4 Federally Listed Species

Several plant and animal species that occur on Vieques have been identified by Federal authorities as threatened or endangered. Table 1-1 presents a list of these species.

TABLE 1-1
Federally Listed Plants and Animals on Vieques Island
RCRA Facility Investigation, Phase I

Species	Federal Status
Plants	
Cobana negra	T
Thomas' lidflower	E
Chamaecrista glandulosa var. mirabilis	E
Beautiful goetzea	E
Eugenia woodburyana	E
Reptiles	
Hawksbill sea turtle	E
Leatherback sea turtle	E
Green sea turtle	T
Loggerhead sea turtle	T
Kemp's ridley sea turtle	E
Olive ridley sea turtle	T
Birds	
Brown Pelican	E
Roseate tern	T
Mammals	
West Indian manatee	E
Fin whale	E
Sei whale	E
Humpback whale	E
Sperm whale	E
Blue whale	E

Source: TEC, 2002
T = threatened
E = endangered

1.3 Use of Background Data

Because inorganics are naturally occurring and are the primary constituents composing the rock and soil strata on Vieques, a background investigation is planned for eastern Vieques to develop a set of soil inorganics data representative of background conditions (i.e., representative of naturally occurring areas and areas not affected by sites under investigation). The background inorganics data will be compared to site-specific inorganics data for two purposes:

- **To help delineate the nature and extent of inorganics contamination at various sites.** During the investigation process, the background inorganics data will be compared to site-specific inorganics data to assess whether the site-specific inorganics concentrations are consistent with background or representative of a potential release. In this way, the nature and extent of potential releases, if present, will be adequately delineated.
- **To help make risk management decisions following completion of quantitative risk assessments.** Following completion of a quantitative risk assessment involving soil inorganics, the background inorganics data will be compared to the site-specific

data for the inorganics that represent an unacceptable level of potential risk to determine if the site-specific inorganics concentrations are consistent with background. It is emphasized that this background data comparison will be done following the risk assessment and will not be used to screen out inorganic constituents prior to determination of potential risk.

The background data use process is graphically displayed in Figure 1-11. There may be site-specific circumstances when the background data may be used to obviate the need for a quantitative risk assessment. For example, where inorganics are the only site-specific constituents that exceed risk-based screening criteria and the site-specific inorganics concentrations are consistent with the background levels, no quantitative risk assessment will be necessary. In addition, if the concentrations of certain site-specific inorganics that are deemed not to be site-related are above background levels, they may be deemed not to represent a release and may be eliminated from further consideration via a risk management decision versus a comprehensive risk assessment. It is emphasized that this determination will be done on a site-specific basis.

It should be noted that some sites may have inorganics concentrations that exceed background and screening levels (which are conservative screening levels), but the qualitative risk assessment shows they do not pose an unacceptable risk.

British Virgin Islands

Anegada

U.S. Virgin Islands

Virgin Gorda

Tortola

St. Thomas

St. John

San Juan

Culebra

U.S. Naval Activity Puerto Rico

PUERTO RICO

VIEQUES

WEST VIEQUES (Former NASD)

Former AFWTF

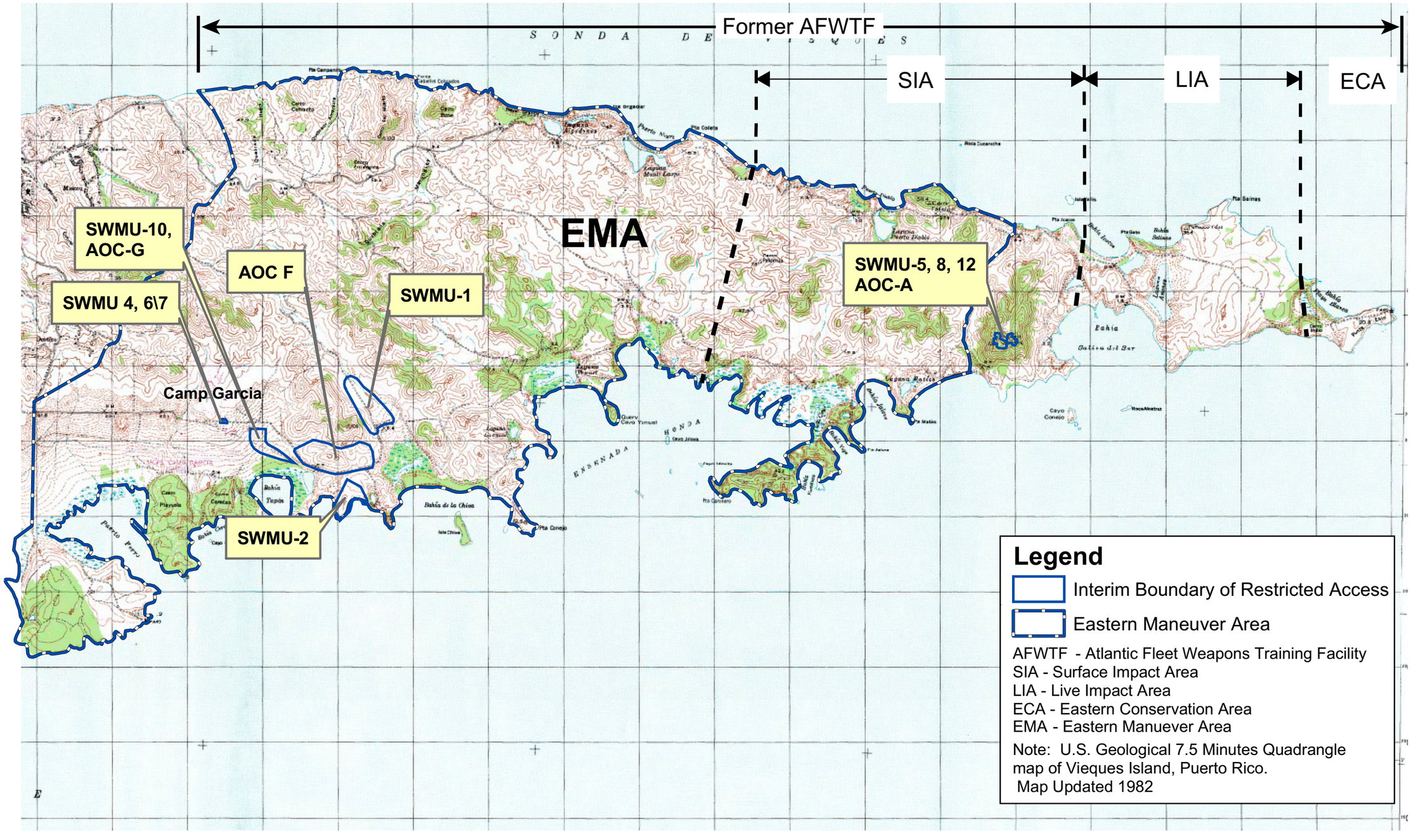
St. Croix

N

Scale in Miles

0 15

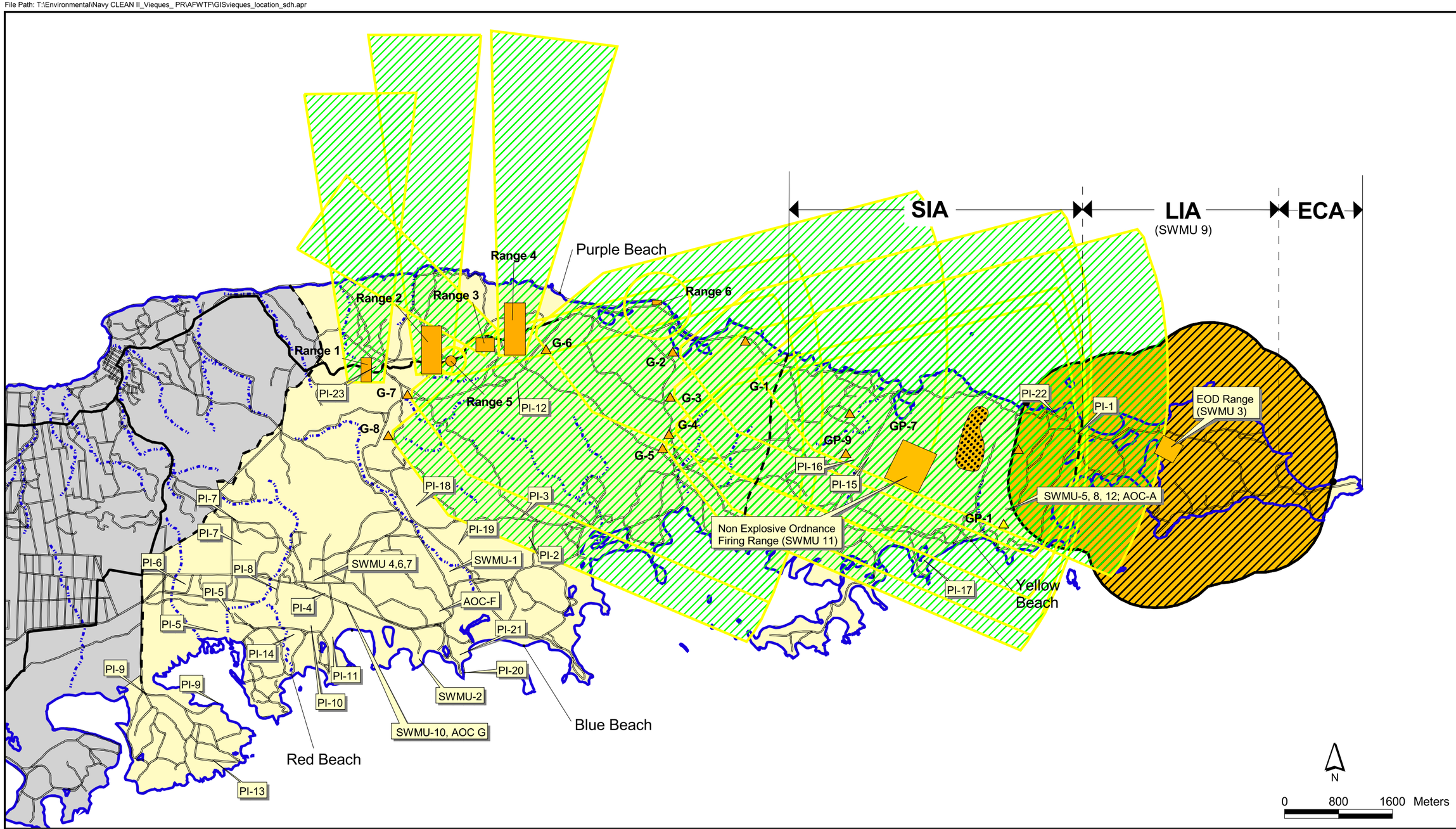
Figure 1-1
Regional Location Map
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico



CH2MHILL

Figure 1-2
Former AFWTF Site Location Map
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

File Path: T:\Environmental\Navy CLEAN II_Vieques_ PR\AFWTF\GISvieques_location_sdh.apr



LEGEND

- Roads
- Hydrography
- Streams
- Property Line
- Navy Property
- Non-Navy Property

Ordnance / Explosives Sites

- Gun Position
- Explosive Safety Quantity Distance Arc
- General Location of Marine Artillery Targets
- Small Arms/Artillery Ranges
- Artillery Safetyfan

Environmental Sites

- Swmu, AOC, PI Sites

ECA - Eastern Conservation Area
LIA - Live Impact Area
SIA - Surface Impact Area

Figure 1-3
Potential Environmental and Ordnance / Explosives Impacted Areas
Former AFWTF, Puerto Rico

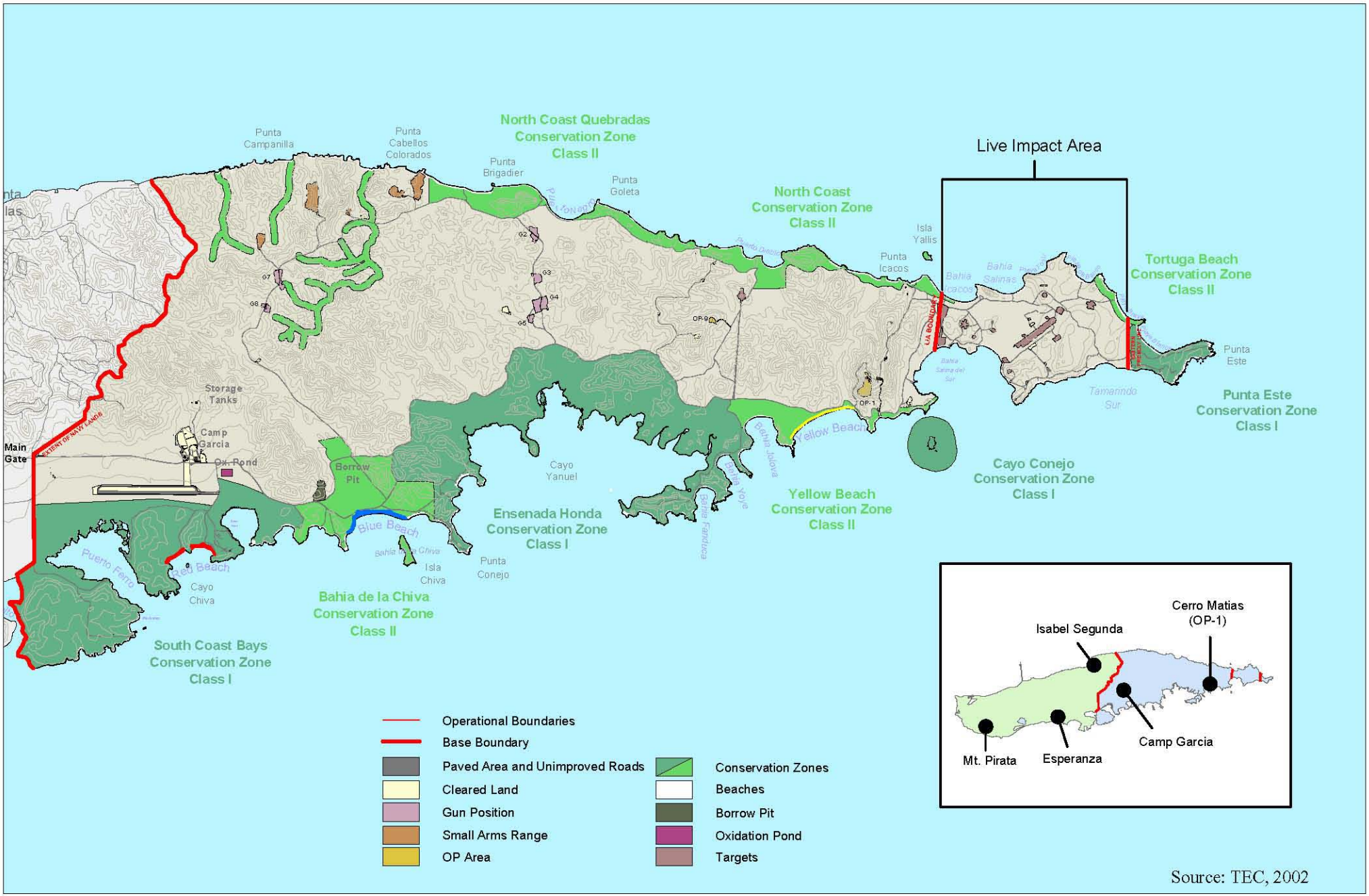
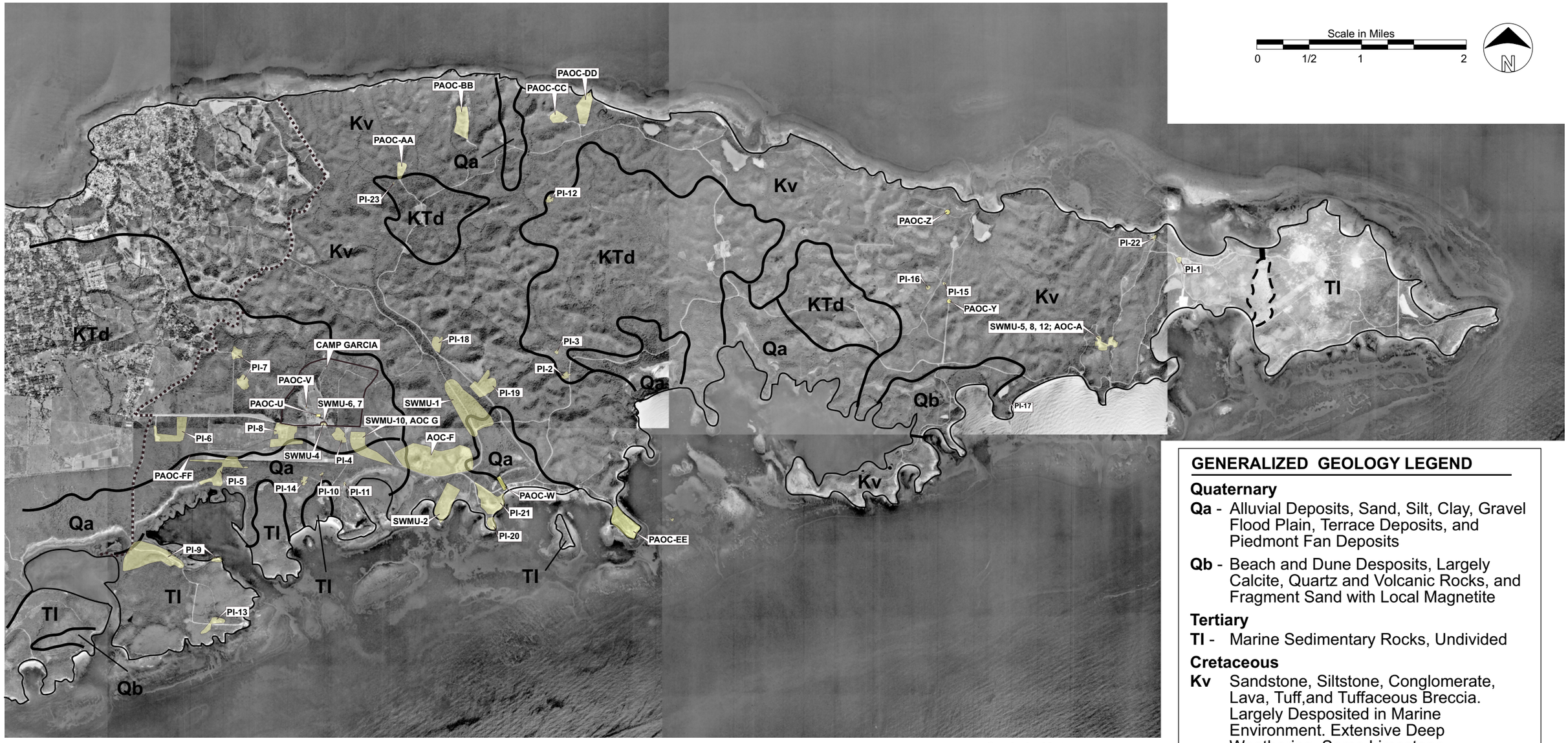


Figure 1-4
Conservation Zones of Vieques
Former Atlantic Fleet Weapons Training Facility
Vieques, Puerto Rico



Base imagery is comprised of 1994 1-meter USGS Digital Ortho-imagery quarter quadrangles (DOQQs).

GENERALIZED GEOLOGY LEGEND

Quaternary

Qa - Alluvial Deposits, Sand, Silt, Clay, Gravel Flood Plain, Terrace Deposits, and Piedmont Fan Deposits

Qb - Beach and Dune Desposits, Largely Calcite, Quartz and Volcanic Rocks, and Fragment Sand with Local Magnetite

Tertiary

Tl - Marine Sedimentary Rocks, Undivided

Cretaceous

Kv Sandstone, Siltstone, Conglomerate, Lava, Tuff,and Tuffaceous Breccia. Largely Desposited in Marine Environment. Extensive Deep Weathering. Some Limestone.

KTd- Plutonic Rocks, Largely Grandiorite,and Quartz Diorite, Locally Deeply Weathered (from Torres-Gonzalez, 1989)

LEGEND

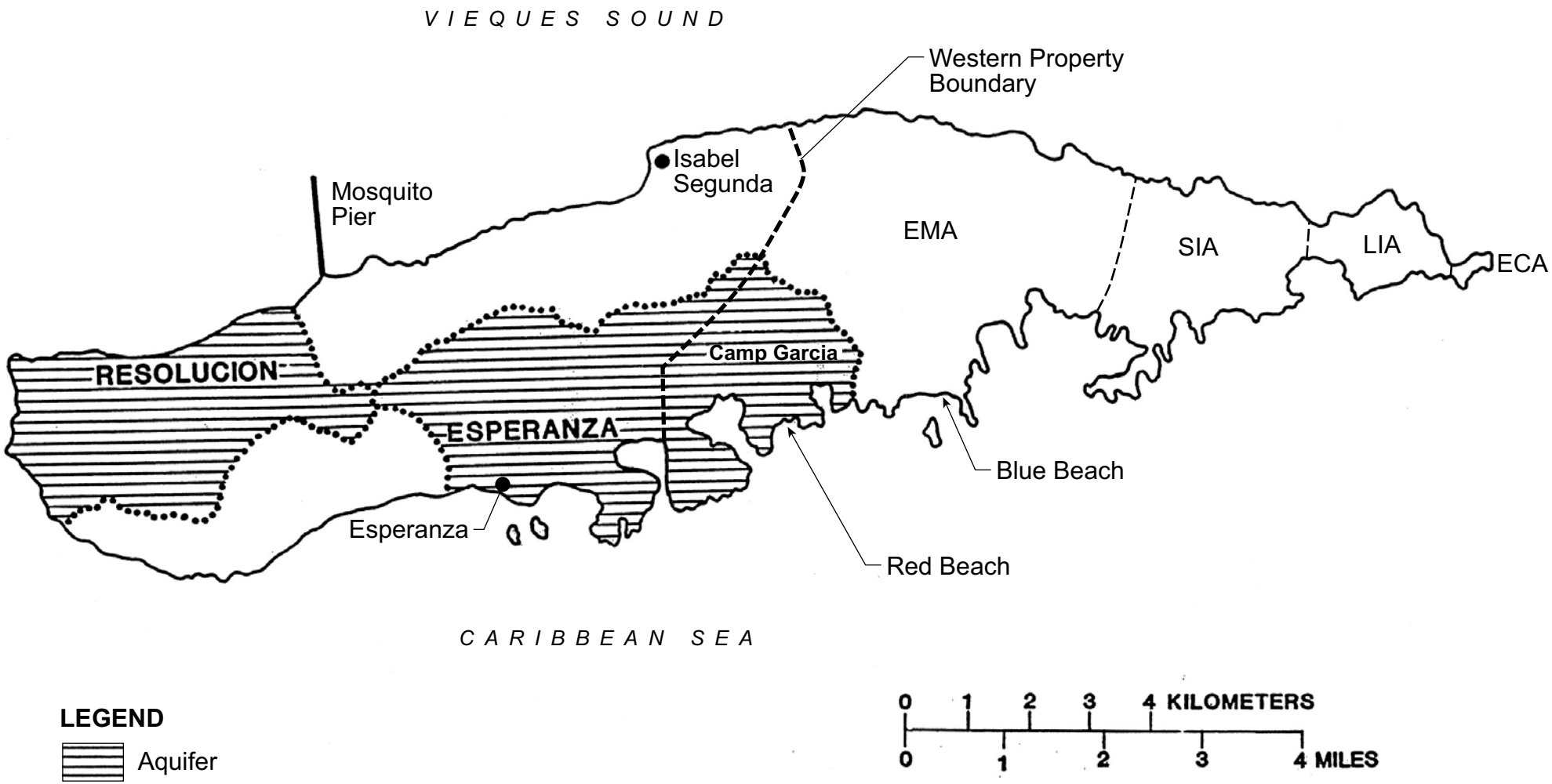
AOC = Area of Concern

PAOC = Potential Area of Concern

PI = Photo Identified Site

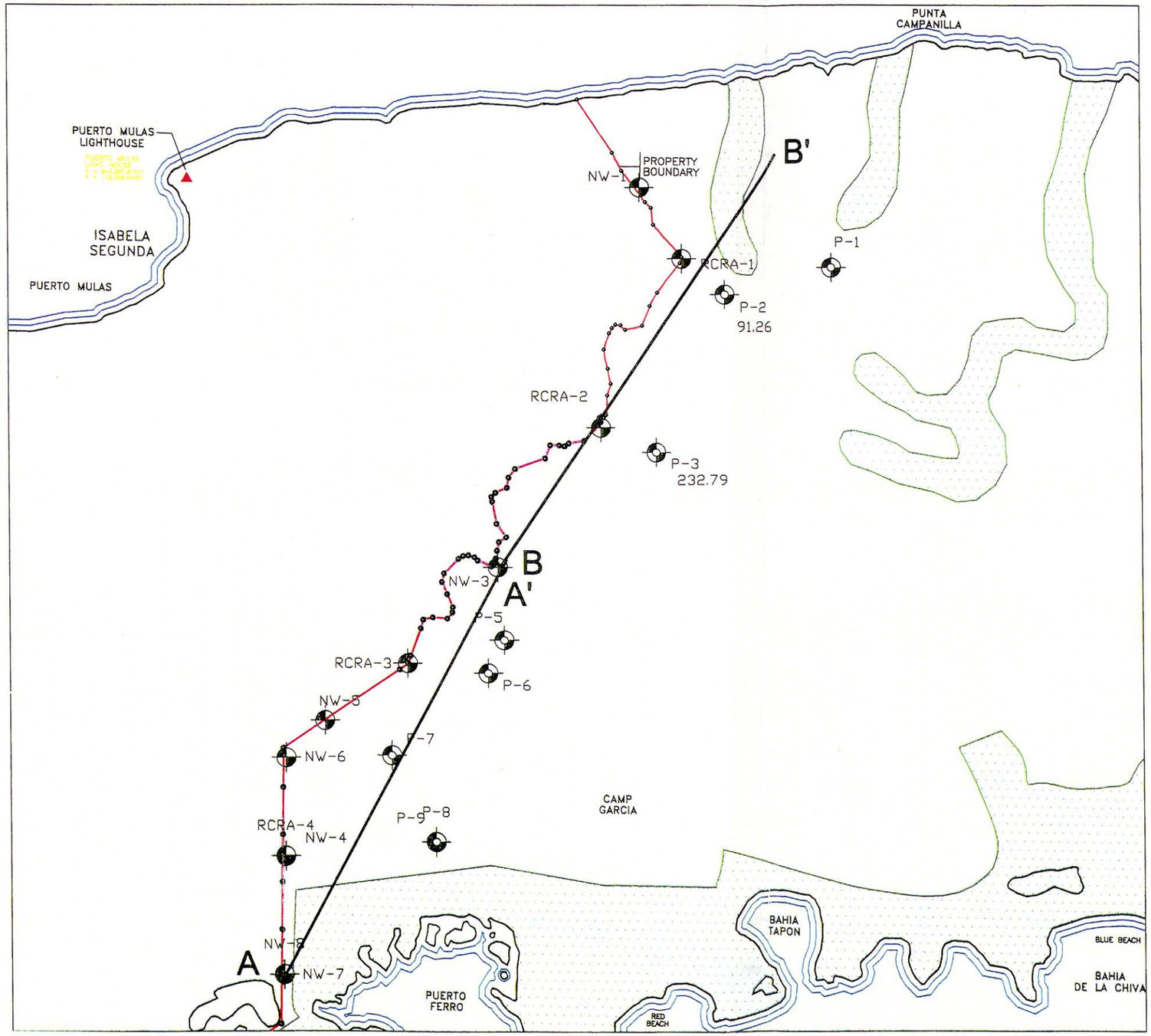
SWMU = Solid Waste Management Unit

Figure 1-5
Generalized Geology of Former AFWTF
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico



(Reference: Torres - Gonzalez, 1989)

Figure 1-6
Resolución and Esperanza Aquifers
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico



LEGEND

RCRA-1 MONITORING WELL

P-1 PIEZOMETER

SHORELINE

A — A' HYDROGEOLOGIC CROSS-SECTION

AFWTF PROPERTY LINE

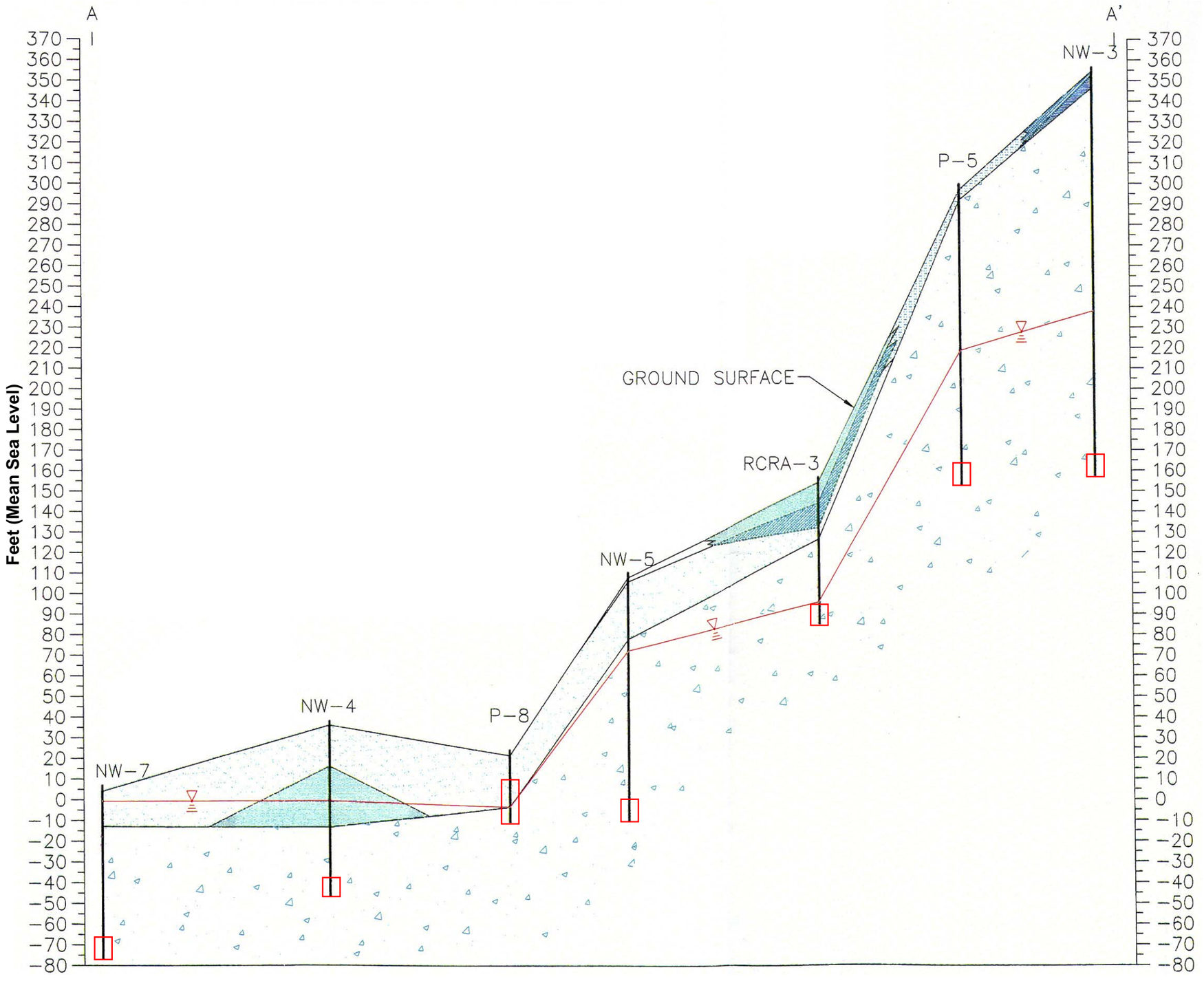
2400 0 1200 2400

1 inch = 2400 ft.

N W E S

Source: Developed from Baker, 1999

FIGURE 1-7
Hydrogeologic Cross-Section Location Map
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico



LEGEND

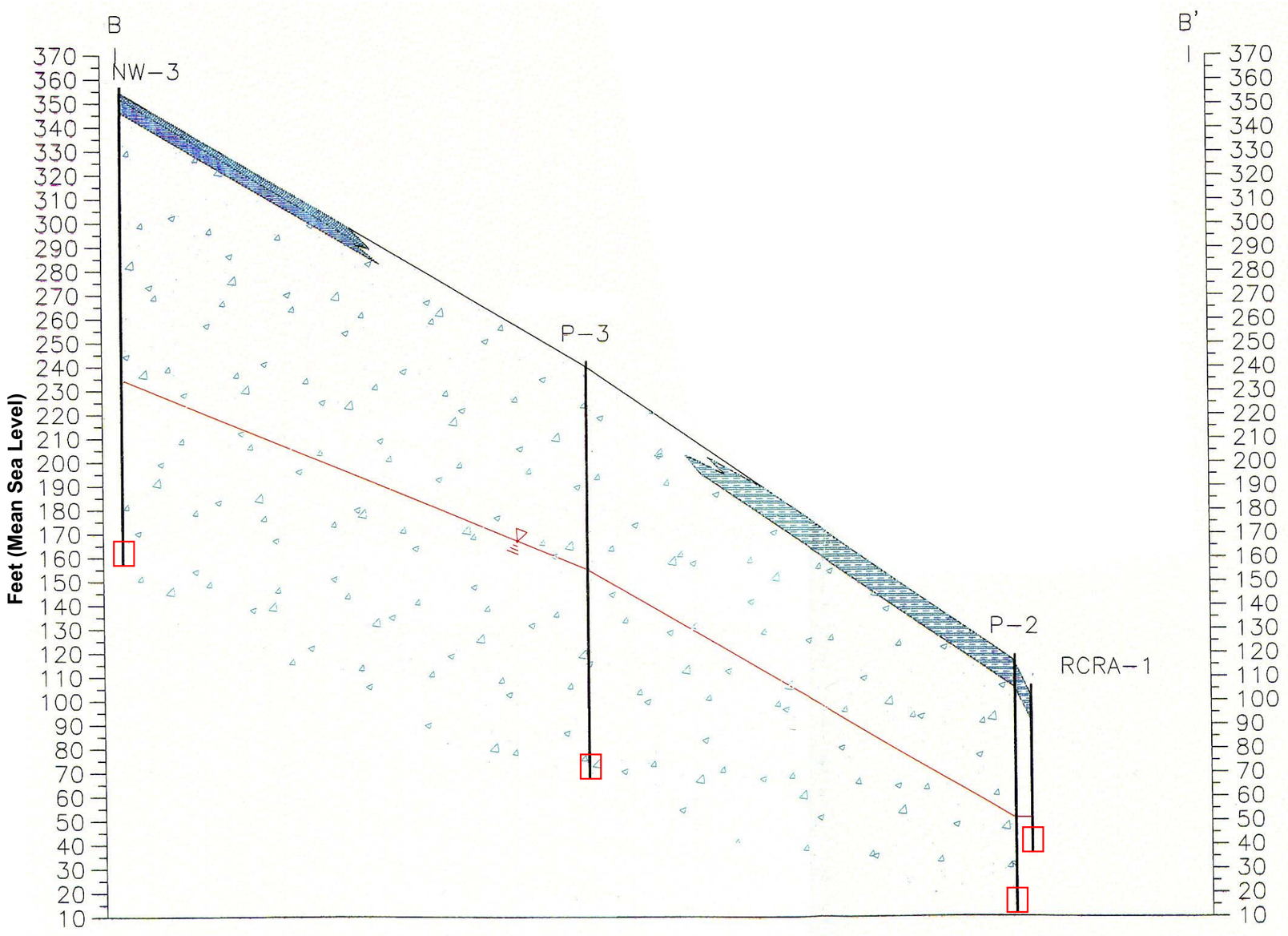
- WELL GRADED SANDS
- POORLY GRADED GRAVELS
- POORLY GRADED SANDS
- SILTY SANDS
- CLAYEY SANDS
- SILTY GRAVELS/SILTY SAND
- GRANODIORITE
- MONITORING WELL/PIEZOMETER
- SCREENED INTERVAL
- GROUNDWATER SURFACE

50 0 25 50
1 inch = 50 ft.
VERTICAL SCALE

1000 0 500 1000
1 inch = 1000 ft.
HORIZONTAL SCALE

Source: Developed from Baker, 1999

Figure 1-8
Hydrogeologic Cross-Section A-A'
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico



LEGEND

- SANDY CLAY/SILTY CLAY
- CLAYEY SANDS
- SILTY GRAVELS/SILTY SAND
- GRANODIORITE
- MONITORING WELL/PIEZOMETER
- SCREENED INTERVAL
- GROUNDWATER SURFACE

50 0 25 50
1 inch = 50 ft.
VERTICAL SCALE

1000 0 500 1000
1 inch = 1000 ft.
HORIZONTAL SCALE

Source: Developed from Baker, 1999

Figure 1-9
Hydrogeologic Cross-Section B-B'
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

SECTION 2

Field Investigation and Data Analysis Procedures

This Data Summary Report for the Phase I RFI at the former AFWTF summarizes the activities and results of the soil and groundwater sampling and surveying, geophysical surveys, and MEC avoidance surveys. The groundwater investigation included monitoring well installation, groundwater sampling and groundwater elevation monitoring. The initial field investigation for 6 of the 12 sites was conducted in June 2000 (April 2003 for AOC A), during which surface and subsurface soil samples were collected at SWMUs 4, 6/7, 10, AOC A, and AOC F. The second field investigation took place in January and February 2004, with work being conducted at SWMUs 1, 2, 4, 5, 8, 10, 12, and AOC G. SWMU 6/7, AOC A, and AOC F were not investigated during the second field investigation of the Phase I RFI field effort, but are discussed in this report. The approved Site-Specific Work Plan for the Phase I RFI (CH2M HILL, June 12, 2003c) contains the sampling rationale for all sites discussed in the Data Summary Report.

During the January and February 2004 field investigation, representatives from EPA Region 2 and PREQB were present onsite to review the sampling procedures, observe monitoring well installation, and participate in split sample collection. Split samples for all media were collected at various SWMUs and AOCs by EPA and PREQB and submitted for analysis at laboratories contracted directly to the respective agencies. The samples collected in this shared sampling effort are displayed in Table 2-1.

Data were collected in general accordance with the standard operating procedures (SOPs) presented in the *Master Work Plan for the Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico* (CH2M HILL, 2003a) and with the Field Sampling Plan checklist presented in the *Site-Specific Work Plan for the Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico* (CH2M HILL, 2003b). The Master Work Plan (MWP) and Site-Specific Work plan (SSWP) were approved by EPA and PREQB prior to the start of field activities. Brief descriptions of the field procedures used during the Phase I RFI are provided in the following subsections. Detailed descriptions of the field investigations sampling protocol can be found in the SSWP.

It is noted here that "inorganics" and "metals" are used interchangeably throughout this report, and are identified here as synonymous.

2.1 Decontamination of Sampling Equipment

Drill rigs and auger flights were decontaminated with potable water using a high-pressure steam cleaner before use and between borings. Non-disposable sampling equipment comprising pumps, sampling spoons, split-spoons, hand augers, and bowls were decontaminated between each sample location using the following procedure:

- Rinse with potable water to remove most of the soil

- Wash with scrub brush using potable water and Liquinox™
- Rinse with potable water
- Rinse with distilled water
- Rinse with isopropyl alcohol
- Rinse with laboratory grade deionized water
- Air dry

All decontamination fluids were managed in accordance with the Investigation-derived waste (IDW) procedure in the MWP.

2.2 Monitoring Well Installation

The SSWP called for the installation of monitoring wells at two sites: five monitoring wells at SWMU 1 and five monitoring wells at SWMU 10. Each monitoring well was constructed with a 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) well casing and 10 or 15-ft well screen. The annular space between the well screen and borehole was filled with a silica sand pack that extended above the well screen. A bentonite seal was installed above the sand pack and the annular space above the bentonite seal was filled with a cement/bentonite grout. Each monitoring well was equipped with a concrete pad, a protective surface casing with a locking cap to minimize unauthorized access to the wells, and two protective bollards.

The monitoring well screens were installed into the first encountered groundwater within the bedrock using hollow stem auger and air hammer drilling methods. Monitoring well CGW1MW03 at SWMU 1 was the only monitoring well installed by using only the hollow stem auger drilling technique. All others used a combination of hollow stem auger drilling to bedrock followed by air rotary drilling to the water zone. During the drilling of the boreholes for these monitoring wells, drill cuttings were collected either continuously or at approximately 5-ft intervals until rock was encountered. The cuttings were examined for lithology and all wells were logged in the field during drilling.

In addition, drill cuttings were screened in the field with an Organic Vapor Meter (OVM) or an Organic Vapor Analyzer (OVA) for the potential presence of volatile organic compound (VOC) vapors. The well construction details are presented in the site-specific discussions of this report. Well construction information is presented in Section 3 for SWMU 1 and in Section 9 for SWMU 10.

Drill cuttings generated during monitoring well installation and water generated during well purging and equipment decontamination were collected and stored onsite in properly labeled 55-gallon drums. Composite soil and water samples were collected from these drums and analyzed for reactivity, corrosivity, ignitability, TCLP VOCs, SVOCs, metals, herbicides, and pesticides. The drums were then transported off Vieques and disposed of at the BFI landfill in Ponce in accordance with the waste characterization results.

2.3 Monitoring Well Development

Monitoring well development was performed at SWMU 1 and SWMU 10 using a procedure of surging with a 2-inch surge block, then pumping with either a stainless steel Grundfos® submersible pump, a Geopump® peristaltic pump, or a Whale pump.

The submersible pump was placed at the top of the screen and the well was pumped until clear water (minimal turbidity) was produced. The pump was subsequently lowered from the top of the water column to the bottom until the majority of the turbid water was pumped out. The pump was then removed from the well and the surge block (or the pump) was used to surge through the screened interval to force water in and out of the screen. Pumping and surging continued until clear, sediment-free water was generated at a turbidity less than 50 nephelometric turbidity units (NTUs) or a minimum of 6 hours of pumping time was achieved, as stated in the *Master Field Sampling Plan* (CH2M HILL, 2003a). Development records are presented in Section 3 for SWMU 1 and in Section 9 for SWMU 10.

2.4 Monitoring Well Purging and Sampling

After the wells had been developed, the wells were purged and sampled either with a stainless steel Grundfos® submersible pump or a bladder pump, depending on the water volume and recharge rate of the well.

Prior to sampling, a minimum of three well volumes of water was purged from each well. The wells were pumped at a rate of approximately 0.01 to 0.26 gpm. In-situ measurements were collected during well purging, comprising temperature, conductivity, redox potential, dissolved oxygen, pH, turbidity, and depth to water. Groundwater was sampled after the parameters had stabilized (less than 10 percent fluctuation) using either a stainless steel Grundfos® pump or a bladder pump. New separate Teflon® tubing was used for each well. The pump and cables were decontaminated between wells by washing with Alconox® and potable water, rinsing with potable water, rinsing with isopropyl alcohol, and then performing a final rinse with distilled water. Potable water and distilled water were pumped through the submersible pump during rinsing

2.5 Groundwater Elevation Measurements

Depth to water measurements were obtained after monitoring well development and prior to groundwater sampling from monitoring wells at SWMU 1 on February 5, 2004, and from SWMU 10 on February 7, 2004. An electronic water level meter was used to measure the depth to water from the top of casing of each monitoring well. Groundwater elevations were determined by measuring the depth to water from the top of casing (TOC) elevations. Water level measurements are presented in Section 3 for SWMU 1 and in Section 9 for SWMU 10.

2.6 Surface Soil Sampling

Surface soil samples were collected at SWMUs 4, 6 and 7, 10, and AOC F during the June 2000 sampling event. Surface soil samples were also collected at SWMUs 1, 2, 5, 8, 10, 12, and AOC G during the January/February 2004 sampling event. Surface soil samples were collected from the surface to approximately 6 to 8 inches bls (i.e., the length of the hand auger bucket). The top layer of grass and organic matter (approximately 1 inch) was scraped away before sampling began. Due to the soil conditions encountered, the procedure used to collect VOC soil samples comprised retrieving the soil sample from the 0 to 8-inch depth with a hand auger, pouring the soil into a stainless steel bowl, and then pushing the En Core™ sampler into the soil several times to get a composite sample. After the VOC sample was collected, the soil in the bowl was homogenized with a stainless steel spoon, and soil for semi-volatile organic compounds (SVOCs), metals, pesticides, polychlorinated biphenyls (PCBs), explosives, and dioxins, as applicable, was then transferred to appropriate laboratory containers. This method of En Core™ sampling is consistent with EPA Method 5035 and EPA field sampling SOP. All soil borings were logged in the field using the Unified Soil Classification System (USCS).

2.7 Subsurface Soil Sampling

Subsurface soil samples were collected in the 2000 sampling event at SWMU 10 only. Four locations were sampled from the 4 to 5-ft interval in each of the treatment plant lagoons using a hand auger.

Subsurface soil samples were collected in the 2004 sampling event at SWMUs 2, 4, and 10 using a hand auger or a 3-inch-diameter split-spoon sampler with a drilling rig to obtain a sufficient amount of soil for all of the analyses. Soil sample collection was performed in the same manner as that used for surface soil samples.

The SWMU 2 original scope was to collect soil continuously to 15 feet, and sample the soil within the three intervals with the highest OVA headspace readings. However, bedrock was encountered at 4 to 5 feet and there were no OVA headspace detections above background. Therefore, the subsurface soil sample was collected directly above bedrock. At SWMU 2 CGW2SB01, the sample was collected from 3 to 5 ft bls, and at CGW2SB02 the sample was collected from 2 to 4 ft bls.

At the single SWMU 4 soil boring location (CGW4SB01), the 3-inch-diameter split spoon was advanced to the 4 to 6 ft interval and the sample was collected from within that interval. No bedrock was encountered at SWMU 4.

Sixteen subsurface soil samples were obtained at SWMU 10. These samples were obtained by boring with a hand auger until the black plastic liner was encountered. Once this was found, a sample was obtained from the liner to approximately 8 inches below the liner (i.e., one auger bucket length). The subsurface samples were collected immediately below the liner to determine if the liner had remained intact. The black plastic liner was approximately 2 millimeters (mm) in thickness and appeared to be in good condition. The assumed use of this liner was to prevent leaching of the waste into the soils below the liner. All subsurface

soil borings were grouted to the surface after completion to prevent material from leaching through the liner. All soil borings were logged in the field for soil type using the USCS.

At each SWMU 2 and SWMU 4 sampling location, the split-spoon was removed from the hole, opened, and the VOC sample was collected immediately using the Encore™ sampling device. After the VOC sample was collected, the soil was removed from the split-spoon, placed in a stainless steel bowl, and homogenized with a stainless steel spoon. Samples for SVOCs, metals, pesticides, PCBs, explosives and dioxins were then transferred to appropriate laboratory glass jars. Soil samples at SWMU 10 were collected as described in Section 2.6.

Four subsurface soil samples were collected at AOC A in July 1997, during underground storage tank (UST) replacement activities, and 10 confirmation soil samples were collected during UST removal activities on April 14, 2003.

2.8 Surveying

Both global position system (GPS) and traditional surveying techniques were used to record sample locations for the base mapping of the IRP sites. Prior to surveying any sample locations, a first order control network was set up. This was done by using an array of control points that were strategically located across the entire island. Three dual frequency GPS instruments were used to tie in all of the control points to two National Geodetic Monuments. The accuracy level of this network is +\- 0.005 mm. This GPS network provided the horizontal control for all survey activities.

The survey activities for the 2000 and 2004 sampling events employed a combination of surveying techniques. Real-Time Kinematic (RTK) GPS was used for the majority of sampling locations. These locations comprised monitoring wells, surface soil samples, and soil borings. The RTK GPS method uses a base station and rover units to establish a position with an accuracy level of +\- 0.02 centimeters (cm). Traditional techniques were used in areas where GPS signals were not available. A total station system was used to tie in positions where satellites were obstructed. Elevations for the top of casings of the monitoring wells were surveyed using traditional techniques. An automatic level was used to determine elevations for each site.

Different sets of data were generated for the activities completed in 2000 and 2004. In 2000, horizontal coordinates of all the samples were expressed in the World Grid System of 1984 (WGS84), latitude and longitude. The elevations for the monitoring wells were reported in meters and converted to feet, to the nearest 0.01 ft. These elevations refer to the National Geodectic Vertical Datum of 1929 (NGVD29). Elevations were established from a standard tablet found in a concrete wall, stamped “53 R 1941, 3.1 meters.”

In 2004, all horizontal coordinates were given in WGS84 latitude and longitude, as well as Universal Transverse Mercator Zone 20 (UTM20) northing and easting (meters [m]). The 2004 elevations refer to NGVD29 and were in meters with an accuracy level of +\- 0.003 mm. Elevations at each monitoring well were surveyed and adjusted to mean sea level. Section 3 presents survey data for the monitoring well elevations at SWMU 1, and Section 9 presents survey data for monitoring well elevations at SWMU 10. RTK GPS

methods were used to help locate and stake transect lines during clearing activities at SWMU 1.

2.9 Geophysical Survey

Geoview, Inc. conducted a geophysical survey over the former landfill area at SWMU 1. The geophysical survey used magnetic and electromagnetic methods to map the areal extent of former disposal cells and trenches. Geophysical transects were run on approximately 100-ft line spacings in both east-west and north-south directions over the former landfill areas mapped from aerial photographs. Data were collected digitally and locations maintained using a GPS.

The starting points for the geophysical survey transects were located based on the locations (latitude and longitude) of the former landfill cells and trenches determined through interpretation of aerial photographs of the site (ERI, 2000). Profiles of magnetic and electromagnetic data were developed for each transect. Geophysical anomalies were interpreted from the profiles and plotted on a SWMU 1 base map.

2.10 Munitions and Explosives of Concern Avoidance Surveys

An MEC avoidance survey was conducted by USA Environmental, Inc. at SWMUs 1, 2, 5, 8, 10, 12, and AOC G in January 2004. The MEC avoidance survey was conducted along 18 transects, soil boring locations, egress pathways, and at drilling locations for monitoring wells. Before mobilizing to the field, USA Environmental prepared an MEC Avoidance Work Plan that described the procedures to clear sites for environmental investigations.

The MEC avoidance survey work conducted at SWMU 1 consisted of one unexploded ordnance (UXO) technician walking in the woods with a Schonstedt metal detector and a GPS to perform a sweep to check for the presence of ordnance in advance of the bulldozer. An additional UXO technician followed the bulldozer as it cleared a path through the woods and visually inspected for any MEC items that might have been uncovered by the bulldozer clearing activities. This procedure was used for all 18 transects across the Camp García Landfill (SWMU 1), as described in Section 3 of this report. SWMU 1 monitoring well locations were cleared using a Schonstedt metal detector before drilling began and at 2-ft intervals from ground surface to 10 ft bls.

No MEC items were identified during the clearing and survey efforts at SWMU 1. The only military operations-related items identified during the January 2004 field activities comprised two expended M125 Series Signal Flares (Slap Flares) found in the SWMU 1 area.

2.11 Laboratory and Field Sampling Protocol

Prior to the collection of data, the intended data usage was evaluated and the proper level of data quality was established. Analytical data quality for the Phase I RFI is specified in terms of the following levels:

Level I – Used for field screening. The only Level I data collected as part of the Phase I RFI were OVM screening and water quality data collected during well purging. Water quality

data comprise pH, conductivity, temperature, and turbidity, dissolved oxygen (DO), and oxidation reduction potential (ORP).

Level IV – To be used for quantitative assessment and potential risk evaluation. Level IV data underwent validation processes external to the laboratory. Level IV data were obtained for all media samples to satisfy requirements for site characterization.

Surface soil, subsurface soil, and groundwater samples collected for analyses were placed on ice and shipped via overnight courier to Progress Environmental Laboratories (PEL) located in Tampa, Florida. The samples were analyzed for VOCs, SVOCs, metals, pesticides, herbicides, explosives, perchlorate, dioxins, and PCBs.

2.12 Sample Analysis

All analytical tests were conducted in accordance with the appropriate SW846 method. The Appendix IX list of compounds and elements was analyzed for (except explosives, which were analyzed for by SW846 method 8330, and perchlorate, which was analyzed for by EPA 314.0).

All analyses of soil and groundwater were conducted at PEL, a contracted laboratory fulfilling all requirements of the U.S. Navy's QA/QC Program Manual and SW 846. A signed certificate of analysis was provided with each laboratory data package, along with a certificate of compliance certifying that all work was performed in accordance with the appropriate analytical SW846 or EPA methodologies. All analyses were performed following the highest level of Navy guidance which is referred to as a Level IV data package. A Level IV data package consists of all the contract laboratory procedure (CLP) quality control (QC) summary forms or forms with equivalent information and the raw data.

This task included checking the data from the laboratory and converting it into an electronic format that could be readily incorporated into the data management system for the project team and the client.

2.12.1 Quality Assurance/ Quality Control Procedures

QA/QC samples comprised blanks, duplicates, and MS/MSDs. The Quality Assurance Project Plan (QAPP) provides details with regard to the number and frequency of field QC samples to be collected during the investigation.

2.12.1.1 Blanks

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample.

American Society for Testing and Materials (ASTM) Type II water was used for blanks. Four types of blanks were generated during sampling activities: trip blanks, field blanks, equipment rinsate blanks, and temperature blanks.

Trip blanks are utilized to monitor VOC contamination throughout the shipping and sampling tasks. One trip blank was included in each cooler containing VOC samples.

One field blank was collected per lot of source water used for decontamination. A single source was used for these field efforts. Field blanks are used as a measure of ambient conditions at the site.

One equipment blank was collected per day, per type of sampling equipment. Equipment blanks provide an indication of the efficiency of the decontamination procedure. Single use, pre-cleaned pump tubing does not require an equipment blank.

EPA recently requested inclusion of a temperature blank in each cooler containing samples for analyses, so that the laboratory can record the temperature without disturbing the samples. The temperature blank was labeled, but was not be given a sample number nor was it listed as a sample on the chain-of-custody (COC) form. The temperature reading was recorded on the COC form or on a sample receipt checklist.

2.12.1.2 Duplicates

Field duplicate samples were collected at a frequency of one field duplicate per 10 field samples, per matrix. The locations from which the duplicates were taken were selected randomly. Each duplicate sample was homogenized, split evenly into two sample containers, and submitted for analysis as two independent samples. This QC sample type measures sampling precision and, for solids only, matrix homogeneity or heterogeneity.

2.12.1.3 Matrix Spike / Matrix Spike Duplicate (MS/MSD)

MS/MSD samples were collected at a frequency of one MS/MSD set for every 20 field samples collected per matrix. The MS/MSD measures accuracy and precision as they relate to a matrix. The percent recoveries of the MS and MSD (that is, the amount recovered of the amount spiked) provide the matrix accuracy statistics. Comparison of the MS/MSD concentrations (SW846) measures matrix precision in percent relative standard deviation units.

2.13 Data Validation

Analytical results were validated by independent validators approved by the Navy. Data validators used EPA's Region 2 worksheets utilizing the EPA guidance document *Contract Laboratory Program National Functional Guidelines for Organic (EPA, 1999) and Inorganic Data Review (EPA, 2002*), modified for SW846 criteria. Areas of review (when applicable to the method) include holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by laboratory confirmation samples (LCSs), field duplicate results, surrogate recoveries, internal standard performance, and interference checks. A Region 2 data review worksheet was completed for each method of each data package and any non-conformance was documented. This data review and validation process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes.

The validation of data for Region II is dictated by the SW846 analytical methods used by the laboratories to generate the data and is performed in accordance with EPA Region II Data Validation Standard Operating Procedures. The data validation methods used by the validator for this project are as follows:

- VOC and gasoline range organics (GRO) - USEPA Region II SOP HW-24, Revision 1, June 1999: Validating Volatile Organic Compounds by SW-846 Method 8260B
- Semi-volatile organic compounds (SVOC) and diesel range organics (DRO) - USEPA Region II SOP No. HW-22, Revision 2, June 2001: Validating Semivolatile Organic Compounds by SW-846 Method 8270C
- Metals and wet chemistry - USEPA Region II SOP No. HW-2, Revision 11, January 1992, for Evaluation of Metals Data for the Contract Laboratory Program
- Pesticide and PCB - USEPA Region II SOP No. HW-23, Revision 0, April 1995: Validating Pesticide/PCB Compounds by SW-846 Method 8080A and SOP No. HW-23B, Revision 1.0, May 2002
- Explosives - USEPA Region II SOP No. HW-16, Revision 1.3, September 1994: Nitroaromatics and Nitroamines by HPLC
- Dioxin - USEPA "Region II, Data Validation Standard Operating Procedure for SW-846 Method 8290 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS)," SOP No. HW-19, Revision 1, October 1994
- Herbicides - USEPA Region II SOP, Revision 1.3, November 1994: Chlorinated Herbicides

Data that were not within acceptance limits were appended with a qualifying flag, which consisted of a single or double-letter abbreviation that reflected a non-conformance of the data, referred to as primary or secondary qualifiers.

2.14 Data Quality Evaluation

The electronic data deliverable containing the analytical results was checked against the hard copy results to ensure agreement and comparability. The database was then populated with the data validation subcontractor's primary and secondary qualifiers. Post-validation queries were then applied to the populated database to ensure that the populated data were logical and had no apparent anomalies. Once this was accomplished, the data quality evaluation (DQE) queries were generated and reviewed by the project chemist for discrepancies. At this point, the database was deemed complete and ready to generate project reports and the final DQE queries for the DQE technical memorandum (TM), which will be presented in the Phase I RFI Report.

The purpose of the DQE process is to assess the effect of the complete analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements; either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of matrix interferences is more subtle and involves the analysis of several areas of results, including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

The DQE addresses the following topics:

- *Potential blank contamination*—the effect on the usability of data for constituents detected in samples which may have been also detected in field or laboratory blanks
- *Laboratory accuracy and precision*—evaluation of the recovery(ies) for blank spike/blank spike duplicate (or LCS/LCSD) samples for method precision and accuracy
- *Tuning and calibration* – evaluation of all calibration requirements and criteria in order to evaluate percent completeness and usability per analytical fraction and analyte
- *Potential matrix interferences*—evaluation of the matrix accuracy and precision for surrogates, internal standards, MS/MSDs, and field duplicate sample results. Serial dilutions, method of standard additions, and degradation checks are also evaluated.
- *Assessment of PARCCs*—comparison of data validation (DV) findings with PARCCs (precision, accuracy, representativeness, comparability, and completeness)

Completeness for the Phase I RFI data set was determined to be 96 percent, exceeding the target project DQOs for completeness of 90 percent. Therefore, the data may be used, as qualified, in the project decision-making process.

TABLE 2-1
Navy Samples Split with EPA and PREQB During Phase I RFI Field Work (June 2000, April 2003, and January and February 2004)
Phase I RFI, East Vieques, Puerto Rico

Site	Navy	EPA	PREQB
	Surface Soil Samples		
SWMU 1	CGW1SS01 through CGW1SS50	SS-08, SS-17, SS-33, SS-35, SS-48	None
	Groundwater Samples		
	CGW1MW01 through CGW1MW05	MW-02, MW-04	MW-01, MW-03
	Surface Soil Samples		
SWMU 2	CGW2SS01 through CGW2SS12	SS-03, SS-07, SS-09, SS-12	None
	Soil Boring Samples		
	CGW2SB01, CGW2SB02	SB-01, SB-02	None
	Surface Soil Samples		
SWMU 4	CGW4SS01 through CGW4SS12	None	None
	Soil Boring Samples		
	CGW4SB01	SB-01	None
	Surface Soil Samples		
SWMU 5	CGW5SS01 through CGW5SS04	SS-01	None
	Surface Soil Samples		
SWMU 6/7	CGW6/7SS01 through CGW6/7SS11	None	None
	Surface Soil Samples		
SWMU 8	CGW8SS01 through CGW8SS05	SS-02	None
	Surface Soil Samples		
SWMU 10	CGW10SS01 through CGW10SS20	SS-06, SS-07, SS-10, SS-11, SS-13, SS-15, SS-19	None
	Soil Boring Samples		
	CGW10SB01 through CGW10SB20	SB-06, SB-11, SB-13, SB-19,	None
	Groundwater Samples		
	CGW10MW01 through CGW10MW05	MW-04, MW-05	MW-02, MW-03
	Surface Soil Samples		
SWMU 12	CGW12SS01 through CGW12SS05	SS-05	None
	Soil Boring Samples		
AOC A	CGAUST01 through CGAUST10	None	None
	Surface Soil Samples		
AOC F	CGAOCFSS01 through CGAOCFSS05	None	None
	Surface Soil Samples		
AOC G	CGAGSS01 through CGAGSS05	SS-04	None

Notes:
MW = signifies a groundwater sample
SS = signifies a surface soil sample
SB = signifies a subsurface soil sample

SECTION 3

SWMU 1 – Camp García Landfill (Camp García)

This section presents the results of the Phase I RFI performed at SWMU 1 – Camp García Landfill at the AFWTF in January and February 2004. It includes a site description, results of the field investigation, and a summary of laboratory results.

3.1 Site Description

The Camp García Landfill is located in the EMA, approximately 4,000 ft north-northwest of Blue Beach, within the Camp García Area. According to the Initial Assessment Study (IAS) (Greenleaf-Telesca, 1984), the unlined landfill was in operation from approximately 1954 to 1978, when it became inactive. When the landfill was operational, it was used for the disposal of waste paper, corrugated containers, cans and food packaging material, rags, wood, scrap metal, and yard waste. Normal trash (food waste, waste paper, etc.) from AFWTF was also disposed at the landfill. No hazardous materials reportedly were placed in this disposal area (Greenleaf-Telesca, 1984). Since 1978, all waste from the AFWTF has been disposed in the Vieques municipal landfill. From 1954 through 1978, the landfill serviced an average population of 150 individuals that were stationed at Camp García. This number experienced short-term increases during maneuvers and other military exercises. According to PREQB (1995), approximately 1,800 to 3,120 tons of waste were disposed in the landfill.

During its operation, the trench method of disposal was employed and land clearing was kept to a minimum to avoid erosion problems. A bulldozer was used to dig a trench into which materials were disposed. The trench was then covered with about 6 inches of soil to control blowing of litter. A final soil cover 2 ft thick was placed over the trench (Greenleaf-Telesca, 1984).

An aerial photographic analysis of the landfill indicated that the fill area extended over an area of approximately 55 acres (ERI, 2000). The analysis identified several trenches and landfill cells within the fill area. The results of the analysis are shown on Figure 3-1.When operation of the landfill ceased in 1978, a soil cover consisting of compacted native soil was installed. A gravel road was constructed down the center of the landfill in the mid-1980s. During the 1995 RFA (PREQB, 1995), no signs of erosion or stresses on vegetation were observed in the landfill area, and no documentation was found regarding releases of hazardous constituents from the landfill.

During the February 2000 CH2M HILL site visit, no signs of previous landfill activities were visible at the site. The site was heavily vegetated. Observations made in January 2004 during the Phase I RFI indicated that the landfill was vegetated with dense grasses and trees. Several areas of debris (fill material) were observed during the clearing of geophysical transects. Debris observed included galley (kitchen) waste (cans, bottles, forks, knives), metal pipes, and a small metal tank. The trenches appeared as depressions after clearing, probably due to compaction of the decomposing galley waste. A barbed wire fence was installed at SWMU 1 along roads to exclude public access to the site.

3.2 Field Investigation Results

3.2.1 Previous Investigations

No previous environmental sampling has been performed at the landfill. The locations of the landfill cells and trenches were determined from ground scarring and cleared vegetation evident from historical aerial photograph reviews conducted by Environmental Research, Inc. (ERI, 2000). Based on the aerial photographic survey, apparent landfill cells and trenches were identified in the 1959, 1962, and 1964 aerial photographs (Figure 3-1). Figure 3-2 shows the site topography and has been color-coded to present the limits of the apparent landfill cells and trenches evident in the aerial photographs described previously. The approximate landfill boundary limit shown on Figures 3-1 and 3-2 is based on the aerial photograph analysis compiled by ERI and submitted in *Aerial Photographic Analysis* (ERI, August 2000).

3.2.2 2004 Geophysical Investigation

A geophysical survey was conducted over the landfill from January 27 through 30, 2004, to map the areal extent of former disposal cells and trenches. The geophysical investigation was performed using Electromagnetic (EM) and Total Field Magnetics (magnetic) techniques which can determine the presence and identify the location of buried metallic debris.

The geophysical survey transects were laid out based on the locations (latitude and longitude) of the former landfill cells and trenches, as determined through interpretation of aerial photographs of the site (ERI, 2000). The geophysical survey was performed along 18 transect lines (TR-1 to TR-18), as shown in Figure 3-3. The transect lines were surveyed and cleared of brush prior to the start of the geophysical investigation. The survey was conducted using a Geonics EM31-MK2 (EM-31) and a Geometrics G-858 Cesium Vapor Magnetometer (G-858). Survey marks were established on the ground surface using pin flags and flagging tape, and were used as fiduciary (positioning) points to determine the position of the geophysical data as they were collected across the project site.

EM readings were collected every 5 ft along the transect lines. Both the terrain conductivity and in-phase responses were recorded, with a total of 3,968 readings collected. Magnetometer readings were collected on 0.1-second intervals, with positioning marks collected at 5-ft intervals. A total of 77,289 magnetic data readings were collected. The EM and magnetometer data were processed using EM-31 MK2^{tm} and MagMap^{TM} 2000 software, respectively. Microsoft Excel® was then used to present the processed data as individual profiles showing instrument response versus distance.

The results of the geophysical survey indicate that the boundary of the former landfill may extend further south than the limits estimated from the historical aerial photographs. Additionally, the northernmost geophysical transect encountered buried metal. The geophysical survey successfully defined the eastern and western boundaries of the former landfill, reducing the footprint of the landfill that was based on aerial photographs. An interpreted fill boundary is displayed on Figure 3-3 that shows the results of the geophysical survey and the estimated footprint based on those results. The newly defined footprint covers an area of approximately 33 acres.

3.2.3 2004 Soils Investigation

Surface soil samples and groundwater samples were collected at SMWU 1 between February 4 and February 13, 2004.

Surface soil samples were collected at 50 locations selected based on the highest magnetic or conductivity anomalies, and based on cell locations displayed on the aerial photographs. The samples were collected from a depth of 0 to approximately 8 inches (i.e., one full hand auger bucket) to assess the potential human health risk due to direct contact. Surface soil samples were collected from 0 to 8 inches bls during this field effort to provide sufficient volume of soil samples to be split with EPA and EQB. To obtain enough sample volume for the large quantity of jars, one auger bucket was collected at each location. The auger length is 8 inches. All 50 surface soil samples were collected and analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. Per EPA's request, 5 of the 50 surface soil samples (CGW1SS08, 17, 33, 35, and 48) were analyzed for cyanide, sulfide, and dioxins. Surface soil sample locations are shown in Figure 3-3.

3.2.4 2004 Groundwater Investigation

Five groundwater monitoring wells were installed at SWMU 1, based on the results of the geophysical survey, topography of the landfill area, and the location of the buried cells, as identified by previous aerial photographs (ERI, 2000). The locations of the monitoring wells are depicted on Figure 3-3. One well (MW-01) was installed hydraulically up-gradient and four wells (MW-02 through MW-05) were installed downgradient from the former landfill cells. All wells were screened in the shallow groundwater zone. The monitoring wells were constructed using both 10-ft and 15-ft screens. The bottom of the screens were installed at a depth of less than 10 feet below the first encountered groundwater to allow detection of floating free phase product, if any, at the groundwater/vadose zone interface. After the screen was installed in the first encountered groundwater, the potentiometric surface stabilized above the top of the screen, due to the semi-confining conditions, at the level that was measured and used for the water level readings.

Figure 3-4 and Figure 3-5 show the stratigraphic column across SWMU 1 based on the monitoring well boring logs. The geology encountered during drilling operations at SWMU 1 indicated sand from 0 to approximately 10 ft bls. A clay or clay with gravel was found from approximately 10 to 20 ft bls. The southern portion of the SWMU area had a lean clay with sand zone from approximately 15 ft to 20 ft bls. This layer was not present to the north of SWMU 1 at location MW-01. Bedrock was encountered at approximately 15 ft to 30 ft bls. The shallowest bedrock was found at location MW-01 (furthest north, highest elevation) and the deepest bedrock was found at MW-05 (furthest south and lowest elevation). Groundwater was encountered above andesite bedrock at locations MW-1, 4, and 5. At locations MW-2 and MW-3 the saturated zone was encountered below the bedrock surface. The potentiometric surface is located within the alluvial deposits for all drilling locations except MW-2 (furthest east) where it appears the potentiometric level is within the bedrock zone.

The monitoring wells were developed a minimum of 3 days after installation to remove any fines introduced to the formation during the drilling and well installation process. Well development was performed by surging with a 2-inch surge block, then pumping with

either a stainless steel Grundfos® submersible pump, a Geopump® peristaltic pump, a Whale pump, or purging with a Teflon® bailer. One week after completion of well development, one round of groundwater level collection was performed to establish the groundwater flow pattern. The groundwater elevation data, illustrated on Figure 3-6, show that groundwater flow is from northwest to southeast. Based on this information, monitoring well MW-01 appropriately serves as an upgradient well and wells MW-02, MW-03, MW-04 and MW-05 provide groundwater data downgradient from the landfill.

Tables 3-1, 3-2, 3-3, and 3-4 provide a summary of the well construction details, the well development details, the water level data, and the water quality parameters measured during groundwater sampling for the five monitoring wells installed at SMWU 1.

TABLE 3-1
Summary of Well Construction Details
SWMU 1, East Vieques, Puerto Rico

Well ID	Date Installed	Top of Casing Elevation (ft AMSL)	Boring Depth (ft bls)	Well Depth (ft bls)	Screen Interval Depth (ft bls)	Depth to Bentonite (ft bls)	Depth to Sandpack (ft bls)
CGW1MW01	01/15/2004	54.47	21.5	20.73	10.7-20.7	6.7	8.7
CGW1MW02	01/15/2004	18.98	34.5	34.06	24.1-34.1	20.1	22.1
CGW1MW03	01/16/2004	15.32	32.0	29.98	19.9-29.9	15.9	17.9
CGW1MW04	01/17/2004	18.76	42.0	31.52	21.5-31.5	17.5	19.5
CGW1MW05	01/23/2004	19.04	37.0	37.08	22.0-37.0	18.0	20.0

Notes:
AMSL = Above Mean Sea Level
ft = ft
bls = below land surface

TABLE 3-2
Summary of Well Development Records
SWMU 1, East Vieques, Puerto Rico

Well ID	Development Method	Development Completion Date	Total Gallons Removed	Number of Well Volumes Removed
CGW1MW01	Grundfos Pump/Surge block	01/18/2004	170	246
CGW1MW02	Grundfos Pump/Surge block	01/19/2004	72	40
CGW1MW03	Peristaltic Pump/Surge block	01/23/2004	20	9
CGW1MW04	Peristaltic Pump/Surge block	01/23/2004	70	33
CGW1MW05	Whale Pump/Surge block	01/29/2004	20	7

TABLE 3-3
Summary of Monitoring Well Water Level Measurements
SWMU 1, East Vieques, Puerto Rico

Well ID	Date	Elevation (TOC) (ft AMSL)	Depth to Water (ft btoc)	Groundwater Level (ft AMSL)
CGW1MW01	02/05/04	54.47	19.19	35.28
CGW1MW02	02/05/04	18.98	25.75	-6.77
CGW1MW03	02/05/04	15.32	19.05	-3.73
CGW1MW04	02/05/04	18.76	21.09	-2.33
CGW1MW05	02/05/04	19.04	23.70	-4.66

Notes:
TOC = top of casing
btoc = ft below top of casing
AMSL = Above Mean Sea Level
ft – feet

TABLE 3-4
Summary of Final Field Parameter Measurements Taken Prior to Groundwater Sample Collection – 2/5-11/2004
SWMU 1, East Vieques, Puerto Rico

Well ID	Purged Vol. (gals)	pH	Cond. µmhos/cm	Temp., °C	DO	ORP	Turbidity
CGW1MW01	14.0	6.67	510	31.67	4.70	137.00	14.2
CGW1MW02	13.5	6.85	5,959	28.61	2.15	183.00	3.66
CGW1MW03	9.0	6.70	10,137	27.99	0.62	137.00	30.9
CGW1MW04	11.5	7.22	4,251	28.13	8.05	209.30	76.1
CGW1MW05	6.8	7.35	4,885	28.08	5.31	122.00	35.6

Groundwater samples were collected at the five monitoring wells (one upgradient and four downgradient of the landfill trenches and cells). All groundwater samples were analyzed for VOCS, SVOCs, metals, herbicides, pesticides/PCBs, explosives and perchlorate. Two samples (CGW1MW02 and 04) were also analyzed for cyanide, sulfide, and dioxins.

3.3 Laboratory Analytical Results

3.3.1 Surface Soil

Figure 3-3 shows the locations of the surface soil samples collected at SWMU 1 during the Phase I RFI. Table 3-5 summarizes the surface soil constituent detections.

3.3.2 Groundwater

Figure 3-3 shows the locations of the monitoring wells installed and sampled at SWMU 1 during the Phase I RFI. Table 3-6 summarizes all groundwater constituent detections.

TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS01		CGW1SS02		CGW1SS03		CGW1SS04		CGW1SS05		CGW1SS06	
SampleID		CGW1SS01-R01		CGW1SS02-R01		CGW1SS03-R01		CGW1SS04-R01		CGW1SS05-R01		CGW1SS06-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		02/04/2004		02/04/2004		02/04/2004		02/04/2004		02/04/2004		02/04/2004	
SampleType		N		N		N		N		N		N	
Parameter	**Units**												
Metals													
Antimony	mg/kg	0.381	J	0.91	J	0.462	J	ND		0.72	J	0.482	J
Arsenic	mg/kg	ND		ND		ND		ND		ND		ND	
Barium	mg/kg	62.7	=	59.2	=	54.9	=	46.7	=	59.4	=	53.2	=
Beryllium	mg/kg	0.294	J	0.216	J	0.242	J	0.238	J	0.25	J	0.246	J
Cadmium	mg/kg	ND		ND		ND		ND		ND		ND	
Chromium, total	mg/kg	18.9	J	15.3	J	16.2	J	18.1	J	17.3	J	20.6	J
Cobalt	mg/kg	12.5	=	11.8	=	10.6	=	10.6	=	11.1	=	12.6	=
Copper	mg/kg	39.5	=	24.6	=	37.1	=	32.4	=	37.9	=	40.1	=
Lead	mg/kg	7.19	=	7.06	=	10.2	=	6.9	=	9.94	=	11.2	=
Mercury	mg/kg	0.0321	J	0.0175	J	0.0198	J	0.0199	J	0.0253	J	0.0505	=
Nickel	mg/kg	8.11	J	6.11	J	6.62	J	6.95	J	7.09	J	8.79	J
Selenium	mg/kg	0.646	J	0.539	J	0.334	J	0.515	J	0.752	J	0.679	J
Silver	mg/kg	ND		ND		ND		ND		ND		ND	
Thallium	mg/kg	1.54	J	0.785	J	1.13	J	0.44	J	0.986	J	1.13	J
Tin	mg/kg	1.13	J	0.726	J	0.852	J	1.4	J	0.685	J	1.43	J
Vanadium	mg/kg	85.9	=	81.3	=	84.9	=	81.7	=	85.4	=	86.1	=
Zinc	mg/kg	48	=	25.5	=	36.8	=	25.9	=	36	=	47.4	=
Pesticides													
Endrin ketone	mg/kg	ND		ND		ND		ND		ND		ND	
p,p'-DDD	mg/kg	ND		ND		0.00043	J	ND		ND		ND	
p,p'-DDE	mg/kg	ND		0.00029	J	0.0061	J	ND		0.00034	J	0.0088	J
p,p'-DDT	mg/kg	0.00041	J	ND		0.0064	J	ND		ND		0.00096	J
PCBs													
Aroclor-1221	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1248	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1254	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1260	mg/kg	ND		ND		ND		ND		ND		ND	
Semi-Volatiles													
4-Methylphenol (p-Cresol)	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(a)pyrene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Pyridine	mg/kg	ND		ND		ND		ND		ND		ND	
Volatiles													
Methylene chloride	mg/kg	ND		ND		ND		ND		ND		ND	
Styrene	mg/kg	ND		ND		ND		ND		ND		ND	
Chemistry													
Cyanide	mg/kg	NA		NA		NA		NA		NA		NA	
Sulfide	mg/kg	NA		NA		NA		NA		NA		NA	
Dioxins													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is available.

TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS07			CGW1SS08			CGW1SS09			CGW1SS10			CGW1SS11			CGW1SS12		
SampleID		CGW1SS07-R01			CGW1SS08-R01			CGW1SS09-R01			CGW1SS10-R01			CGW1SS11-R01			CGW1SS12-R01		
Depth		0 to 0.7 feet			0 to 0.7 feet			0 to 0.7 feet			0 to 0.7 feet			0 to 0.7 feet			0 to 0.7 feet		
DateCollected		02/04/2004			02/04/2004			02/04/2004			02/04/2004			02/05/2004			02/05/2004		
SampleType		N			N			N			N			N			N		
Parameter	**Units**																		
Metals																			
Antimony	mg/kg	0.139	J		0.284	J		0.252	J		1.49	J		0.676	J		0.629	J	
Arsenic	mg/kg	ND			ND			ND			0.467	J		0.424	J		0.397	J	
Barium	mg/kg	52.8	=		51.6	=		44.1	=		59.8	=		80.2	J		60.8	J	
Beryllium	mg/kg	0.244	J		0.182	J		0.193	J		0.268	J		0.222	J		0.259	J	
Cadmium	mg/kg	ND			ND			ND			ND			ND			ND		
Chromium, total	mg/kg	18.3	J		16.2	J		14.3	J		36.9	J		24.2	J		15.8	J	
Cobalt	mg/kg	12.1	=		10.4	=		9.01	J		13.9	=		12.2	J		10.4	J	
Copper	mg/kg	31.6	=		25.5	=		24.8	=		113	=		27.8	=		35.9	=	
Lead	mg/kg	4.32	=		3.49	=		4.3	=		34.5	=		4.68	=		4.23	=	
Mercury	mg/kg	0.0212	J		0.0114	J		0.0145	J		0.0386	=		0.0121	J		0.0314	=	
Nickel	mg/kg	7.32	J		5.23	J		5.26	J		13.7	J		11.4	J		6.93	J	
Selenium	mg/kg	0.86	J		ND			0.321	J		0.329	J		0.202	J		0.942	=	
Silver	mg/kg	ND			ND			ND			0.0446	J		ND			0.0519	J	
Thallium	mg/kg	0.623	J		1.01	J		0.987	J		1.31	J		1.1	J		1.1	J	
Tin	mg/kg	0.297	J		ND			0.468	J		9.7	J		0.549	J		0.671	J	
Vanadium	mg/kg	87.5	=		82.5	=		75.5	=		109	=		60.6	J		74.6	J	
Zinc	mg/kg	27	=		22.5	=		22.6	=		209	=		21.8	J		31.6	J	
Pesticides																			
Endrin ketone	mg/kg	ND			ND			ND			ND			ND			ND		
p,p'-DDD	mg/kg	ND			ND			ND			0.0014	J		0.00017	J		ND		
p,p'-DDE	mg/kg	0.00021	J		0.001	J		0.0007	J		0.025	J		0.0013	J		0.0041	J	
p,p'-DDT	mg/kg	ND			0.00028	J		0.00026	J		0.0059	J		0.0005	J		0.0016	J	
PCBs																			
Aroclor-1221	mg/kg	ND			ND			ND			ND			ND			ND		
Aroclor-1248	mg/kg	ND			ND			ND			ND			ND			ND		
Aroclor-1254	mg/kg	ND			ND			ND			ND			ND			ND		
Aroclor-1260	mg/kg	ND			ND			ND			ND			ND			ND		
Semi-Volatiles																			
4-Methylphenol (p-Cresol)	mg/kg	ND			ND			ND			ND			ND			ND		
Benzo(a)pyrene	mg/kg	ND			ND			ND			ND			ND			0.0458	J	
Benzo(b)fluoranthene	mg/kg	ND			ND			ND			ND			ND			0.0569	J	
Benzo(k)fluoranthene	mg/kg	ND			ND			ND			ND			ND			0.0475	J	
bis(2-Ethylhexyl) phthalate	mg/kg	ND			ND			ND			ND			ND			ND		
Di-n-butyl phthalate	mg/kg	ND			ND			ND			ND			ND			ND		
Pyridine	mg/kg	ND			ND			ND			ND			ND			ND		
Volatiles																			
Methylene chloride	mg/kg	ND			ND			ND			ND			ND			ND		
Styrene	mg/kg	ND			ND			ND			ND			0.0013	J		ND		
Chemistry																			
Cyanide	mg/kg	NA			ND			NA			NA			NA			NA		
Sulfide	mg/kg	NA			ND			NA			NA			NA			NA		
Dioxins																			
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA			5.37E-06	=		NA			NA			NA			NA		
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA			ND			NA			NA			NA			NA		
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA			ND			NA			NA			NA			NA		
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA			ND			NA			NA			NA			NA		
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA			ND			NA			NA			NA			NA		
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA			0.0000104	=		NA			NA			NA			NA		
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA			ND			NA			NA			NA			NA		
Octachlorodibenzo-p-dioxin	mg/kg	NA			0.0000509	=		NA			NA			NA			NA		
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA			ND			NA			NA			NA			NA		
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA			ND			NA			NA			NA			NA		

Data Flags:
U = Undetected; analyte was analyzed but not detected ab
UJ = Detection limit was estimated; analyte was analyzed a
qualified as undetected.
J = Estimated value; compounds detected at concentration
the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no s

TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS13		CGW1SS14		CGW1SS15		CGW1SS16		CGW1SS17		CGW1SS18	
SampleID		CGW1SS13-R01		CGW1SS14-R01		CGW1SS15-R01		CGW1SS16-R01		CGW1SS17-R01		CGW1SS18-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		02/05/2004		02/05/2004		02/05/2004		02/05/2004		02/04/2004		02/05/2004	
SampleType		N		N		N		N		N		N	
Parameter	**Units**												
Metals													
Antimony	mg/kg	0.661	J	0.657	J	1.3	J	0.63	J	0.402	J	1.04	J
Arsenic	mg/kg	ND		ND		ND		0.269	J	1.81	J	0.166	J
Barium	mg/kg	91.6	J	49.3	J	42.5	J	50	J	50.3	=	46.6	J
Beryllium	mg/kg	0.196	J	0.219	J	0.199	J	0.257	J	0.397	J	0.239	J
Cadmium	mg/kg	ND		ND		ND		ND		ND		ND	
Chromium, total	mg/kg	11.4	J	13.7	J	13.6	J	18.2	J	49.6	J	17.9	J
Cobalt	mg/kg	9.43	J	8.6	J	8.89	J	10.7	J	19.6	=	10.3	J
Copper	mg/kg	30.8	=	23.9	=	35.4	=	30.7	=	37.7	=	39.5	=
Lead	mg/kg	3.48	=	0.221	J	19.3	=	2.49	=	11.8	=	12.6	=
Mercury	mg/kg	0.0178	J	0.0182	J	0.038	=	0.0255	J	0.028	=	0.0391	=
Nickel	mg/kg	5.09	J	5.95	J	6.61	J	8.07	J	16.4	J	8.8	J
Selenium	mg/kg	0.492	J	0.342	J	0.483	J	0.66	J	0.343	J	0.393	J
Silver	mg/kg	ND		ND		ND		0.0261	J	ND		ND	
Thallium	mg/kg	0.602	J	1.54	J	0.828	J	1.22	J	0.609	J	1.14	J
Tin	mg/kg	0.589	J	0.419	J	3.52	J	0.693	J	0.845	J	3.72	J
Vanadium	mg/kg	65.6	J	68	J	58.1	J	76.9	J	191	=	75.7	J
Zinc	mg/kg	24.5	J	19.5	J	123	J	38.6	J	32.8	=	77.5	J
Pesticides													
Endrin ketone	mg/kg	ND		ND		ND		ND		ND		ND	
p,p'-DDD	mg/kg	0.0018	J	ND		ND		ND		0.00016	J	ND	
p,p'-DDE	mg/kg	0.13	J	0.00033	J	0.0013	J	0.0014	J	0.0032	J	0.0075	J
p,p'-DDT	mg/kg	0.022	J	0.00026	J	0.00067	J	0.00074	J	0.00051	J	0.0018	J
PCBs													
Aroclor-1221	mg/kg	0.015	J	ND		ND		ND		ND		ND	
Aroclor-1248	mg/kg	0.0018	J	ND		ND		ND		ND		ND	
Aroclor-1254	mg/kg	0.029	JN	ND		ND		ND		ND		ND	
Aroclor-1260	mg/kg	0.056	=	ND		ND		ND		ND		ND	
Semi-Volatiles													
4-Methylphenol (p-Cresol)	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(a)pyrene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		8.72E-02	J
Pyridine	mg/kg	ND		ND		ND		ND		ND		ND	
Volatiles													
Methylene chloride	mg/kg	ND		0.0008	J	ND		ND		ND		ND	
Styrene	mg/kg	ND		ND		ND		ND		ND		ND	
Chemistry													
Cyanide	mg/kg	NA		NA		NA		NA		0.37	J	NA	
Sulfide	mg/kg	NA		NA		NA		NA		34.2	J	NA	
Dioxins													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		0.0000178	=	NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		ND		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		ND		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		ND		NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		ND		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		0.0000332	=	NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		0.0000123	=	NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		0.00013	=	NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		4.22E-06	=	NA	
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		4.92E-06	=	NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected ab
UJ = Detection limit was estimated; analyte was analyzed a
qualified as undetected.
J = Estimated value; compounds detected at concentration
the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no s

TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS19		CGW1SS20		CGW1SS21		CGW1SS22		CGW1SS23		CGW1SS24	
SampleID		CGW1SS19-R01		CGW1SS20-R01		CGW1SS21-R01		CGW1SS22-R01		CGW1SS23-R01		CGW1SS24-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		02/05/2004		02/05/2004		02/05/2004		02/05/2004		02/09/2004		02/09/2004	
SampleType		N		N		N		N		N		N	
Parameter	**Units**												
Metals													
Antimony	mg/kg	0.703	J	0.478	J	0.582	J	0.522	J	1.5	J	1.77	J
Arsenic	mg/kg	ND		ND		ND		ND		0.91	J	0.713	J
Barium	mg/kg	49	J	41	J	60.9	J	54.2	J	75.3	J	74.8	J
Beryllium	mg/kg	0.22	J	0.192	J	0.28	J	0.255	J	0.284	J	0.275	J
Cadmium	mg/kg	ND		ND		ND		ND		0.177	J	0.309	J
Chromium, total	mg/kg	14.4	J	9.26	J	15.8	J	16.6	J	31.4	J	30.9	J
Cobalt	mg/kg	9.36	J	6.82	J	10.6	J	12.7	J	13.6	J	12.7	J
Copper	mg/kg	25.1	=	18.4	=	34.2	=	30.4	=	47.2	J	41.2	J
Lead	mg/kg	ND		ND		1.69	=	0.868	=	17.2	=	10.7	=
Mercury	mg/kg	0.0182	J	0.00937	J	0.0331	=	0.0153	J	0.0203	J	0.188	=
Nickel	mg/kg	5.98	J	4.09	J	7.58	J	7.7	J	16.6	J	17.5	J
Selenium	mg/kg	0.689	J	0.379	J	0.736	J	0.517	J	0.795	=	0.608	J
Silver	mg/kg	ND		ND		0.0322	J	ND		ND		ND	
Thallium	mg/kg	0.916	J	0.862	J	1.26	J	0.883	J	ND		4.02	J
Tin	mg/kg	0.315	J	0.354	J	0.919	J	0.373	J	138	J	2.29	J
Vanadium	mg/kg	72.1	J	55	J	74.7	J	74.1	J	89.5	J	95	J
Zinc	mg/kg	17.7	J	13.8	J	30.5	J	23.8	J	76.3	J	521	J
Pesticides													
Endrin ketone	mg/kg	ND		ND		ND		0.0049	J	ND		ND	
p,p'-DDD	mg/kg	ND		ND		ND		ND		0.0029	J	0.0023	J
p,p'-DDE	mg/kg	ND		ND		0.00087	J	0.014	J	0.14	J	0.044	J
p,p'-DDT	mg/kg	ND		ND		0.00053	J	0.0038	J	0.047	J	0.031	J
PCBs													
Aroclor-1221	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1248	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1254	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1260	mg/kg	ND		ND		ND		ND		ND		ND	
Semi-Volatiles													
4-Methylphenol (p-Cresol)	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(a)pyrene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		0.118	J	ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Pyridine	mg/kg	ND		ND		ND		ND		ND		ND	
Volatiles													
Methylene chloride	mg/kg	0.00055	J	ND		ND		ND		ND		ND	
Styrene	mg/kg	ND		ND		ND		ND		ND		ND	
Chemistry													
Cyanide	mg/kg	NA		NA		NA		NA		NA		NA	
Sulfide	mg/kg	NA		NA		NA		NA		NA		NA	
Dioxins													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected ab
UJ = Detection limit was estimated; analyte was analyzed a
qualified as undetected.
J = Estimated value; compounds detected at concentration
the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no s

TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS25		CGW1SS26		CGW1SS27		CGW1SS28		CGW1SS29		CGW1SS30	
SampleID		CGW1SS25-R01		CGW1SS26-R01		CGW1SS27-R01		CGW1SS28-R01		CGW1SS29-R01		CGW1SS30-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		02/09/2004		02/09/2004		02/09/2004		02/09/2004		02/09/2004		02/09/2004	
SampleType		N		N		N		N		N		N	
Parameter	**Units**												
Metals													
Antimony	mg/kg	1.44	J	1.17	J	0.891	J	0.722	J	0.653	J	0.538	J
Arsenic	mg/kg	0.575	J	1.09	J	0.326	J	ND		0.182	J	ND	
Barium	mg/kg	55.5	J	85.6	J	56.6	J	51	J	66.9	J	29.8	J
Beryllium	mg/kg	0.335	J	0.433	J	0.283	J	0.218	J	0.278	J	0.173	J
Cadmium	mg/kg	ND		0.114	J	ND		ND		ND		ND	
Chromium, total	mg/kg	30.1	J	31.2	J	24.9	J	16.7	J	21.9	J	13.1	J
Cobalt	mg/kg	12.9	J	17.2	J	9.96	J	12.1	J	13.9	J	8.33	J
Copper	mg/kg	56.2	J	34.8	J	29.2	J	26.4	J	39.6	J	22.5	J
Lead	mg/kg	7.85	=	0.634	=	2.61	=	1.12	=	3.18	=	ND	
Mercury	mg/kg	0.0413	=	0.0285	=	0.0258	=	0.0177	J	0.0239	J	0.00688	J
Nickel	mg/kg	14.9	J	15.7	J	11.3	J	6.15	J	9.77	J	4.82	J
Selenium	mg/kg	0.876	=	0.965	=	0.848	=	0.634	J	0.908	=	0.339	J
Silver	mg/kg	0.0321	J	ND		0.0223	J	ND		ND		ND	
Thallium	mg/kg	ND		4.44	J	0.44	J	0.438	J	ND		0.609	J
Tin	mg/kg	4.56	J	14.5	J	1.07	J	0.935	J	1.06	J	0.536	J
Vanadium	mg/kg	89	J	123	J	89.4	J	77	J	88.7	J	77.7	J
Zinc	mg/kg	67.3	J	23.4	J	44.3	J	21.9	J	47	J	13.8	J
Pesticides													
Endrin ketone	mg/kg	ND		ND		ND		ND		ND		ND	
p,p'-DDD	mg/kg	ND		ND		0.00022	J	ND		ND		ND	
p,p'-DDE	mg/kg	0.0028	J	0.0071	J	0.0048	J	0.00027	J	0.0023	J	ND	
p,p'-DDT	mg/kg	0.00083	J	ND		0.00055	J	ND		0.0007	J	ND	
PCBs													
Aroclor-1221	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1248	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1254	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1260	mg/kg	ND		ND		ND		ND		ND		ND	
Semi-Volatiles													
4-Methylphenol (p-Cresol)	mg/kg	0.304	J	ND		ND		ND		ND		ND	
Benzo(a)pyrene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		8.02E-02	J	ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Pyridine	mg/kg	ND		ND		ND		ND		ND		ND	
Volatiles													
Methylene chloride	mg/kg	ND		ND		ND		ND		ND		ND	
Styrene	mg/kg	ND		ND		ND		ND		ND		ND	
Chemistry													
Cyanide	mg/kg	NA		NA		NA		NA		NA		NA	
Sulfide	mg/kg	NA		NA		NA		NA		NA		NA	
Dioxins													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected ab
UJ = Detection limit was estimated; analyte was analyzed a
qualified as undetected.
J = Estimated value; compounds detected at concentration
the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no s

TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS31		CGW1SS32		CGW1SS33		CGW1SS34		CGW1SS35		CGW1SS36	
SampleID		CGW1SS31-R01		CGW1SS32-R01		CGW1SS33-R01		CGW1SS34-R01		CGW1SS35-R01		CGW1SS36-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		02/09/2004		02/09/2004		02/04/2004		02/09/2004		02/04/2004		02/10/2004	
SampleType		N		N		N		N		N		N	
Parameter	**Units**												
Metals													
Antimony	mg/kg	1.4	J	4.08	J	0.118	J	0.664	J	0.478	J	0.192	J
Arsenic	mg/kg	1.39	J	2.71	=	ND		ND		3.28	=	0.763	J
Barium	mg/kg	66.2	J	69.6	J	61.1	=	47.7	J	91.8	=	61.2	=
Beryllium	mg/kg	0.375	J	0.32	J	0.266	J	0.205	J	0.402	J	0.252	J
Cadmium	mg/kg	ND		ND		ND		ND		0.133	J	ND	
Chromium, total	mg/kg	80	J	113	J	21.2	J	18.1	J	62.7	J	19.5	J
Cobalt	mg/kg	32.1	J	17.6	J	11.9	=	9.36	J	26.3	=	11	=
Copper	mg/kg	28.5	J	130	J	48.5	=	23.8	J	39.9	=	28.3	=
Lead	mg/kg	ND		22.9	=	6.29	=	4.59	=	9.46	=	2.77	=
Mercury	mg/kg	0.055	=	0.0476	=	0.0203	J	0.0144	J	0.059	=	0.018	J
Nickel	mg/kg	23.9	J	31.5	J	8.31	J	5.87	J	22.5	J	7.77	=
Selenium	mg/kg	1.35	=	0.559	J	0.465	J	0.623	J	1.07	=	0.556	J
Silver	mg/kg	ND		0.0745	J	ND		ND		ND		ND	
Thallium	mg/kg	2.89	J	ND		0.735	J	0.293	J	ND		1.26	J
Tin	mg/kg	1.04	J	6.3	J	0.909	J	0.74	J	1.84	J	0.331	J
Vanadium	mg/kg	191	J	143	J	80.4	=	79.2	J	192	=	78.3	=
Zinc	mg/kg	21.2	J	73.1	J	40.2	=	21.1	J	61.9	=	18.6	J
Pesticides													
Endrin ketone	mg/kg	ND		ND		ND		ND		ND		ND	
p,p'-DDD	mg/kg	ND		ND		ND		ND		ND		ND	
p,p'-DDE	mg/kg	ND		0.019	J	0.00031	J	0.00028	J	ND		ND	
p,p'-DDT	mg/kg	ND		0.0018	J	ND		0.00022	J	ND		ND	
PCBs													
Aroclor-1221	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1248	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1254	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1260	mg/kg	ND		ND		0.021	J	ND		ND		ND	
Semi-Volatiles													
4-Methylphenol (p-Cresol)	mg/kg	ND		0.755	=	ND		ND		ND		ND	
Benzo(a)pyrene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Pyridine	mg/kg	ND		ND		ND		ND		ND		ND	
Volatiles													
Methylene chloride	mg/kg	ND		ND		ND		ND		ND		ND	
Styrene	mg/kg	ND		ND		ND		ND		ND		ND	
Chemistry													
Cyanide	mg/kg	NA		NA		0.595	J	NA		0.439	J	NA	
Sulfide	mg/kg	NA		NA		26.9	J	NA		ND		NA	
Dioxins													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		0.000141	=	NA		0.000236	=	NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		ND		NA		2.99E-06	=	NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		0.0000032	=	NA		7.26E-06	=	NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		3.75E-06	=	NA		0.0000128	=	NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		NA		ND		NA		1.55E-06	=	NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		0.000256	=	NA		0.000456	=	NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		0.0000315	=	NA		6.48E-05	=	NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		0.00112	=	NA		0.00295	=	NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		1.73E-06	=	NA		8.49E-06	=	NA	
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		2.32E-06	=	NA		0.0000035	=	NA	

Data Flags:
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qualified as undetected.
J = Estimated value; compounds detected at concentration
the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
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TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS37		CGW1SS38		CGW1SS39		CGW1SS40		CGW1SS41		CGW1SS42	
SampleID		CGW1SS37-R01		CGW1SS38-R01		CGW1SS39-R01		CGW1SS40-R01		CGW1SS41-R01		CGW1SS42-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		02/10/2004		02/10/2004		02/10/2004		02/10/2004		02/10/2004		02/10/2004	
SampleType		N		N		N		N		N		N	
Parameter	**Units**												
Metals													
Antimony	mg/kg	3.27	J	0.398	J	0.5	J	0.418	J	0.148	J	0.166	J
Arsenic	mg/kg	1.13	J	0.742	J	2.03	=	1.2	=	0.789	J	0.939	J
Barium	mg/kg	75.8	=	45.1	=	106	=	49.3	=	53.1	=	29.5	=
Beryllium	mg/kg	0.275	J	0.212	J	0.351	J	0.246	J	0.201	J	0.185	J
Cadmium	mg/kg	ND		ND		ND		ND		ND		ND	
Chromium, total	mg/kg	18.1	J	13	J	38.7	J	24.4	J	13.5	J	10.1	J
Cobalt	mg/kg	15.6	=	8.65	=	20.1	=	8.5	=	9.79	=	6.36	J
Copper	mg/kg	61.4	=	36.6	=	38.6	=	30.9	=	21.8	=	19.5	=
Lead	mg/kg	4.81	=	3.47	=	8.68	=	3.77	=	3.21	=	2.67	=
Mercury	mg/kg	0.0324	=	0.0207	J	0.0368	=	0.0176	J	0.0172	J	0.00988	J
Nickel	mg/kg	7.74	=	5.57	J	20.9	=	7.64	=	5.43	=	4.29	J
Selenium	mg/kg	0.54	J	0.514	J	0.532	J	0.483	J	0.449	J	0.588	J
Silver	mg/kg	ND		ND		0.357	J	ND		ND		ND	
Thallium	mg/kg	1.38	J	1.72	=	1.78	=	0.778	J	0.88	J	0.843	J
Tin	mg/kg	0.265	J	0.5	J	0.571	J	0.974	J	ND		ND	
Vanadium	mg/kg	90.3	=	78.8	=	116	=	89.6	=	71.5	=	61.2	=
Zinc	mg/kg	28.9	J	21.5	J	36.5	J	54.6	J	18	J	14.8	J
Pesticides													
Endrin ketone	mg/kg	ND		ND		ND		ND		ND		ND	
p,p'-DDD	mg/kg	ND		ND		ND		ND		ND		ND	
p,p'-DDE	mg/kg	0.0024	J	0.0001	J	0.024	J	0.0015	J	0.00067	J	ND	
p,p'-DDT	mg/kg	ND		ND		0.014	J	0.00064	J	0.00054	J	ND	
PCBs													
Aroclor-1221	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1248	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1254	mg/kg	ND		ND		ND		ND		ND		ND	
Aroclor-1260	mg/kg	ND		ND		ND		ND		ND		ND	
Semi-Volatiles													
4-Methylphenol (p-Cresol)	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(a)pyrene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Pyridine	mg/kg	ND		ND		ND		ND		ND		ND	
Volatiles													
Methylene chloride	mg/kg	ND		ND		ND		ND		ND		0.00064	J
Styrene	mg/kg	ND		ND		ND		ND		ND		ND	
Chemistry													
Cyanide	mg/kg	NA		NA		NA		NA		NA		NA	
Sulfide	mg/kg	NA		NA		NA		NA		NA		NA	
Dioxins													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected ab
UJ = Detection limit was estimated; analyte was analyzed a
qualified as undetected.
J = Estimated value; compounds detected at concentration
the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no s

TABLE 3-5
Surface Soil Analytical Data Detection Summary
SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1SS43		CGW1SS44		CGW1SS45		CGW1SS46		CGW1SS47		CGW1SS48		CGW1SS49		CGW1SS50	
SampleID		CGW1SS43-R01		CGW1SS44-R01		CGW1SS45-R01		CGW1SS46-R01		CGW1SS47-R01		CGW1SS48-R01		CGW1SS49-R01		CGW1SS50-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		02/10/2004		02/10/2004		02/10/2004		02/10/2004		02/10/2004		02/04/2004		02/10/2004		02/10/2004	
SampleType		N		N		N		N		N		N		N		N	
Parameter	**Units**																
Metals																	
Antimony	mg/kg	0.227	J	0.569	J	0.636	J	1.13	J	0.526	J	0.275	J	0.197	J	0.359	J
Arsenic	mg/kg	0.755	J	1.16	J	2.23	=	4.25	=	1.09	J	0.915	J	0.722	J	0.766	J
Barium	mg/kg	52.4	=	63.3	=	95.3	=	74	=	59	=	70.3	=	67.2	=	58.8	=
Beryllium	mg/kg	0.25	J	0.294	J	0.288	J	0.444	J	0.265	J	0.251	J	0.267	J	0.226	J
Cadmium	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Chromium, total	mg/kg	15.1	J	23.6	J	57.5	J	58	J	19.8	J	22.5	J	17.2	J	17.1	J
Cobalt	mg/kg	9.63	=	12.4	=	26.9	=	23.4	=	10.9	=	13.9	=	11.6	=	10.3	=
Copper	mg/kg	24.5	=	53	=	41.5	=	55.4	=	31.5	=	40.8	=	34.9	=	31.3	=
Lead	mg/kg	2.09	=	6	=	4.93	=	12.4	=	4.44	=	5.4	=	3.79	=	5.03	=
Mercury	mg/kg	0.0229	J	0.0269	J	0.0329	=	0.0213	J	0.0243	J	0.0166	J	0.0367	=	0.0258	J
Nickel	mg/kg	6.36	=	9.68	=	33.9	=	22.2	=	8.23	=	8.82	J	7.78	=	7.08	=
Selenium	mg/kg	0.655	J	0.582	J	0.803	J	0.619	J	0.663	J	0.65	J	0.574	J	0.52	J
Silver	mg/kg	ND		ND		ND		ND		ND		0.0367	J	ND		ND	
Thallium	mg/kg	1.22	J	1.31	J	1.45	J	3.07	=	1.33	J	ND		1.57	J	1.31	J
Tin	mg/kg	0.239	J	0.523	J	0.694	J	0.971	J	0.843	J	0.661	J	0.274	J	0.886	J
Vanadium	mg/kg	70.4	=	84.5	=	147	=	180	=	82.4	=	92.7	=	80.3	=	77.1	=
Zinc	mg/kg	16.5	J	36.7	J	36.5	J	72.9	J	23.7	J	30.4	=	30.4	J	24.9	J
Pesticides																	
Endrin ketone	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
p,p'-DDD	mg/kg	ND		ND		ND		ND		ND		ND		ND		0.0062	J
p,p'-DDE	mg/kg	ND		0.0018	J	0.00042	J	0.0027	J	0.0007	J	0.00071	J	0.00076	J	0.19	=
p,p'-DDT	mg/kg	ND		0.0012	J	0.00067	J	0.0027	J	ND		ND		0.00039	J	0.049	J
PCBs																	
Aroclor-1221	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Aroclor-1248	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Aroclor-1254	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Aroclor-1260	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Semi-Volatiles																	
4-Methylphenol (p-Cresol)	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(a)pyrene	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		ND		ND		0.13	J	ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Pyridine	mg/kg	ND		ND		0.0293	J	ND		ND		ND		ND		ND	
Volatiles																	
Methylene chloride	mg/kg	ND		0.00059	J	ND		ND		ND		ND		ND		ND	
Styrene	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND	
Chemistry																	
Cyanide	mg/kg	NA		NA		NA		NA		NA		0.276	J	NA		NA	
Sulfide	mg/kg	NA		NA		NA		NA		NA		ND		NA		NA	
Dioxins																	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		0.0000561	=	NA		NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		ND		NA		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		ND		NA		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		ND		NA		NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		ND		NA		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		0.0000991	=	NA		NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		0.0000113	=	NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		0.000512	=	NA		NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		ND		NA		NA	
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		NA		NA		ND		NA		NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected ab
UJ = Detection limit was estimated; analyte was analyzed a
qualified as undetected.
J = Estimated value; compounds detected at concentration
the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no s

TABLE 3-6

Groundwater Analytical Data Detection Summary

SWMU 1, Campa García Landfill, Vieques, PR

StationID		CGW1MW01		CGW1MW02		CGW1MW03		CGW1MW04		CGW1MW05	
SampleID		CGW1GW01-R01		CGW1GW02-R01		CGW1GW03-R01		CGW1GW04-R01		CGW1GW05-R01	
DateCollected		02/05/2004		02/05/2004		02/06/2004		02/07/2004		02/13/2004	
SampleType		N		N		N		N		N	
Parameter	**Units**	Background									
Dissolved Metals											
Antimony, dissolved	µg/L	ND		ND		2.83	J	ND		ND	
Barium, dissolved	µg/L	18	J	39.6	J	236	=	41.8	J	77.2	J
Chromium, dissolved	µg/L	7.91	J	9.93	J	0.595	J	1.25	J	1.27	J
Cobalt, dissolved	µg/L	ND		ND		11	J	ND		ND	
Copper, dissolved	µg/L	5.24	J	3.25	J	1.96	J	1.31	J	5.2	J
Mercury, dissolved	µg/L	ND		0.461	=	ND		0.0264	J	ND	
Nickel, dissolved	µg/L	6.66	J	10.4	J	4.36	J	1.84	J	4.74	J
Selenium, dissolved	µg/L	ND		3.62	J	ND		2.38	J	3.25	J
Silver, dissolved	µg/L	ND		ND		0.515	J	ND		ND	
Thallium, dissolved	µg/L	ND		2.99	J	ND		ND		ND	
Tin, dissolved	µg/L	ND		ND		ND		1.8	J	ND	
Vanadium, dissolved	µg/L	8.88	J	9.48	J	10.6	J	10.9	J	22.1	J
Zinc, dissolved	µg/L	5.89	J	ND		ND		ND		17.2	J
Metals											
Antimony	µg/L	ND		ND		3.25	J	ND		3.02	J
Barium	µg/L	36.8	J	47.8	J	238	=	45.7	J	81.8	J
Beryllium	µg/L	0.18	J	0.0973	J	ND		ND		ND	
Cadmium	µg/L	ND		0.492	J	ND		ND		ND	
Chromium, total	µg/L	29	=	20.2	=	0.774	J	1.47	J	2.01	J
Cobalt	µg/L	3.81	J	2.47	J	11	J	ND		0.738	J
Copper	µg/L	15.3	J	3.83	J	1.74	J	1.26	J	8.74	J
Mercury	µg/L	ND		1.29	=	0.0507	J	0.0888	J	ND	
Nickel	µg/L	17.2	J	15.5	J	4.71	J	2.28	J	5.34	J
Selenium	µg/L	ND		4.74	J	ND		3.49	J	4.93	J
Silver	µg/L	ND		0.858	J	0.547	J	ND		0.656	J
Thallium	µg/L	ND		5.08	J	2.99	J	3.89	J	ND	
Vanadium	µg/L	31.5	J	14.9	J	11.7	J	12.9	J	24.3	J
Zinc	µg/L	14	J	4.66	J	ND		ND		10.8	J
Chemistry											
Cyanide	µg/L	NA		ND		NA		4.79	J	NA	
Sulfide	µg/L	NA		560	J	NA		720	J	NA	

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

ND = Not detected.

NA = Not analyzed

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample

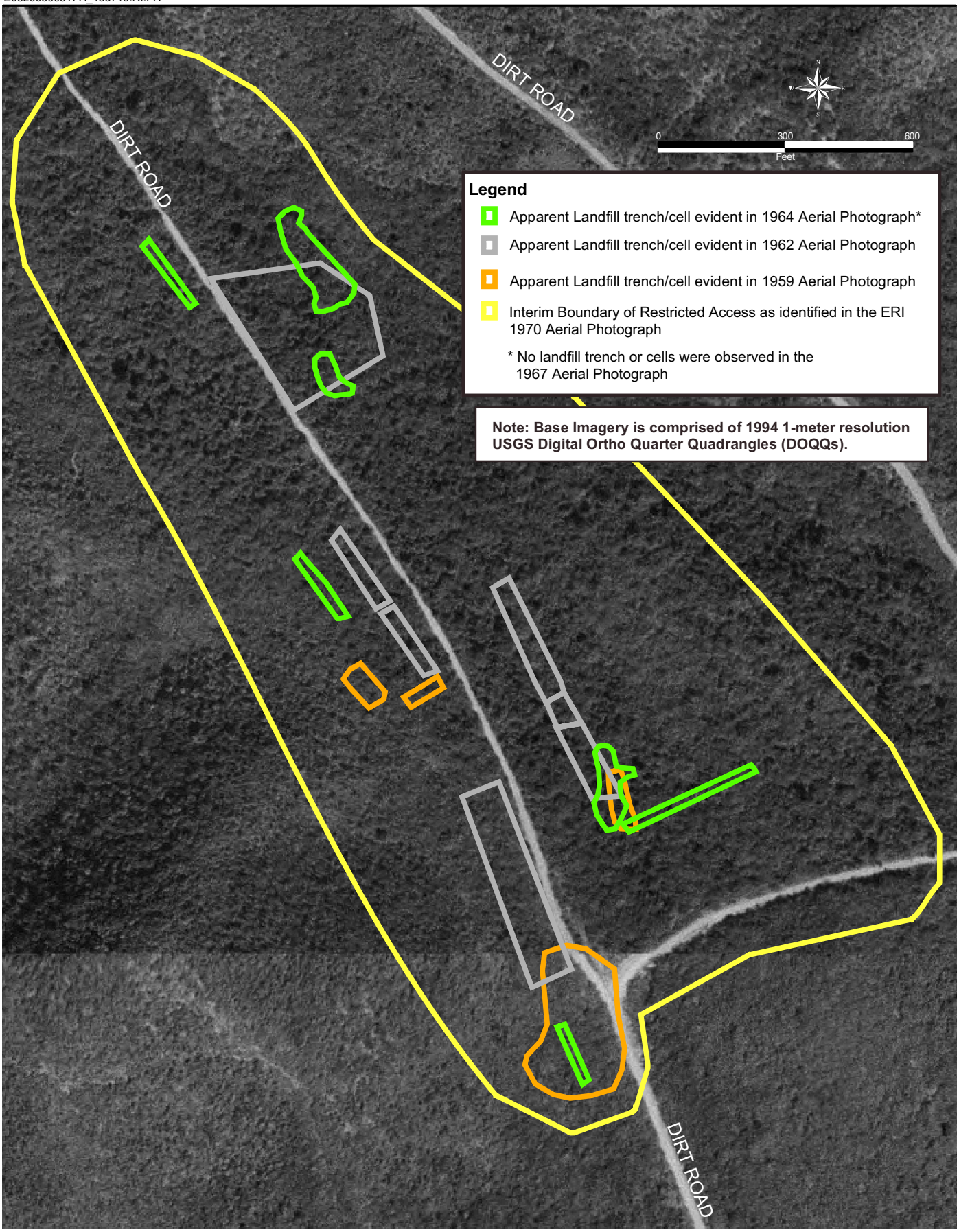


Figure 3-1
Aerial Photograph of Camp Garcia Landfill
SWMU 01, Former AFWTF, Puerto Rico

CH2MHILL

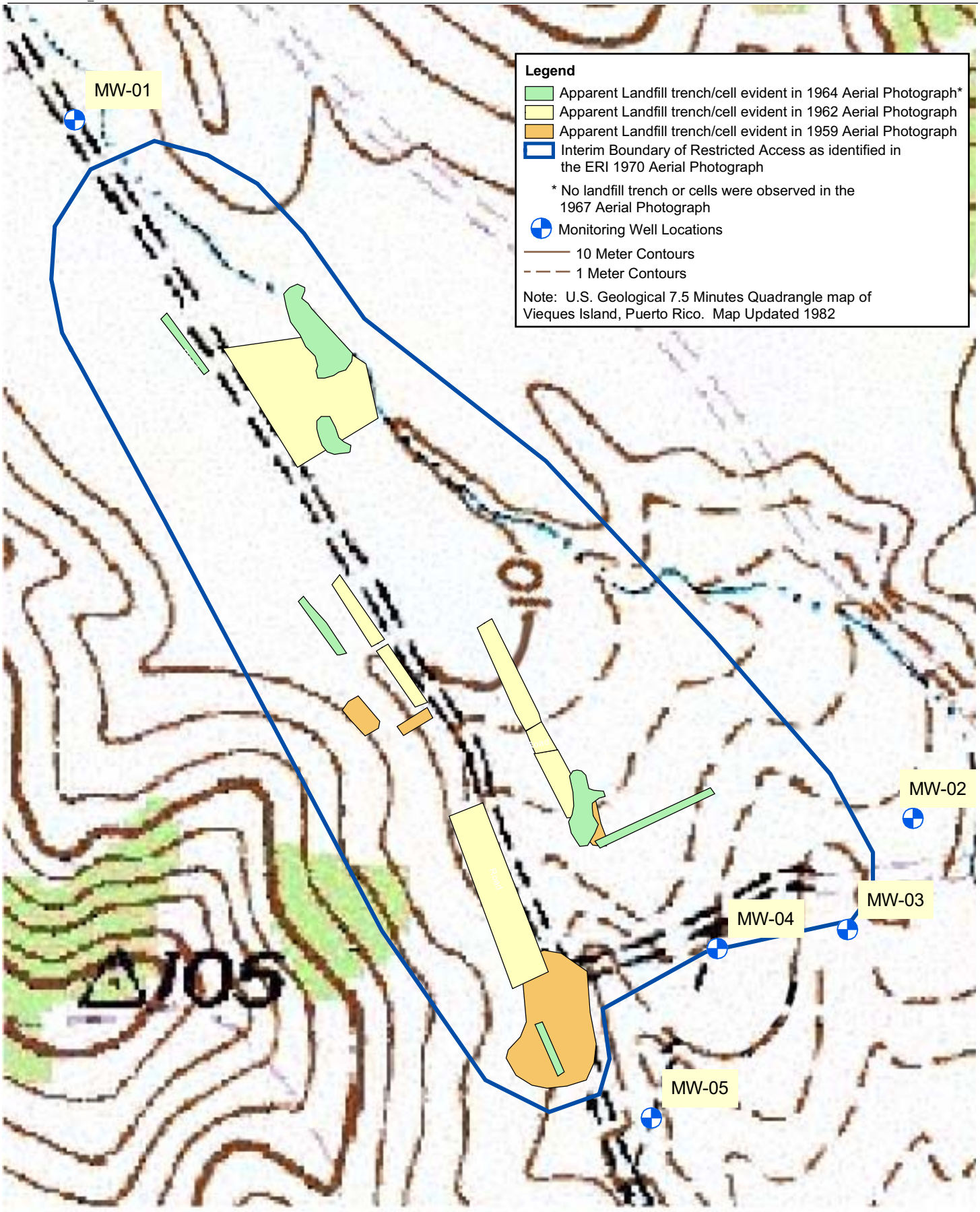


Figure 3-2
Topographic Map
SWMU 1, Former AFWTF, Puerto Rico

CH2MHILL

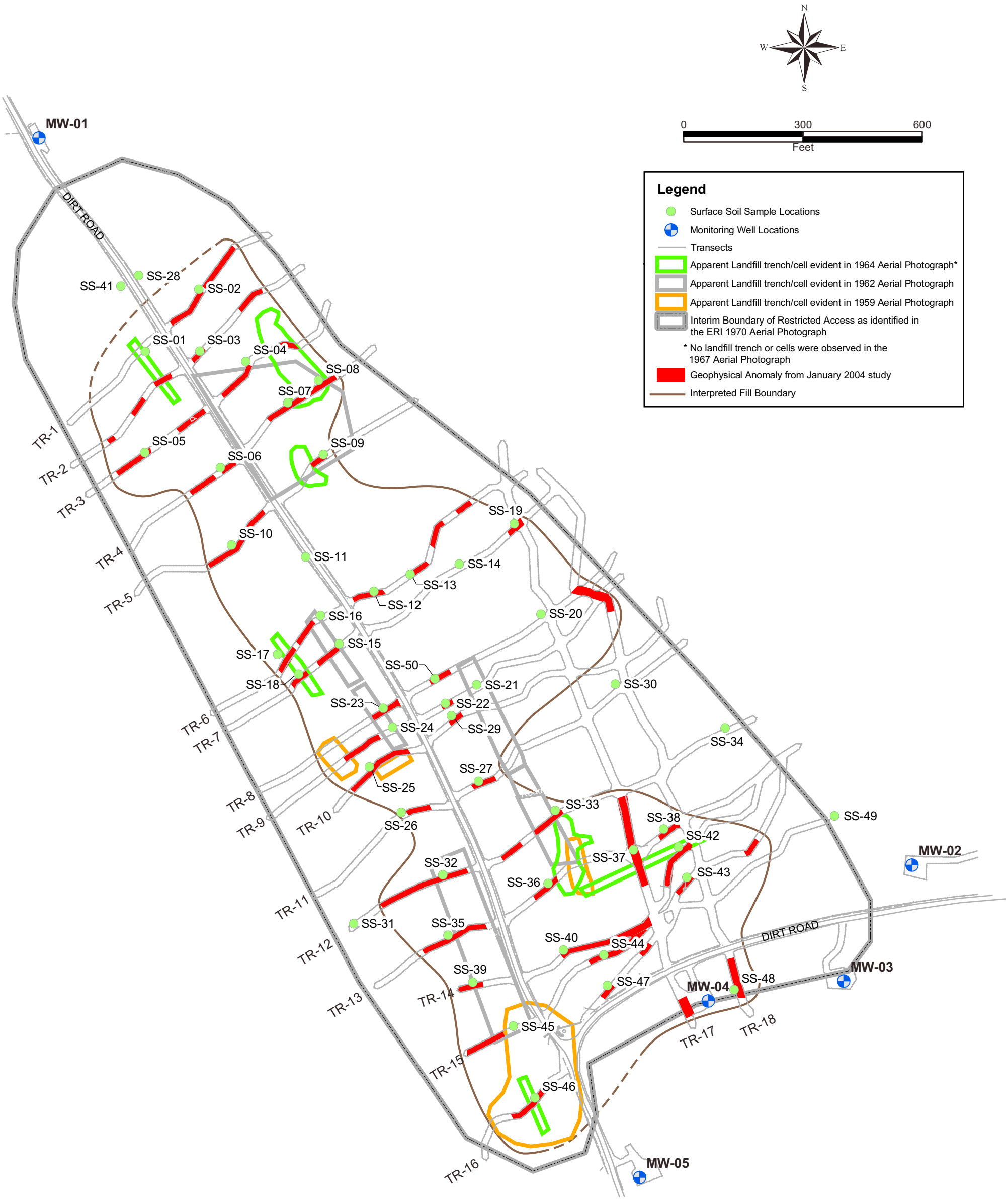


Figure 3-3
Surface Soil Sample Location Map
SWMU 1, Former AFWTF, Puerto Rico

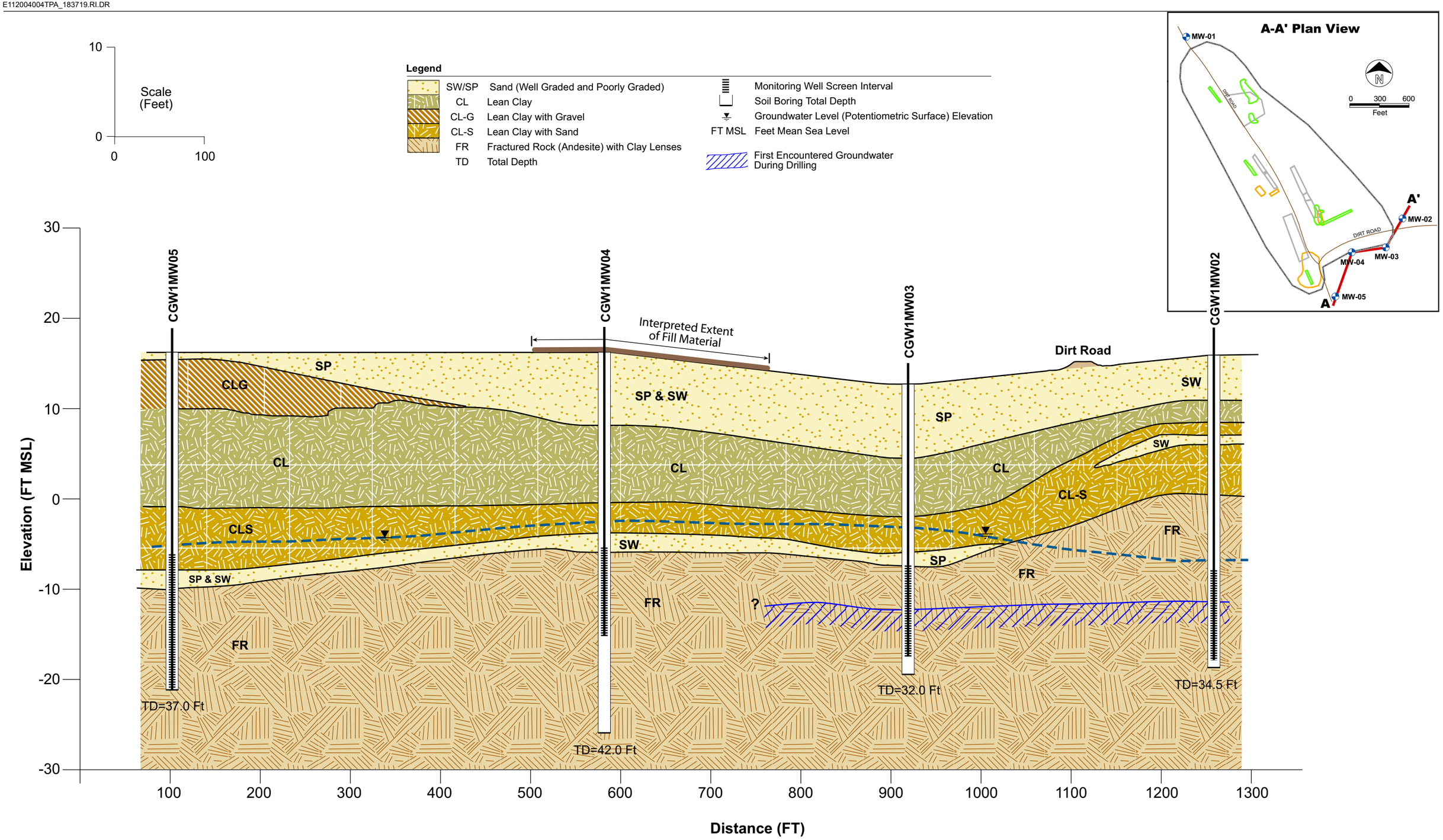


Figure 3-4
Geologic Cross Section A-A'
Former AFWTF, Puerto Rico

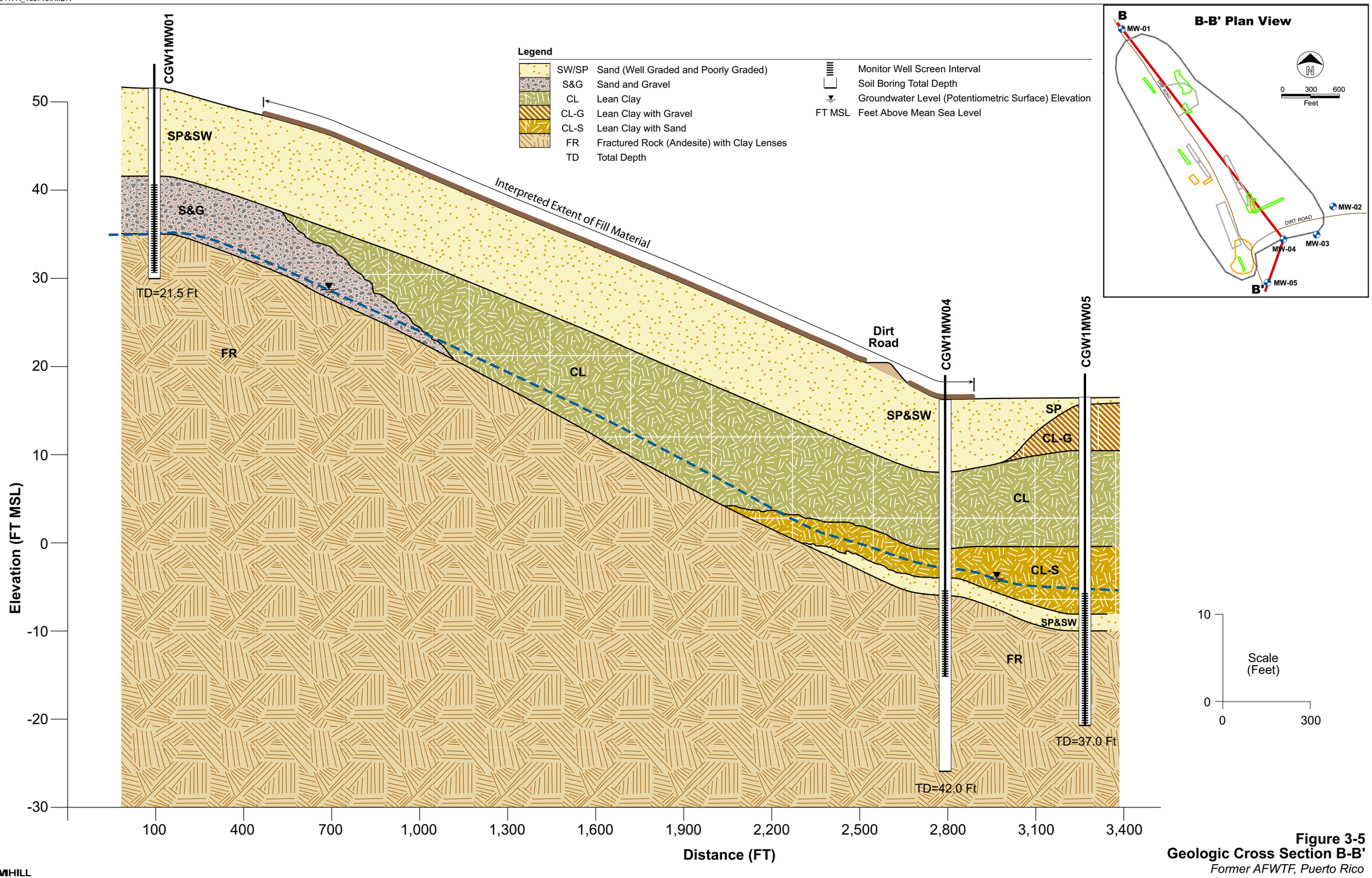


Figure 3-5
Geologic Cross Section B-B'
Former AFWTF, Puerto Rico

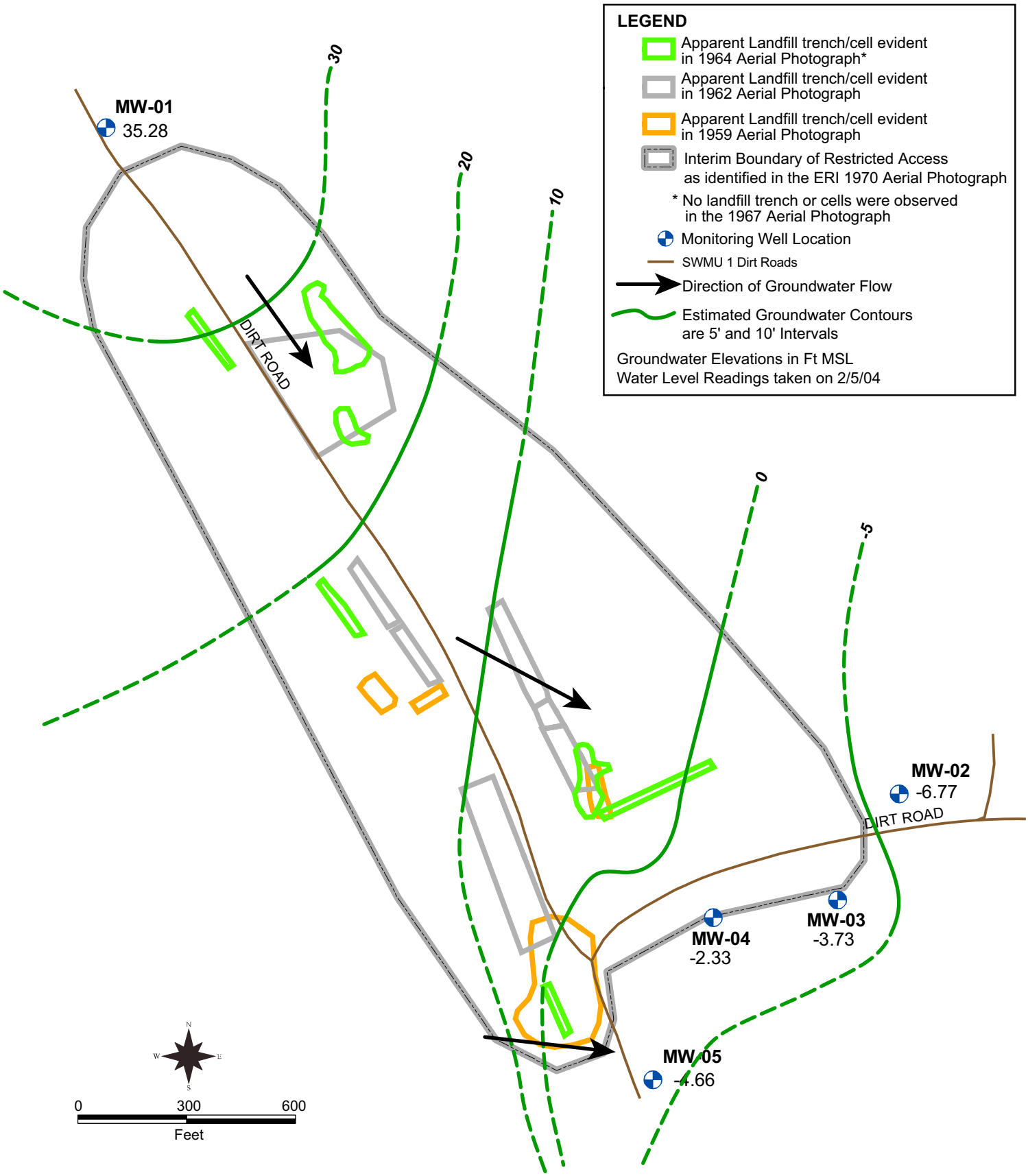


Figure 3-6
Groundwater Flow Map
SWMU 01, Former AFWTF, Vieques, Puerto Rico

SECTION 4

SWMU 2 – Fuels Off-Loading Site (Camp García)

This section presents the results of the Phase I RFI performed at SWMU 2 – Fuels Off-Loading Site in January and February 2004. It includes a site description, results of the field investigation, and a summary of laboratory results.

4.1 Site Description

SWMU 2 is located at Camp García, and is the former location of four aboveground fuel storage tanks (ASTs). Two 20,000-gallon tanks and two 30,000-gallon tanks at this location were reported to have been used to store diesel fuel, unleaded gasoline (MOGAS), leaded gasoline, aviation gasoline (AVGAS), and JP-5 fuel (Greenleaf-Telesca, 1984). These tanks became operational in 1953 and were removed between 1978 and 1979. Tank refueling occurred approximately every 3 months, and involved pumping fuel from a barge through an 8-inch submarine line to each of these tanks. Prior to the start of refueling, seawater had to be flushed from the submarine line, which reportedly resulted in the discharge of fuel mixed with seawater into the ocean and onto the soil along the shoreline in the vicinity of the concrete loading ramp. According to the 1984 IAS (Greenleaf-Telesca, 1984), this refueling process took place for approximately 25 years.

The sludge that accumulated in the bottom of the tanks was removed periodically by a private contractor and disposed of on the main island of Puerto Rico (Kearney, 1988).

The site is currently overgrown with grass and small shrubs. The only visual signs of historical site activities are the concrete loading ramp and the steel pipeline supports next to the loading ramp. The 1995 RFA (PREQB, 1995) stated that the migration of waste or accumulated liquids to the soil, groundwater or surface water was very low. No staining or other evidence of release was found during a Visual Site Inspection. The RFA recommended no further action for this site based on the following conditions: the remote location, the inactive nature of the site, the minimal exposure potential from this SWMU to human receptors, and the absence of visible petroleum contamination on surface media. These same conditions were observed during the February 2004 CH2M HILL site visit.

An environmental survey was conducted in 1978 (Tippetts, et al., 1979), shortly after the tanks were dismantled and the refueling halted. The survey did not find any indications of stressed vegetation, impacts to the fauna, oil-stained beaches, or other indications of pollution. Because no effects on the environment or to human health could be postulated, SWMU 2 was not recommended for a Confirmation Study (Greenleaf-Telesca, 1984).

A Phase II RFA was conducted by Kearney in 1988. The study concluded SWMU 2 had low to no potential for exposure to environmental receptors and recommended no further action (Kearney, 1988).

Figure 4-1 shows the site topography and the location of the former ASTs and refueling area. Figure 4-2 presents a photograph of the former shoreline fuel off-loading area.

4.2 Field Investigation Results

No previous environmental sampling investigations have been conducted at this site.

A visual inspection was conducted by CH2M HILL personnel during the Phase I RFI to attempt to determine the exact location of the pipeline that reportedly extended from the AST area to the loading dock area. The inspection was conducted by traversing north and south in the area between AST area and the dock area. Broken pieces of 6-inch pipe were located along a water-filled ditch, but these pieces appeared to have been moved to this location. No signs of the actual piping location were identified during the extensive field visual survey.

Surface and subsurface soil samples were collected at SMWU 2 between January 19 and January 21, 2004. Soil sampling stations were established based on the locations of existing concrete pads and interpretations of the ERI aerial photography (ERI, 2000). The aerial photographs indicated the presence of the four storage tanks and the fuel loading area.

CH2M HILL collected 12 surface soil samples (0 to 6 inches) and installed two soil borings at SWMU 2. Eight of the 12 surface soil samples were collected from the area of the former above ground storage tanks (two surface soil samples from each tank pad area), and a single subsurface soil sample was collected from the soil boring at this location, as shown in Figure 4-3. The other four surface soil samples were collected near the two fuel pipe supports in the concrete ramp area (two surface soil samples from each pipe support area), and a single subsurface soil sample was collected approximately 30 feet north of a pipe support as shown in Figure 4-4. This location was determined to be the closest location to the pipe at which the drilling crew could safely execute the required work. The two soil borings were installed to 5 ft bls in the AST area and 4.5 ft bls in the fuel pipe support area, and soil samples were screened continuously with an organic vapor analyzer (OVA). OVA readings for all samples indicated no detectable volatile constituents. Therefore, only one subsurface soil sample was collected from each soil boring. A sample was collected between 3 and 5 ft bls at GCW2SB01, and a sample was collected between 2 and 4 ft bls at GCW2SB02, the locations of which are shown in Figure 4-3.

All surface soil samples were analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. Surface soil samples CGW2SS03, CGW2SS07, CGW2SS09, and CGW2SS12 were additionally analyzed for cyanide, sulfide, dioxins, and explosives. The two subsurface soil samples were analyzed for VOCs and SVOCs. Sample CGW2SB01 was also analyzed for cyanide, sulfide, and dioxins.

Although historical information for SWMU 2 did not indicate the potential presence of explosives or related residues at this site, explosives were included in the sample analyses because of the location of the site within the property designated as the range area of the AFWTF.

4.3 Laboratory Analytical Results

4.3.1 Surface Soil

Figures 4-3 and 4-4 show the locations of surface soil samples collected at SWMU 2 during the Phase I RFI. Table 4-1 summarizes the surface soil constituent detections.

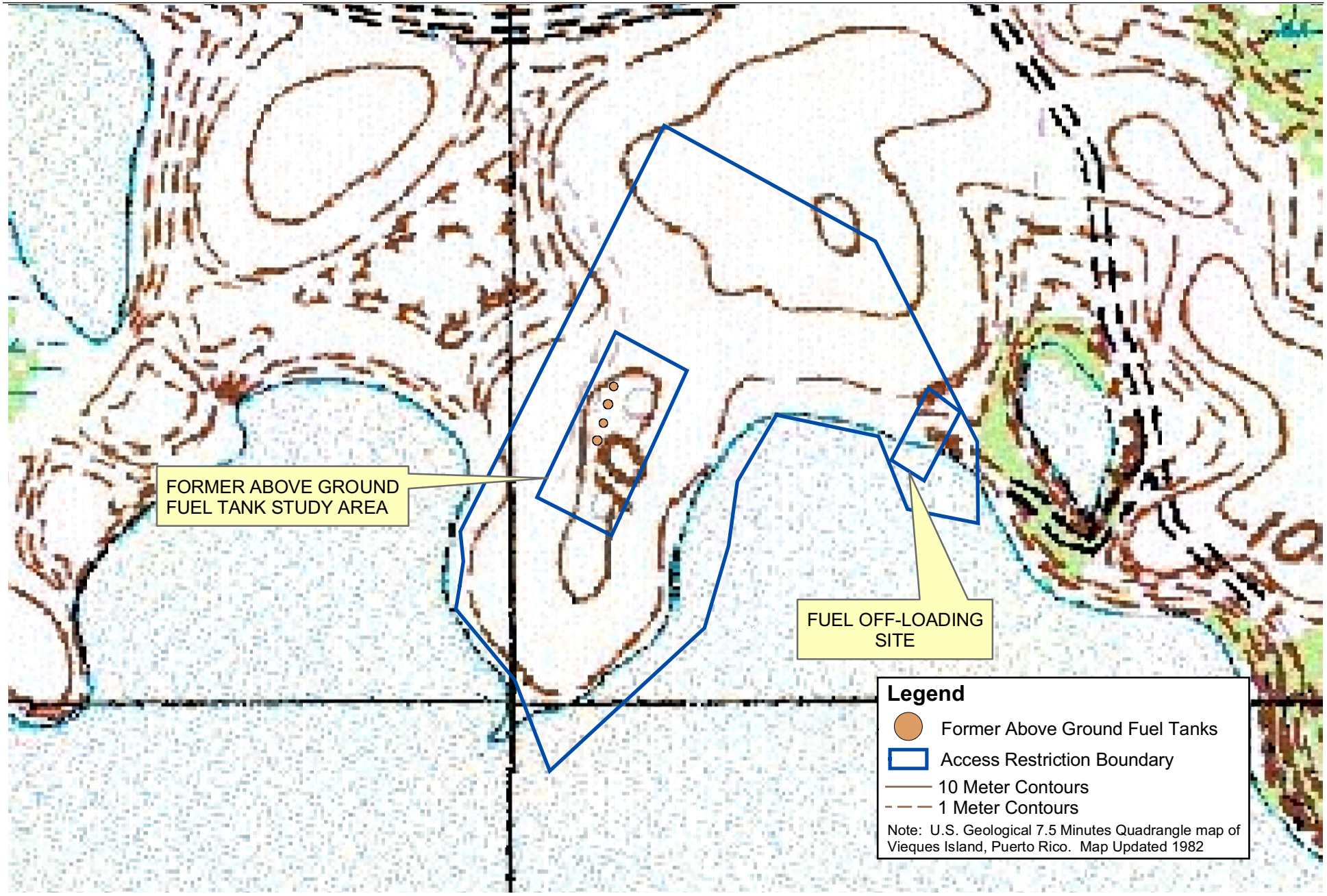
4.3.2 Subsurface Soil

Figures 4-3 and 4-4 show the locations of subsurface soil samples collected during the Phase I RFI. There were no detections of VOCs, SVOCs, cyanide, sulfide, or dioxins in the subsurface soil samples collected at SWMU 2.

Table 4-1
Surface Soil Analytical Data Detection Summary
SWMU 2, Fuels Off-Loading Site, Campa García, Vieques, PR

StationID		CGW2SS01		CGW2SS02		CGW2SS03		CGW2SS04		CGW2SS05		CGW2SS06		CGW2SS07		CGW2SS08		CGW2SS09		CGW2SS10		CGW2SS11		CGW2SS12	
SampleID		CGW2SS01-R01		CGW2SS02-R01		CGW2SS03-R01		CGW2SS04-R01		CGW2SS05-R01		CGW2SS06-R01		CGW2SS07-R01		CGW2SS08-R01		CGW2SS09-R01		CGW2SS10-R01		CGW2SS11-R01		CGW2SS12-R01	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004		01/21/2004	
SampleType		N		N		N		N		N		N		N		N		N		N		N		N	
Parameter	**Units**																								
Metals																									
Antimony	mg/kg	0.64	J	0.582	J	0.147	J	0.289	J	0.219	J	0.211	J	0.458	J			0.705	J	0.675	J	0.48	J	0.653	J
Arsenic	mg/kg	1.25	J	0.231	J	1.1	J	0.719	J	1.31	J	0.46	J	1.66	=	1.11	J	1.16	J	2.03	=	2.33	=	1.84	=
Barium	mg/kg	53.6	J	66.3	J	69.3	J	74.2	J	73.2	J	65.4	J	67	J	60.6	J	54.9	J	53.9	J	89	J	45.1	J
Beryllium	mg/kg	0.348	J	0.376	J	0.342	J	0.314	J	0.32	J	0.263	J	0.364	J	0.37	J	0.0976	J	0.122	J	0.137	J	0.113	J
Cadmium	mg/kg	0.189	J	0.125	J	0.0504	J	ND		0.0451	J	ND		0.0441	J	ND		0.153	J	0.112	J	0.192	J	0.0528	J
Chromium, total	mg/kg	19.4	J	18.1	J	20.7	J	56.2	J	18.8	J	16.8	J	18.9	J	19	J	11.1	J	19.7	J	18.6	J	12.5	J
Cobalt	mg/kg	13	J	11	J	14	J	10.3	J	13.4	J	11	J	15.1	J	12.2	J	18.8	J	20.6	J	24.7	J	51.2	J
Copper	mg/kg	28	J	17.1	J	24.1	J	22.4	J	33.2	J	10.7	J	28.8	J	29.1	J	76.7	J	70.7	J	48.3	J	42.9	J
Lead	mg/kg	16	J	3.21	J	15.6	J	5.05	J	4.17	J	1.19	J	5.87	J	2.58	J	3.09	J	3.69	J	1.7	J	2.52	J
Mercury	mg/kg	0.0181	J	0.0108	J	0.0125	J	0.0108	J	0.0152	J	0.00537	J	0.02	J	0.00927	J	0.00358	J	0.0146	J	0.00462	J	0.00524	J
Nickel	mg/kg	7.98	J	7.89	J	10	J	23.7	J	8.47	J	6.77	J	6.36	J	8.38	J	8.47	J	10.6	J	12.7	J	7.26	J
Selenium	mg/kg	0.551	J	0.207	J	0.627	J	0.331	J	0.352	J	ND		0.424	J	0.23	J	0.197	J	0.175	J	0.443	J	0.319	J
Silver	mg/kg	0.101	J	0.156	J	0.0722	J	0.126	J	0.0572	J	0.106	J	0.0775	J	0.0565	J	0.0534	J	0.0841	J	0.0752	J	0.0815	J
Tin	mg/kg	0.237	J	ND		0.29	J	ND		ND		ND		ND		ND		ND		0.368	J	0.262	J	ND	
Vanadium	mg/kg	117	J	114	J	89.4	J	97.3	J	67.2	J	95.4	J	140	J	58	J	82.4	J	73.8	J	96.7	J	71.1	J
Zinc	mg/kg	21.2	J	19.1	J	17.6	J	14.8	J	15.5	J	19.6	J	19.2	J	9.81	J	40.2	J	31	J	28.9	J	23.7	J
Pesticides																									
p,p'-DDE	mg/kg	ND		ND		0.0004	J	0.00028	J	0.00073	J	ND		0.00016	J	ND		0.00059	J	0.0005	J	0.00013	J	0.00008	J
Semi-Volatiles																									
Benzo(a)pyrene	mg/kg	0.0535	J	ND		ND		ND		ND		ND		ND		ND		ND		0.0465	J	ND		0.0481	J
Di-n-butyl phthalate	mg/kg	ND		0.146	J	0.386	J	0.418	=	ND		0.331	J	0.416	=	0.14	J	0.0789	J	0.0547	J	0.0452	J	0.0486	J
Indeno(1,2,3-c,d)pyrene	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND		ND		0.114	J	0.116	J	ND	
Chemistry																									
Cyanide	mg/kg	NA		NA		0.3	J	NA		NA		NA		ND		NA		ND		NA		NA		ND	
Sulfide	mg/kg	NA		NA		119	=	NA		NA		NA		ND		NA		ND		NA		NA		ND	
Dioxins																									
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		0.0000127	=	NA		NA		NA		0.00001	=	NA		0.00011	=	NA		NA		0.000004	=
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		ND		NA		NA		NA		ND		NA		0.000003	=	NA		NA		ND	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		ND		NA		NA		NA		ND		NA		0.000005	=	NA		NA		ND	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		0.0000283	=	NA		NA		NA		0.00001	=	NA		0.00022	=	NA		NA		0.00001	=
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		0.0000035	=	NA		NA		NA		ND		NA		0.00005	=	NA		NA		ND	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		0.000173	=	NA		NA		NA		0.00007	=	NA		0.00078	=	NA		NA		0.00005	=
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		ND		NA		NA		NA		ND		NA		0.00001	=	NA		NA		ND	

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is available.
N = Normal field sample.

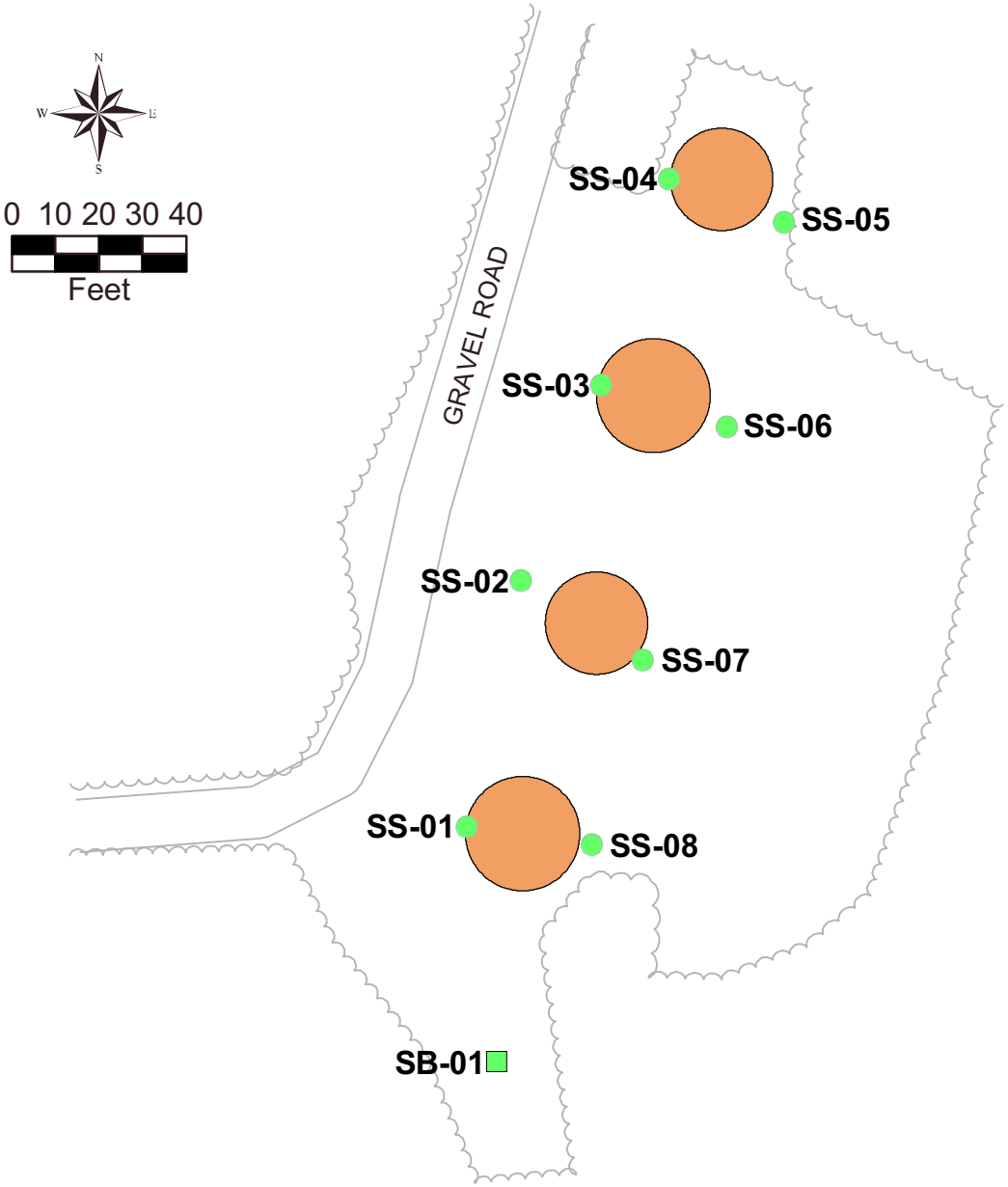


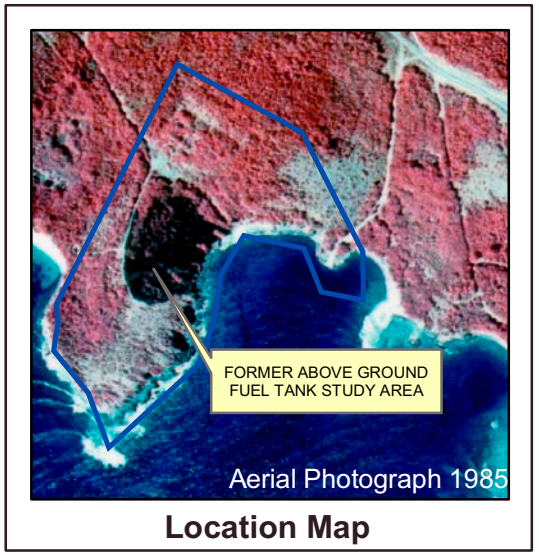
CH2MHILL

Figure 4-1
Topographic Map
SWMU 2, Former AFWTF, Puerto Rico

Photograph taken February 3, 2000

Figure 4-2
SWMU 2 Fuels Off-Loading Site (Camp Garcia)
SWMU 2, Former AFWTF, Puerto Rico

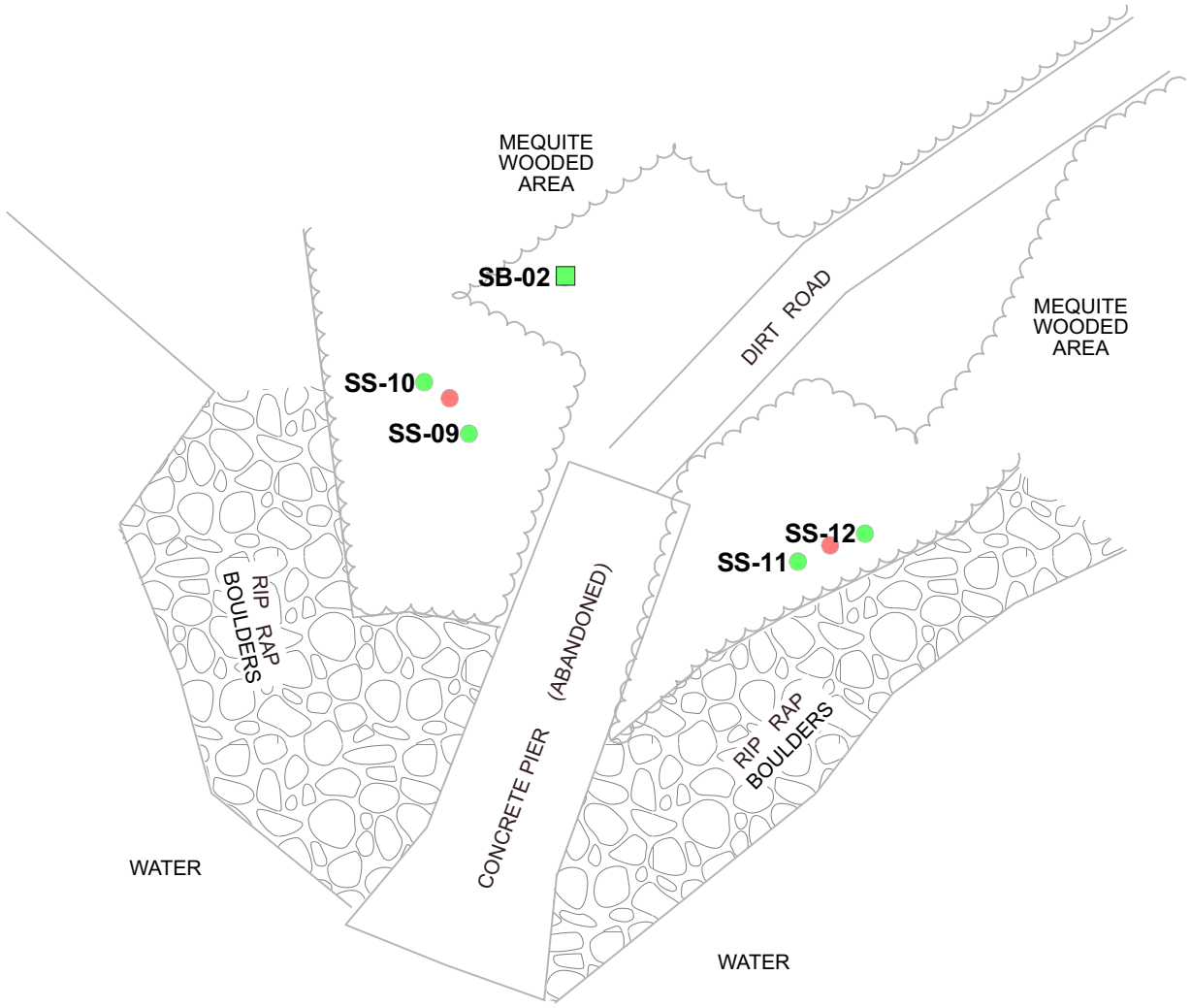


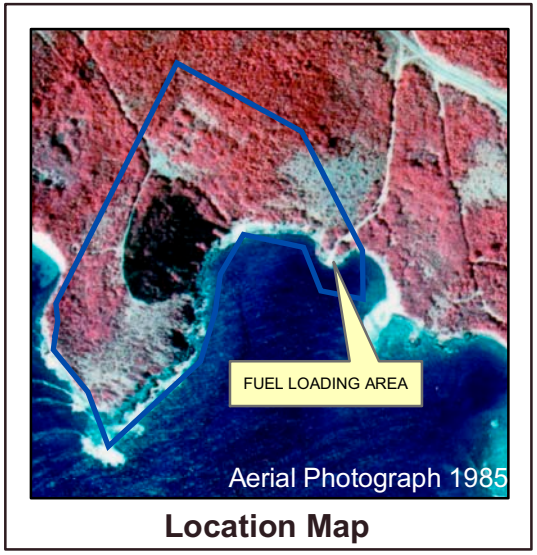


Legend

- Subsurface Soil Sample Location
- Surface Soil Sample Location
- Former Above Ground Fuel Tank Locations

Figure 4-3
Surface and Subsurface Soil Sample Locations
(Former Above Ground Fuel Tank Study Area)
SWMU 2, Former AFWTF, Puerto Rico





Legend

- Steel Pipe Supports
- Subsurface Soil Sample Location
- Surface Soil Sample Location

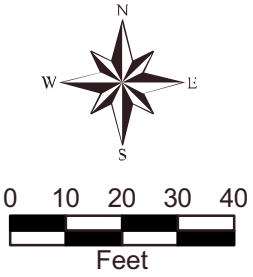


Figure 4-4
Surface and Subsurface Soil Sample Locations (Fuel Loading Area)
SWMU 2, Former AFWTF, Puerto Rico

SECTION 5

SWMU 4 – Waste Areas of Building 303 (Camp García)

This section presents the results of the Phase I RFI performed at SWMU 4 – Waste Areas of Building 303 at the AFWTF in June 2000, and January and February 2004. It includes a site description, results of the field investigations, and a summary of laboratory results.

5.1 Site Description

Building 303 was established as a storage area for batteries when it was erected in the 1960s. The SWMU 4 waste areas located in Building 303 comprise a spent battery accumulation area, a catch basin for hydraulic oil, a cleaning/degreasing basin, and a storage area for waste rags, absorbent material, and grease. Per the classifications in the 1988 and 1995 RFA reports, the oil catch basin, cleaning/degreasing basin, and storage area for rags, absorbent material, and grease were designated as AOCs C, D, and E, respectively. The 1988 RFA report referred to the spent battery accumulation area as being inside Building 303, where batteries and battery acid were stored prior to disposal. The acid from spent batteries was stored in a plastic container prior to offsite shipment.

The catch basin for hydraulic oil consisted of a metal gutter approximately 5 ft long and 6 inches wide, located beneath several containers of hydraulic oil on a rack. The gutter was designed to catch drips that occurred when hydraulic oil was removed from the drums. The unit was located inside Building 303 and was placed over the above grade concrete floor, which is flat and continuous throughout the entire building. No sign of release was observed during the VSI (Kearney, 1988).

The cleaning basin was a square metal container, approximately 24 inches long, 18 inches wide, and 12 inches deep, used to hold solvents for the cleaning and degreasing of parts. The unit was formerly located inside Building 303 (Kearney, 1988).

The rags, absorbent, and grease storage area was located inside Building 303 and consisted of a small area of the shop where several barrels of grease, rags, and adsorbent for spills generated during cleanup of spills within Building 303 were stored. Facility personnel stated that this was also the approximate area where spent batteries were stored. No visual signs of a release or spill to the floor were observed during the VSI (Kearney, 1988). The 1988 RFA report recommended no further action for all four sites included as SWMU 4.

The 1995 RFA (PREQB, 1995) addressed the spent battery accumulation area, catch basin for hydraulic oil, and the rags, adsorbent, and grease storage area in Building 303. The conclusion for the Spent Battery Accumulation Area stated that the potential for migration of waste or accumulated liquids to the soil, groundwater or surface water is very low. According to the 1995 RFA, no batteries or acid were present at former Corrosive Materials Storage Building, nor were there visible signs of acid leakage on the concrete floor from previous storage of these materials. No evidence of release was found during VSI, and the

exposure potential from this SWMU is minimal. No further action was recommended by PREQB.

Because all of the above-described sites were located inside or adjacent to Building 303 at Camp García, they were all included as one SWMU (SWMU 4). This was identified in the Consent Order dated January 2000.

A site inspection was conducted by CH2M HILL in February 2000 to visually assess potential releases at SWMU 4. No staining or signs of contamination were observed on the concrete floor during the site inspection.

As noted in the Current Conditions Report (CH2M HILL, 2001), an additional building adjacent to Building 303 was identified. This building was used as a battery accumulation area and consisted of a small building adjacent to Building 303 designated as "Corrosive Materials Storage." In the past, it contained spent batteries and battery acid, which were disposed offsite at the former NSRR (now referred to as NAPR). Also noted in the Current Conditions Report (CH2M HILL, 2001) was an additional area identified as a storage location for rags, adsorbent material, and grease contained in barrels. This area was described as a small building located adjacent to Building 303 and designated as "Flammable Storage." The Flammable Materials Storage Building has a concrete floor. Spent batteries were also stored in this building. Figure 5-1 illustrates the locations of the Corrosive Materials Storage Building and the Flammable Materials Storage Building at SWMU 4**.** Figure 5-2 is a photograph of the Corrosive Materials Storage Area, and Figure 5-3 is a photograph of the Flammable Storage Area.

Jay Gonzalez, an employee of the DOI U.S. Fish and Wildlife Service (USFWS), stated in a January 2004 interview that Building 303 was cleared of all its contents and that the concrete floor was washed with a high pressure hose. He further stated that there were no floor drains, sumps, or cracks in the concrete floor, and that no apparent staining was observed. A concrete bermed area was observed in Building 303. This site appeared to be a waste storage area, and soil samples were collected outside and adjacent to this area.

5.2 Field Investigation Results

5.2.1 2000 Investigations

Because of the ongoing transfer of NASD activities to Camp García, a surface soil sampling investigation was conducted at SWMU 4 in June 2000. Twelve surface soil samples were collected from a depth of 0 to 8 inches in the areas of the Corrosive Materials Storage Building (spent battery accumulation area), Flammable Materials Storage Building (area of rags, absorbent material, and grease - AOC E), and near Building 303 adjacent to the inner catch basin for hydraulic oil (AOC C).

Five surface soil samples were collected around the Corrosive Materials Storage Building, five samples were collected around the Flammable Materials Storage Building, and two samples were collected outside of the catch basin area. Figure 5-1 shows the surface soil sample locations surrounding these areas at Building 303. The surface soil samples were analyzed for Appendix IX constituents and explosives.

5.2.2 2004 Soils Investigation

On January 21, 2004, one soil boring was installed to a depth of 6 ft outside of Building 303, adjacent to the former hydraulic oil catch basin. Samples were collected continuously in 2-ft intervals. The soil was screened in the field with an OVA. No vapors were detected with the OVA; therefore, one sample was collected for analyses just above bedrock from a depth of 4 to 6 ft bls. The subsurface soil sample was analyzed for VOCs and SVOCs.

The degreasing basin was not found during the 2004 field investigation. There was no sign of additional berms or floor drains or sumps within Building 303. Therefore, no additional soil borings were installed.

5.3 Laboratory Results

5.3.1 Surface Soil

Figure 5-1 shows the locations of the surface soil samples collected at SWMU 4 in 2000. Table 5-1 summarizes the detections of constituents in the surface soil samples.

5.3.2 Subsurface Soil

Figure 5-1 shows the location of the subsurface soil sample collected at SWMU 4 in 2004. Table 5-2 summarizes the detections of constituents in the subsurface soil sample.

Table 5-1
Surface Soil Analytical Data Detection Summary
SWMU 4, Waste Areas of Building 303, Campa García, Vieques, PR

StationID		CGSWMU4SS001		CGSWMU4SS002		CGSWMU4SS003		CGSWMU4SS004		CGSWMU4SS005		CGSWMU4SS006		CGSWMU4SS007		CGSWMU4SS008		CGSWMU4SS009		CGSWMU4SS010		CGSWMU4SS011		CGSWMU4SS012	
SampleID		NDD021		NDD022		NDD023		NDD024		NDD025		NDD026		NDD027		NDD028		NDD029		NDD030		NDD031		NDD032	
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
DateCollected		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000	
SampleType		N		N		N		N		N		N		N		N		N		N		N		N	
Parameter	**Units**																								
Metals																									
Antimony	mg/kg	0.83	J	0.81	J	0.68	J	0.95	J	ND		ND		ND		ND		ND		ND		ND		ND	
Arsenic	mg/kg	2.5	=	2.3	=	1.8	=	2.1	=	1.7	=	ND		0.62	J	0.8	J	0.64	J	0.89	J	0.68	J	ND	
Barium	mg/kg	63.3	=	71.6	=	60.4	=	69.8	=	64.2	=	62.7	=	65.4	=	65.3	=	73.5	=	75.5	=	67.5	=	55.5	=
Beryllium	mg/kg	0.3	=	0.28	=	0.37	=	0.29	=	0.22	=	0.17	J	0.17	J	0.2	J	0.23	=	0.23	J	0.21	J	0.2	J
Cadmium	mg/kg	1	=	1.5	=	0.69	=	1.1	=	0.52	=	ND		ND		ND		ND		ND		ND		ND	
Chromium, total	mg/kg	41.3	=	22.5	=	22.6	=	25.7	=	23.8	=	4.1	=	11.8	=	7.7	=	8.2	=	8.6	=	7.6	=	6	=
Cobalt	mg/kg	19.1	=	11	=	16.4	=	15.8	=	15.3	=	8	=	10.1	=	8.5	=	8.6	=	9.8	=	10.5	=	9.7	=
Copper	mg/kg	72.9	=	58.1	=	66.3	=	76.9	=	76.3	=	32.4	=	50.2	=	34.5	=	37.1	=	41.9	=	38.1	=	30.2	=
Lead	mg/kg	20	=	26.7	=	17.3	=	24.5	=	29.7	=	2.7	=	5.9	=	7.6	=	3.6	=	5.1	=	6.4	=	4.5	=
Mercury	mg/kg	ND		0.044	J	0.034	J	0.062	J	0.025	J	ND		ND		0.02	J	0.021	J	0.021	J	ND		ND	
Nickel	mg/kg	22.7	=	8.8	=	9.9	=	10	=	14.6	=	2	J	5.9	=	3.1	J	3.7	J	3.7	J	2.9	J	2.7	J
Selenium	mg/kg	0.91	J	ND		0.64	J	1	J	0.94	J	0.81	J	0.98	J	0.86	J	1.1	J	0.86	J	1.1	J	0.68	J
Tin	mg/kg	1	J	1	J	1	J	1.2	J	0.7	J	ND		ND		0.58	J	ND		ND		ND		ND	
Vanadium	mg/kg	105	=	75.8	=	95.1	=	82.5	=	90.2	=	50.2	=	71.2	=	62.4	=	63.4	=	72.8	=	79.9	=	60	=
Zinc	mg/kg	355	J	165	J	99.5	J	139	J	127	J	46.3	J	65.2	J	45.4	J	41.9	J	105	J	231	J	184	J
Pesticides																									
p,p'-DDE	mg/kg	0.0011	J	ND		0.0043	J	ND		ND		ND		0.0023	J	0.0032	J	0.0045	J	0.0038	J	ND		ND	
p,p'-DDT	mg/kg	0.0012	J	ND		0.0022	J	ND		0.0041	J	0.0043	J	0.00059	J	0.0018	J	0.0034	J	0.00066	J	ND		ND	
Herbicide																									
2,4-d (dichlorophenoxyacetic acid)	mg/kg	0.014	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Semi-Volatiles																									
Acetophenone	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND		0.355	J	ND		ND		ND	
Anthracene	mg/kg	ND		0.105	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Benzyl alcohol	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND		0.065	J	ND		ND		ND	
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		0.055	J	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Di-n-octylphthalate	mg/kg	ND		ND		ND		ND		ND		0.036	J	ND		ND		ND		ND		ND		ND	
Fluoranthene	mg/kg	ND		0.123	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Phenanthrene	mg/kg	ND		0.105	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Pyrene	mg/kg	ND		0.067	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Volatiles																									
2-Hexanone	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		0.002	J
Dibromomethane	mg/kg	ND		ND		ND		0.0006	J	ND		ND		ND		ND		ND		ND		ND		ND	
m,p-Xylene (sum of isomers)	mg/kg	0.0006	J	ND		ND		0.0006	J	ND		0.002	J	ND		ND		0.0009	J	ND		ND		ND	
Toluene	mg/kg	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		0.008	J	ND	
Xylenes, total	mg/kg	0.0006	J	ND		ND		0.0006	J	ND		0.002	J	ND		ND		0.0009	J	ND		ND		ND	

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
Blank spaces in screening criteria columns signify that no screening criteria value is available.
N = Normal field sample.

Table 5-2

Subsurface Soil Analytical Data Detection Summary

SWMU 4, Waste Areas of Building 303, Campa García, Vieques, PR

	StationID	CGW4SB01	
	SampleID	CGW4SB01-R01-5	
	Depth	4 to 6 feet	
	DateCollected	01/21/2004	
	SampleType	N	
Parameter	**Units**		
Semi-Volatiles			
bis(2-Ethylhexyl) phthalate	mg/kg	0.161	J
Di-n-butyl phthalate	mg/kg	0.109	J

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample.

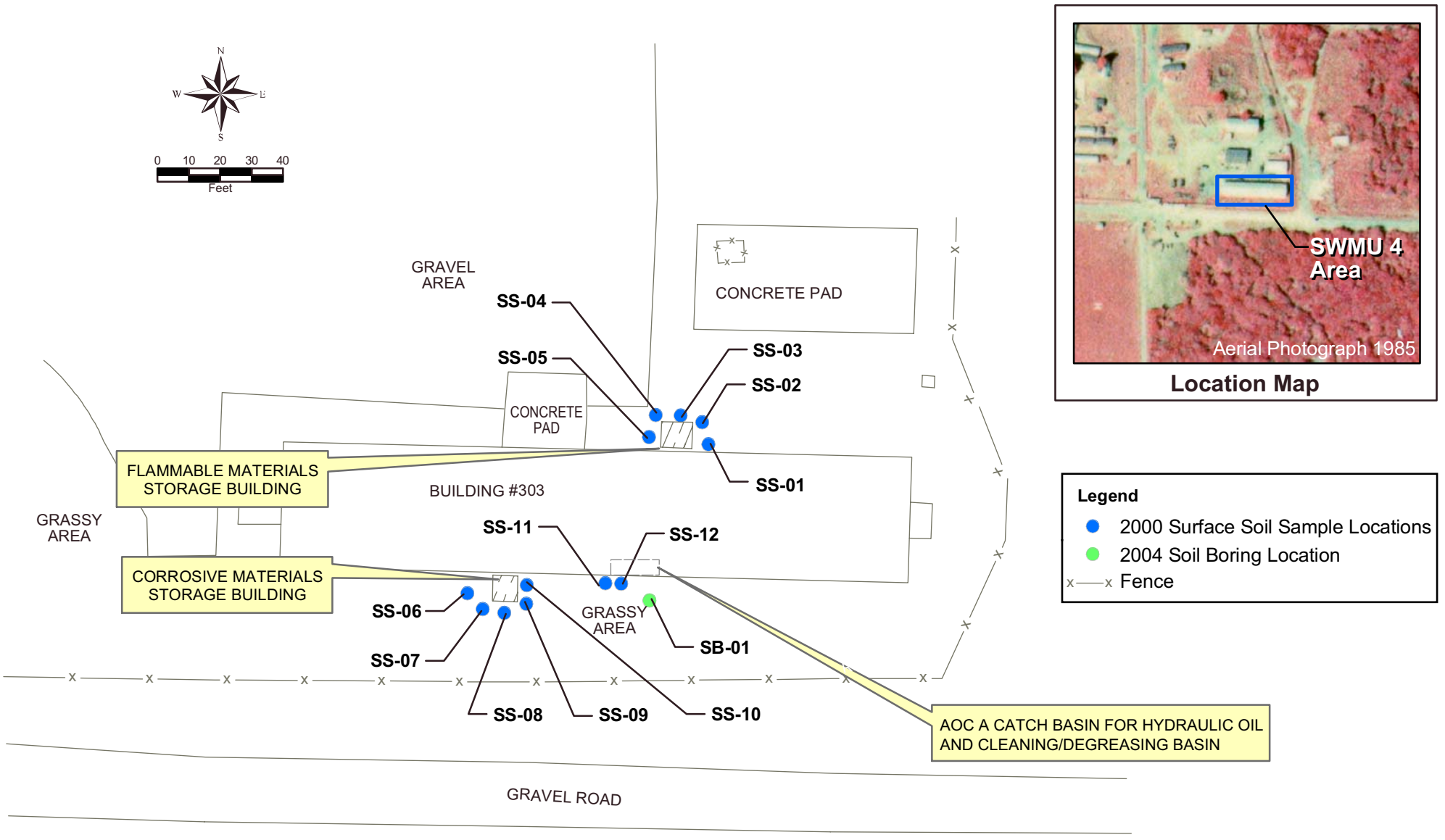


Figure 5-1
Surface and Subsurface Soil Sample Locations
SWMU 4, Former AFWTF, Puerto Rico

Photograph taken February 3, 2000

Figure 5-2
SWMU 4 Corrosive Materials Storage Shed
SWMU 4, Former AFWTF, Puerto Rico

Photograph taken February 3, 2000

Figure 5-3
SWMU 4 Flammable Storage Shed
SWMU 4, Former AFWTF, Puerto Ric

SECTION 6

SWMU 5 – Spent Battery Accumulation Area, OP-1, Inner Range, AFWTF

This section presents the results of the Phase I RFI performed at SWMU 5 – Spent Battery Accumulation Area OP-1, Inner Range, AFWTF in January 2004. It includes a site description, results of the field investigation, and a summary of laboratory results.

6.1 Site Description

SWMU 5 is a spent battery accumulation area located in the vicinity of OP-1 at the Inner Range of the former AFWTF (Figure 6-1). The area is similar to SWMU 4; however, the batteries and battery acid were stored outside on a gravel driveway as noted in the Kearney RFA. According to the 1988 RFA Report (Kearney, 1988), acid from these batteries typically was emptied into plastic containers and shipped to NAPR (the former NSRR). The 1988 and 1995 RFA reports stated that no staining or other signs of release were observed at the unit during the VSI and, therefore, sampling and analysis were not suggested at that time. However, establishment of an area with secondary containment for storage of the batteries and acid was recommended in the 1988 RFA by Kearney.

Although the startup date for SWMU 5 is unknown, the SWMU remained active through May 2003. During the 1995 RFA, nine batteries were observed to be stored at this site on the gravel driveway. No signs of any spills or leaks from these batteries were apparent, and no release controls were identified at this SWMU (PREQB, 1995).

During the CH2M HILL February 2000 site visit, release controls (plastic storage trays) for battery storage were present, but no batteries were stored at the site. No signs of releases of battery acid were observed.

During the January 2004 Phase I RFI site visit, no signs of activity were evident at SWMU 5. No batteries were stored at the site. The plastic trays observed in 2000 had been removed as part of the closure of the former AFWTF.

6.2 Field Investigation Results

6.2.1 Previous Investigations

No previous environmental sampling investigations have been performed at SWMU 5.

6.2.2 2004 Soils Investigation

On January 19, 2004, CH2M HILL collected four surface soil samples from a depth of 0 to approximately 8 inches at the locations shown in Figure 6-2, which were the locations in the gravel adjacent of the former battery storage units. Samples were analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. One surface soil

sample, collected at station CGW5SS01, was additionally analyzed for cyanide, sulfide, and dioxins.

Although historical information for SWMU 5 does not indicate the potential presence of explosives or related residues at this site, explosives were included in the sample analyses because of the use of explosives in the range areas of the AFWTF.

6.3 Laboratory Analytical Results

Figure 6-2 shows the locations of the surface soil samples collected at SWMU 5 during the Phase I RFI. Table 6-1 summarizes the surface soil constituent detections.

Table 6-1

Surface Soil Analytical Data Detection Summary

SWMU 5, Spent Battery Accumulation Area, Observation Post (OP) - 1, Inner Range, AFWTF, Vieques, PR

	StationID	CGW5SS01		CGW5SS02		CGW5SS03		CGW5SS04	
	SampleID	CGW5SS01-R01		CGW5SS02-R01		CGW5SS03-R01		CGW5SS04-R01	
	Depth	0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
	DateCollected	01/19/2004		01/19/2004		01/19/2004		01/19/2004	
	SampleType	N		N		N		N	
Parameter	**Units**								
Metals									
Antimony	mg/kg	1.04	J	1.36	J	0.904	J	1.34	J
Arsenic	mg/kg	3.66	=	6.94	=	5.46	=	4.38	=
Barium	mg/kg	64.3	=	67.6	=	65.1	=	66.8	=
Beryllium	mg/kg	0.144	J	0.157	J	0.165	J	0.178	J
Cadmium	mg/kg	0.242	J	0.739	=	0.298	J	0.265	J
Chromium, total	mg/kg	36.2	J	54.2	J	38.9	J	47.8	J
Cobalt	mg/kg	14.6	J	15.5	J	11.5	J	14.8	J
Copper	mg/kg	43	=	67.1	=	50.5	=	48.7	=
Lead	mg/kg	11.8	J	16.1	J	16.1	J	11.3	J
Mercury	mg/kg	0.0128	J	0.0165	J	0.0122	J	0.0126	J
Nickel	mg/kg	15.5	J	23.9	J	15.2	J	20	J
Selenium	mg/kg	0.472	J	0.456	J	0.476	J	0.45	J
Silver	mg/kg	0.098	J	0.0936	J	0.0905	J	0.124	J
Tin	mg/kg	0.326	J	0.384	J	0.362	J	0.469	J
Vanadium	mg/kg	79.1	J	83.4	J	76.9	J	96.7	J
Zinc	mg/kg	77	J	112	J	80.8	J	84	J
Semi-Volatiles									
Acetophenone	mg/kg	0.0544	J	ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND		0.0596	J	0.0528	J	0.0639	J
Dimethyl phthalate	mg/kg	ND		ND		ND		1.41	J
Dioxins									
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	0.000107	=	NA		NA		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	2.7E-06	=	NA		NA		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	3.2E-06	=	NA		NA		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	0.000209	=	NA		NA		NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	0.000033	=	NA		NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	0.000856	=	NA		NA		NA	

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

ND = Not detected.

NA = Not analyzed

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample.

Photograph taken February 3, 2000

Figure 6-1
SWMU 5 Spent Battery Accumulation Area
(Observation Post 1, Inner Range, AFWTF)
SWMU 5, Former AFWTF, Puerto Rico

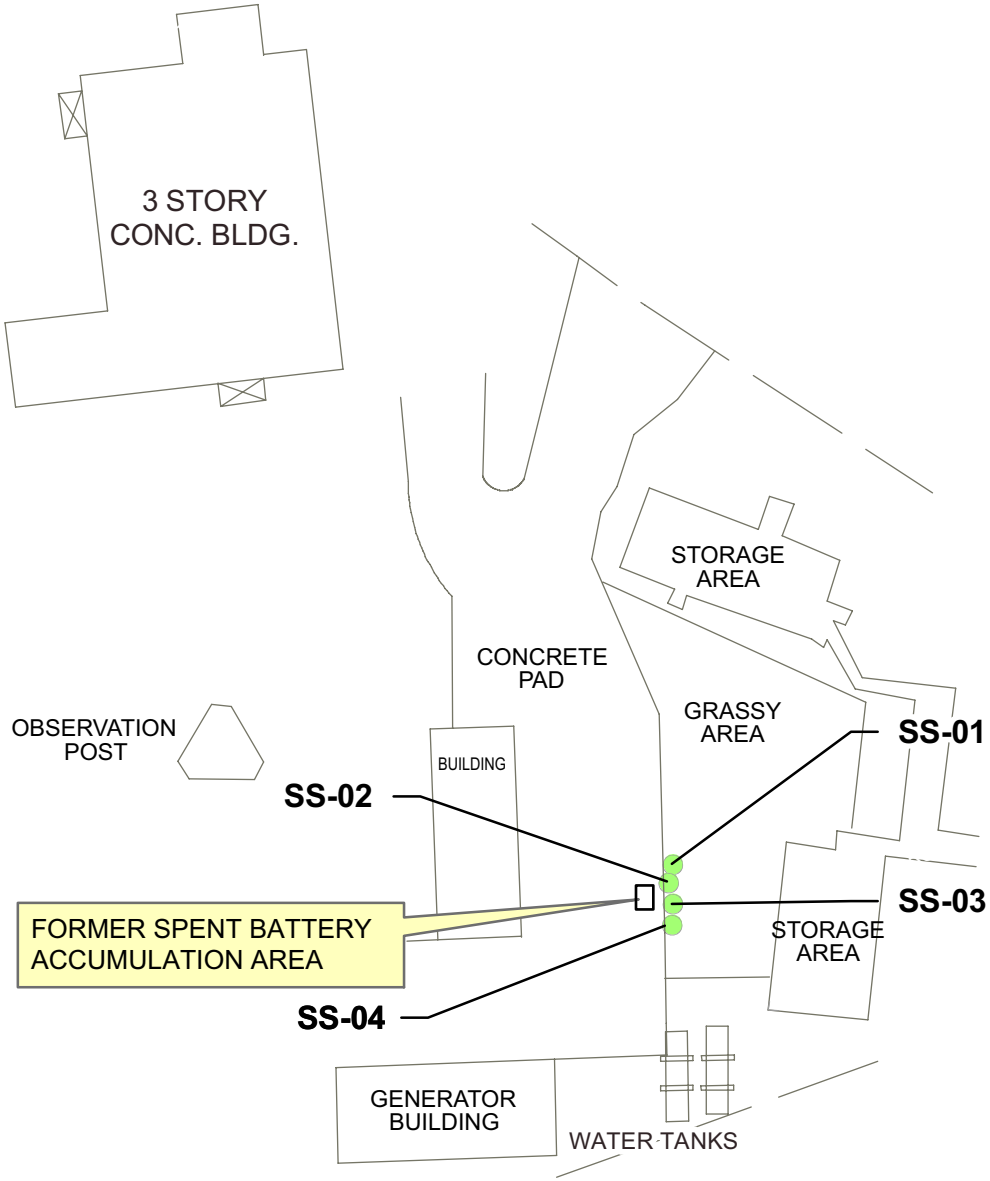


Photo taken from The Former AFWTF Web Page.

Location Map

Legend

Surface Soil Sample Locations

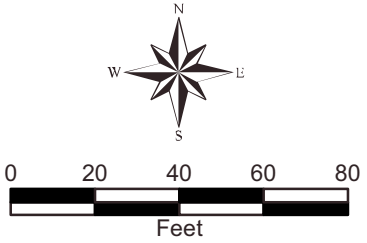


Figure 6-2
SWMU-5 Surface Soil Sample Locations
SWMU 5, Former AFWTF, Puerto Rico

SECTION 7

SWMU 6 and 7 – Waste Oil and Paint Accumulation Areas (Seabees Area, Camp García)

This section presents the results of the Phase I RFI performed in June 2000 at SWMU 6, a storage area for waste oil and paint, and SWMU 7, a waste oil accumulation area located outside Building 303 at Camp García. It includes a site description, results of the field investigation, and a summary of laboratory results.

7.1 Site Description

During interviews with Navy employees in February 2000 and June 2000, it was confirmed that SWMU 6 and SWMU 7 were located adjacent to each other, and, therefore, were investigated as one contiguous unit. The area encompassing these two sites currently consists of an open area, which contains a concrete pad (SWMU 6) and a small covered chain-link cage (SWMU 7), as shown in Figure 7-1. Two RFAs were conducted for these sites, one in 1988 and another in 1995. Findings from these RFAs are summarized below.

7.1.1 SWMU 6

According to the 1988 RFA report (Kearney, 1988), the SWMU 6 area was used by the Navy Construction Group (Seabees) as a storage area for waste oil and paint. The waste oil at this location was containerized in 55-gallon drums, and the paint was housed in small containers. During the RFA, tires and two drums of lubricating oil were present at the site. The waste oil and tires were stored on a grassy area until they were later shipped offsite to the former NSRR (now referred to as NAPR). The RFA Report stated that this area became active in approximately 1978, and was still active in 1988 (Kearney, 1988). During the 1995 RFA (PREQB, 1995), staining from oil leakage from the drums onto the soil surface was visible, and no release controls were present at the site. During the February 2000 site visit by CH2M HILL, no drums or waste materials were present at SWMU 6. Based on available information, the exact location of the staining could not be determined. The 1995 RFA did not provide sufficient description or photographs to facilitate locating the area of soil staining in 2000. Therefore, the June 2000 soil samples were collected around the existing concrete pad where runoff to soil would most likely occur. During the June 2000 site visit, no drums or waste materials were present at the site and no soil staining was observed.

7.1.2 SWMU 7

SWMU 7 is a former waste oil accumulation area located outside of Building 303 at Camp García. It was used by the U.S. Marines for 3 months per year during training exercises. During these 3 months, Marines conducted training exercises at the EMA, and used the waste oil accumulation area at SWMU 7 to store waste oil from the maintenance of their

vehicles. During the 1988 RFA, one open-top 55-gallon drum, a 25-gallon trash can, and two empty drums cut in half were present at SWMU 7. It was reported that the soil in the waste oil accumulation area was stained with oil, likely from spillage and release during vehicle maintenance operations. Once the Marines completed their training, the stained soil was excavated and mixed with sand, containerized in 55-gallon drums, and shipped to the former NSRR. Both the 1988 RFA report (Kearney, 1988) and the 1995 RFA report (PREQB, 1995) stated that "no sampling and analyses were suggested at this time. A general cleanup of the area, however, would help reduce the potential for release. It was suggested that an area with release controls for storage of the waste materials be established and that procedures be developed to minimize spillage of product." During the February 2000 site inspection, no drums of waste oil or other material were present in the SWMU 7 area. During the January 2004 site visit, only concrete pad with no observed staining remained at the site. The chain-link cage had been removed from this location. No waste was stored at the site at the time of the site visit.

7.2 Field Investigation Results

A surface soil sampling investigation was conducted in June 2000 as part of the transfer of Navy Public Works operations from West Vieques to East Vieques. Ten surface soil samples were collected from 0 to about 8 inches bls around the cage and concrete pad as shown in Figure 7-2. These results were provided in the August 1, 2000, Quarterly Report (CH2M HILL, 2000) and presented herein. No sampling was conducted at SWMU 6 and SWMU 7 during 2004.

7.3 Laboratory Analytical Results

Figure 7-2 shows the locations of the surface soil samples collected at SWMUs 6 and 7 in 2000. Table 7-1 summarizes the surface soil constituent detections.

Table 7-1
Surface Soil Analytical Data Detection Summary
SWMU 6 and 7, Waste Oil and Paint Accumulation Areas, Sea Bees Area, Camp García, Vieques, PR

	StationID	CGSWMU6/7SS001		CGSWMU6/7SS002		CGSWMU6/7SS003		CGSWMU6/7SS004		CGSWMU6/7SS005		CGSWMU6/7SS006		CGSWMU6/7SS007		CGSWMU6/7SS008		CGSWMU6/7SS009		CGSWMU6/7SS010	
	SampleID	NDD034		NDD035		NDD036		NDD037		NDD038		NDD039		NDD058		NDD040		NDD041		NDD042	
	Depth	0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet		0 To 0.7 feet	
	DateCollected	06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000		06/13/2000	
	SampleType	N		N		N		N		N		N		N		N		N		N	
Parameter	**Units**																				
Metals																					
Antimony	mg/kg						0.68	J							0.74	J	1.1	J	0.54	J	
Arsenic	mg/kg	=	2.7	=	1.2	=	1.5	=	1.5	=	1.9	=	2.8	=	2.8	=	1.8	=	1.4	=	
Barium	mg/kg	J	106	J	70.6	J	75.9	J	70.3	J	73.4	J	65.7	J	88.4	J	75.4	J	44.8	J	
Beryllium	mg/kg	J	0.18	J	0.21	J	0.22	J	0.21	J	0.18	J	0.25	=	0.17	J	0.24	=			
Cadmium	mg/kg		0.71	=			0.24	=	0.35	=	0.89	=	0.51	=	1.2	=	0.64	=	4.4	=	
Chromium, total	mg/kg	=	24	=	17.3	=	18.1	=	22.4	=	21.6	=	19.6	=	31.5	=	23.2	=	20.9	=	
Cobalt	mg/kg	=	14.5	=	11.3	=	15.2	=	12.5	=	12.8	=	12.2	=	15.3	=	13.9	=	9.2	=	
Copper	mg/kg	=	58.9	=	49.8	=	68.7	=	57.1	=	63	=	62.7	=	86.2	=	59	=	47.5	=	
Lead	mg/kg	=	13.7	=	6.5	=	8.2	=	10.6	=	12.6	=	20.8	=	56.5	=	23.8	=	48.2	=	
Mercury	mg/kg	J			0.031	J					0.028	J			0.043	J					
Nickel	mg/kg	=	12.4	=	6.4	=	6.3	J	8.2	=	7.7	=	6.9	=	8.7	=	8.1	=	8.2	=	
Selenium	mg/kg	J	0.59	J			0.78	J	0.57	J	1.1	J	0.63	J			0.57	J	0.55	J	
Silver	mg/kg	J			0.13	J			0.12	J	0.18	J	0.18	J	0.21	J	0.17	J	0.28	J	
Tin	mg/kg	J	0.76	J	0.61	J	0.81	J	0.93	J	1.2	J	0.81	J	1.9	J	0.93	J	0.69	J	
Vanadium	mg/kg	=	79.3	=	81.8	=	84.3	=	87.1	=	99.5	=	90.3	=	83.3	=	87.6	=	66.1	=	
Zinc	mg/kg	J	587	J	91.8	J	104	J	144	J	129	J	164	J	232	J	81.6	J	205	J	
Pesticides																					
Chlordane	mg/kg																		0.014	=	
Delta bhc (delta hexachlorocyclohexane)	mg/kg										0.00084	J									
Heptachlor	mg/kg																		0.00076	J	
p,p'-DDD	mg/kg																		0.026	J	
p,p'-DDE	mg/kg	=	0.022	=	0.136	=	0.0033	=	0.0057	=	0.0061	J	0.0082	=	0.0032	=	0.022	=	0.0035	=	
p,p'-DDT	mg/kg	=	0.0075	=	0.146	=	0.00081	J	0.0048	=	0.0032	J	0.0048	J			0.0031	=			
Semi-Volatiles																					
Benzyl butyl phthalate	mg/kg														0.04	J					
bis(2-Ethylhexyl) phthalate	mg/kg		0.049	J																	
Volatiles																					
1,2,3-Trichloropropane	mg/kg										0.004	J									
1,2-Dichloroethane	mg/kg										0.003	J					0.0003	J			
1,4-Dichlorobenzene	mg/kg	J									0.0003	J							0.0002	J	
2-Hexanone	mg/kg										0.002	J									
Dibromomethane	mg/kg	J			0.0006	J					0.0005	J			0.0005	J	0.0004	J			
m,p-Xylene (sum of isomers)	mg/kg	J	0.0003	J	0.002	J	0.0004	J	0.0004	J			0.001	J	0.0005	J	0.0003	J	0.0007	J	
Methylene chloride	mg/kg	J			0.004	J															
Vinyl acetate	mg/kg										0.002	J									
Xylenes, total	mg/kg	J	0.0003	J	0.002	J	0.0004	J	0.0004	J			0.001	J	0.0005	J	0.0003	J	0.0007	J	

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
Blank spaces in screening criteria columns signify that no screening criteria value is available.
N = Normal field sample.

Photograph taken February 3, 2000

Figure 7-1
SWMU 6 & 7 Waste Oil and Paint Accumulation Area
SWMU 6/7, Former AFWTF, Puerto Rico

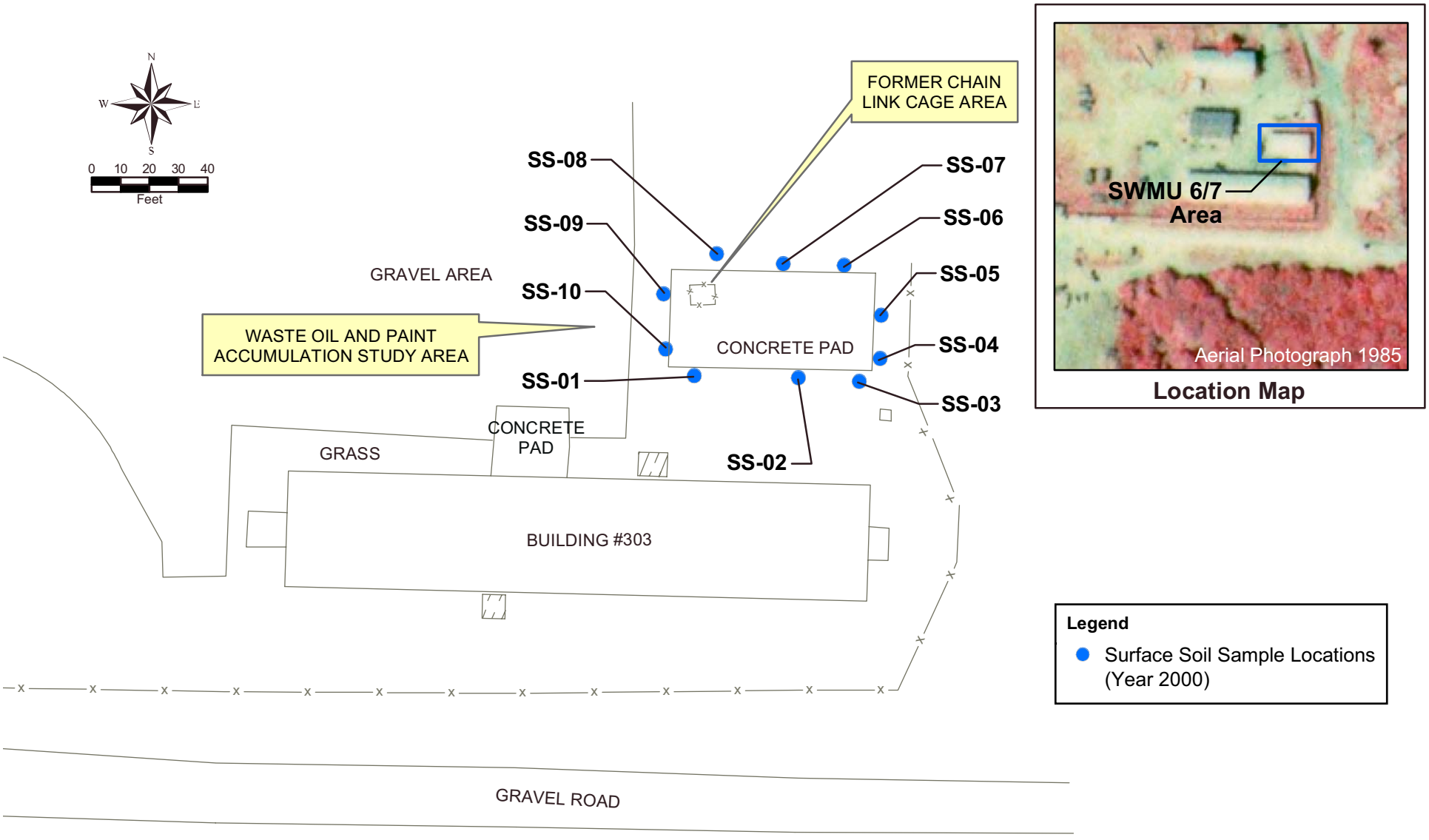


Figure 7-2
Surface Soil Sample Locations
SWMU 6/7, Former AFWTF, Puerto Rico

SECTION 8

SWMU 8 – Waste Oil Accumulation Area (OP-1, Inner Range, AFWTF)

This section presents the results of the Phase I RFI performed in January 2004 at SWMU 8, a waste oil accumulation area located outside the generator building at OP-1 in the Cerro Matías of the former AFWTF. It includes a site description, results of the field investigation, and a summary of laboratory results.

8.1 Site Description

SWMU 8 was a drum storage area for waste lubricants and oil, which was formerly located outside the generator building at OP-1 on Cerro Matías of the former AFWTF (Figure 8-1).

According to the 1988 RFA Report, the waste oil accumulation area contained drums of both waste lubricants and oils. The drums were stored on bare soil prior to being shipped offsite to NSRR. The accumulation area began operation in approximately 1978, and was still active at the time of the first RFA in 1988. During the 1988 RFA, soil staining indicative of minor spills of lubricating oil onto the soil was present in the accumulation area, and no release controls were present as stated in both the 1988 Kearney, RFA and the 1995 ; PREQB revised RFA.

During the February 2000 site inspection by the Navy's contractor (CH2M HILL), no soil staining was evident in the accumulation area, and the drums were stored on concrete in plastic secondary containment trays for release control.

Neither the containment trays nor any waste were present at the time of the 2004 site visit. They had been removed as part of the closure of the former AFWTF.

8.2 Field Investigation Results

The soils around SWMU 8 were sampled on January 19, 2004. Five surface soil samples (0 to about 8 inches) were collected in the gravel area just off the concrete slab in the area where the staining was previously noted. The sampling locations are shown in Figure 8-2. Surface soil samples were collected from 0 to 8 inches bls during this field effort to provide sufficient volume of soil samples to be split with EPA and EQB. To obtain enough sample volume for the large quantity of jars, one auger bucket was collected at each location. The auger length is 8 inches. All samples were analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. Additionally, one sample collected at station CGW8SS02 was analyzed for cyanide, sulfide, and dioxins.

Although historical information for SWMU 8 does not indicate the potential presence of munitions or explosives-related residues at this site, they were included in the sample

analyses because the site is located within the safety fan of the artillery firing positions in the EMA.

8.3 Laboratory Analytical Results

Figure 8-2 shows the locations of the surface soil samples collected at SWMU 8 during the Phase I RFI. Table 8-1 summarizes the surface soil constituent detections.

Table 8-1

Surface Soil Analytical Data Detection Summary

SWMU 8, Waste Oil Accumulation Area, Observation Post (OP) - 1, Inner Range, Vieques, PR

	StationID	CGW8SS01		CGW8SS02		CGW8SS03		CGW8SS04		CGW8SS05	
	SampleID	CGW8SS01-R01		CGW8SS02-R01		CGW8SS03-R01		CGW8SS04-R01		CGW8SS05-R01	
	Depth	0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
	DateCollected	01/19/2004		01/19/2004		01/19/2004		01/19/2004		01/19/2004	
	SampleType	N		N		N		N		N	
Parameter	**Units**										
Metals											
Antimony	mg/kg	0.715	J	1.65	J	1.3	J	0.97	J	1.09	J
Arsenic	mg/kg	3.06	=	19.9	=	5.59	=	3.55	=	5.47	=
Barium	mg/kg	80.9	=	63.5	=	65.9	=	36.5	=	54.5	=
Beryllium	mg/kg	0.173	J	0.191	J	0.223	J	0.115	J	0.15	J
Cadmium	mg/kg	0.358	J	1.25	=	1.14	=	0.178	J	0.221	J
Chromium, total	mg/kg	31.7	J	45.9	J	27.3	J	18.2	J	32.1	J
Cobalt	mg/kg	13.2	J	14.1	J	11.2	J	10.4	J	15	J
Copper	mg/kg	68	=	59.8	=	78.8	=	49	=	62	=
Lead	mg/kg	12.4	J	12.3	J	62.7	J	22.1	J	20.9	J
Mercury	mg/kg	0.00872	J	0.0288	J	0.0392	=	0.0149	J	0.0145	J
Nickel	mg/kg	12.6	J	18.6	J	10.3	J	8.62	J	14.6	J
Selenium	mg/kg	0.72	J	0.295	J	0.633	J	0.378	J	0.258	J
Silver	mg/kg	0.148	J	0.124	J	0.083	J	0.0693	J	0.115	J
Thallium	mg/kg	ND		ND		ND		ND		0.398	J
Tin	mg/kg	0.525	J	0.622	J	1.3	J	0.339	J	1.62	J
Vanadium	mg/kg	79.4	=	85.2	=	62.9	=	60.5	=	82.4	=
Zinc	mg/kg	67.5	=	98.3	=	207	=	82	=	135	=
Pesticides											
p,p'-DDT	mg/kg	ND		0.00046	J	0.00031	J	ND		ND	
Semi-Volatiles											
Acetophenone	mg/kg	0.145	J	ND		ND		ND		ND	
Benzyl butyl phthalate	mg/kg	ND		ND		ND		ND		0.0475	J
Di-n-butyl phthalate	mg/kg	0.0452	J	0.0628	J	0.0734	J	0.0279	J	0.0355	J
Dimethyl phthalate	mg/kg	ND		1.43	=	ND		ND		ND	
Volatiles											
Acetone	mg/kg	ND		ND		ND		0.0042	J	ND	
Chemistry											
Sulfide	mg/kg	NA		9.34	J	NA		NA		NA	
Perchlorate	mg/kg	ND		ND		0.0221	J	ND		ND	
Dioxins											
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		0.000267	=	NA		NA		NA	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		3.5E-06	=	NA		NA		NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		8.3E-06	=	NA		NA		NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		1.33E-05	=	NA		NA		NA	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	mg/kg	NA		0.000002	=	NA		NA		NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.000582	=	NA		NA		NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.000113	=	NA		NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		0.00284	=	NA		NA		NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		1.32E-05	=	NA		NA		NA	

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

ND = Not detected.

NA = Not analyzed

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample.

Photograph taken February 3, 2000

Figure 8-1
SWMU 8 Waste Oil Accumulation
(Observation Post 1, Inner Range, AFWTF)
SWMU 8, Former AFWTF, Puerto Rico

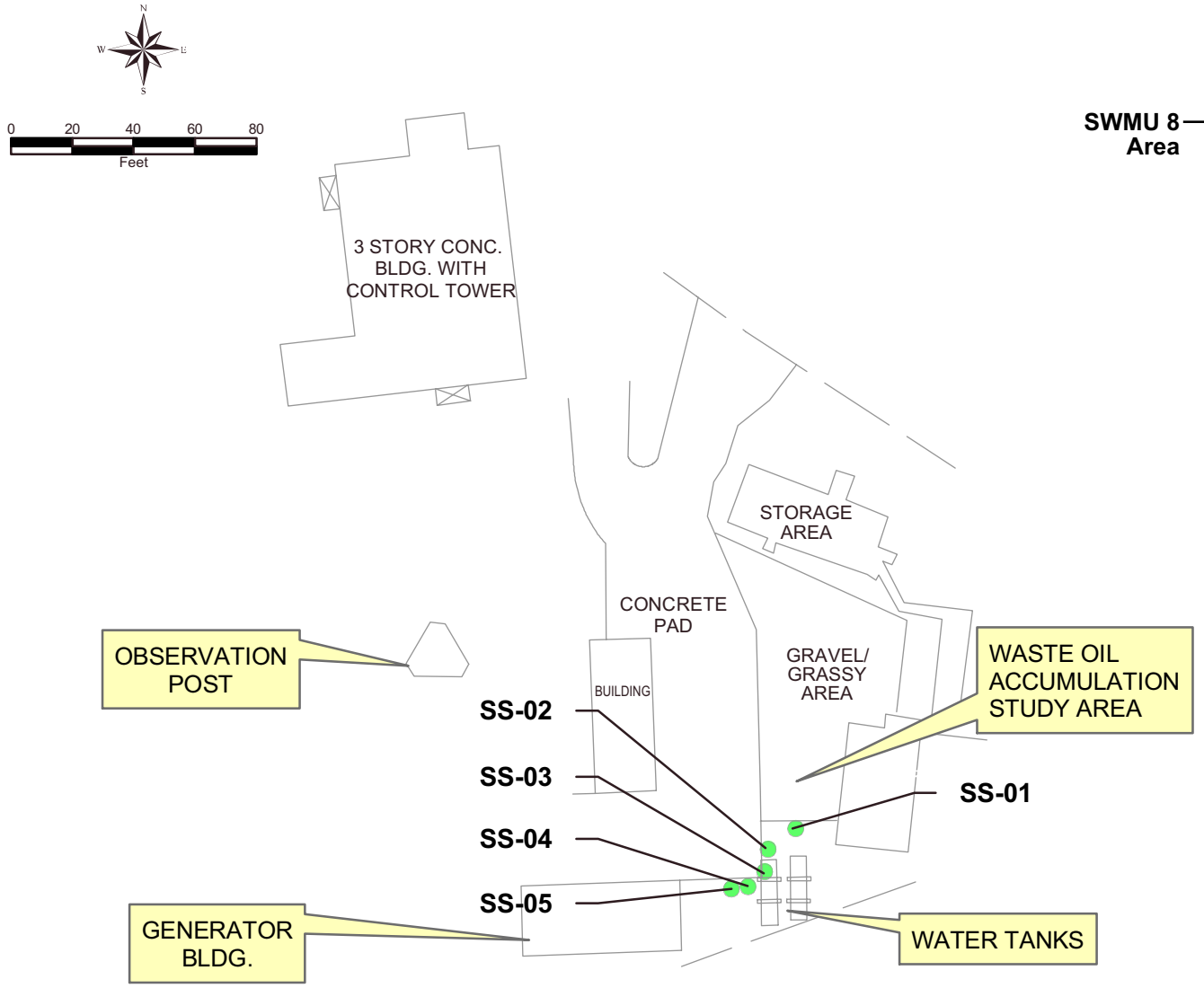


Photo taken from The Former AFWTF Web Page.

Location Map

Figure 8-2
Surface Soil Sample Locations Map
SWMU 8, Former AFWTF, Puerto Rico

SECTION 9

SWMU 10 – Sewage Treatment Lagoons (Camp García)

This section presents the results of the Phase I RFI performed at SWMU 9, the sewage treatment lagoons for Camp Garcia. The field sampling activities associated with this investigation were performed by CH2M HILL in June 2000 and January and February 2004.

This section includes a site description, results of the field investigations, and a summary of laboratory results.

9.1 Site Description

The original sewage treatment lagoons for Camp García went into service in the early 1950s. The facility originally consisted of four unlined lagoons: two of them serving as equalization/treatment lagoons, and the other two providing polishing treatment. Effluent from the final two polishing lagoons was then chlorinated in a chlorine contact chamber and discharged to the sea near Bahia Tapon. In 1974, after the level of activity and associated domestic wastewater generation rate significantly decreased at Camp García, the treatment lagoon system was modified to make it a no-discharge system. The lagoons were then utilized as evaporation lagoons until the new no-discharge lagoon was constructed in September 2000 immediately northwest from the old lagoons. The new lagoon encompassed an area of approximately 40,000 square ft, and was constructed with a clay and plastic liner. The new lagoon was decommissioned when the property transfer occurred in May 2003 and all sanitary effluent was discontinued from the Camp Garcia Area at that time. There is presently no sewage treatment occurring at Camp Garcia. During the January 2004 field effort, it was noted that the new lagoon area was abandoned and no sign of the lagoon was present. No known releases of hazardous constituents have occurred at this site (PREQB, 1995). The action recommended by both RFA reports (Kearney, 1988; PREQB, 1995) was stated as follows:

> "Further review of facility practices or sampling and analysis of the waste should be conducted to determine if hazardous constituents may be present in the waste. Additional sampling and analyses of soil, etc. may be suggested based upon review of this information."

Inspection of the sewage lagoon system during the February 2000 field work revealed that the lagoon system was overgrown with vegetation and did not appear to be active.

9.2 Field Investigations

9.2.1 2000 Soils and WWTP Effluent Investigations

CH2M HILL, under LANTDIV direction, conducted a preliminary investigation at SWMU 10 in June 2000. Four surface soil samples (0 to 8 inches) and four subsurface soil samples (4 to 5 ft) were collected in each of the four lagoon areas. Additionally one water

sample was collected from a rusted pipe leading to the northeastern most lined basin (presumably the influent pipe to the facility). Water was dripping from a crack in the pipe, but its origin is unknown. During the 2004 investigation, no water was dripping from the rusted pipe. The raw wastewater discharge to the lagoon system originated from the Camp García area. This consisted of a steel pipe approximately 6 inches in diameter that runs into the northeastern most lagoon, approximately 80 ft from the berm as shown on Figure 9-1. An effluent sample was collected from a crack in the rusted pipe within the northeast lagoon. The soil samples were collected to determine whether the lagoon material would be classified as hazardous waste. During the February 2000 preliminary field work, it was noted that the lagoons were not active. Figure 9-1 shows the locations sampled in 2000**.** Toxicity characteristic leaching procedure (TCLP) analyses were performed on the soil samples and raw wastewater sample. The soil samples were also analyzed for metals.

9.2.2 2004 Soils Investigations

Four soil sampling stations were established in each quadrant of each lagoon, for a total of 16 stations. Surface soil samples were collected from the upper 0 to 8 inch layer, and subsurface soil samples were collected immediately below the liner to determine whether the liner had remained intact. The depth of the subsurface soil sample was dependent on the depth to liner and varied from one location to another. The black plastic liner was covered with soil within the lagoon areas. It was encountered at all 16 soil boring locations, identified by small pieces brought up in the hand auger cuttings throughout the four lagoon areas. The liner was found in all four lagoons at varying depths from 0.5 feet to 3.6 feet bls. Upon abandonment, the soil borings were capped at the liner depth with a cement grout to eliminate the pathway through the liner. Figure 9-1 presents the 2004 soil sampling locations**.**

Soil samples were collected on January 20 and 21, 2004. All soil samples were analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. Seven of the surface soil samples and four of the subsurface samples were also analyzed for cyanide, sulfide and dioxins.

9.2.3 2004 Groundwater Investigation

In January 2004 under LANTDIV direction, CH2M HILL installed five monitoring wells at SMWU 10. One monitoring was installed in the presumed upgradient direction of the lagoons and four wells were installed in the presumed downgradient direction of the lagoons. The wells were screened across the first encountered groundwater to evaluate the potential presence of free phase product accumulation. Figure 9-1 illustrates monitoring well locations**.** Figure 9-2 shows the geologic column across SWMU 10 based on the monitoring well boring logs.

The monitoring wells were developed a minimum of 3 days after installation to remove any fines introduced to the formation during the drilling and well installation process. Well development was performed by surging with a 2-inch surge block, then pumping with a stainless steel Grundfos® submersible pump.

One week after completion of well development, groundwater levels were measured to establish the groundwater flow pattern. The groundwater elevation data are illustrated in cross section view on

Figure 9-2 and in plan view on Figure 9-3. Figure 9-2 illustrates that the groundwater beneath the site occurs with the andesite bedrock at a depth of approximately 35 feet bls. The groundwater levels in the wells rose by 3 to 10 feet above the zone where groundwater was encountered, indicating that the groundwater was under semi-confined conditions. Figure 9-3 illustrates that the groundwater flows from the southwest of the lagoons radially in a northeast to southeast direction.

Tables 9-1, 9-2, 9-3, and 9-4 provide a summary of well construction data, development details, water level data, and water quality indicator data for the five monitoring wells installed at SMWU 10. The groundwater sampling event occurred between February 9 and 11, 2004. All groundwater samples were analyzed for VOCS, SVOCs, metals, herbicides, pesticides/PCBs, explosives and perchlorate. Two samples (CGW10GW04 and CGW10GW05) were also analyzed for cyanides, sulfide and dioxins. Although historical information for SWMU 10 does not indicate the potential presence of explosives or related residues at this site, explosives were included in the sample analyses because of the use of explosives in the range areas of the former AFWTF.

TABLE 9-1
Summary of Well Construction Details
SWMU 10, East Vieques, Puerto Rico

Well ID	Date Installed	Top of Casing Elevation (ft AMSL)	Boring Depth (ft bls)	Well Depth (ft bls)	Screen Interval Depth (ft bls)	Depth to Bentonite (ft bls)	Depth to Sandpack (ft bls)
CGW10MW01	01/23/2004	36.57	42.0	41.27	31.2-41.2	27.2	29.2
CGW10MW02	01/20/2004	30.44	37.0	36.82	21.8-36.8	17.8	19.8
CGW10MW03	01/20/2004	30.30	37.0	36.68	21.6-36.6	17.6	19.6
CGW10MW04	01/21/2004	30.68	42.0	42.34	27.3-42.3	23.3	25.3
CGW10MW05	01/23/2004	30.30	43.0	41.25	31.2-41.2	27.2	29.2

Notes:
AMSL = Above Mean Sea Level
ft = feet
bls = Below Land Surface

TABLE 9-2
Summary of Well Development Records
SWMU 10, East Vieques, Puerto Rico

Well ID	Development Method	Development Completion Date	Total Gallons Removed	Number of Well Volumes Removed
CGW10MW01	Grundfos Pump/Surge block	01/27/2004	35	58
CGW10MW02	Grundfos Pump/Surge block	01/28/2004	35	38
CGW10MW03	Grundfos Pump/Surge block	01/28/2004	21	24
CGW10MW04	Grundfos Pump/Surge block	01/26/2004	137	84
CGW10MW05	Grundfos Pump/Surge block	01/26/2004	55	36

TABLE 9-3
Summary of Monitoring Well Water Level Measurements
SWMU 10, East Vieques, Puerto Rico

Well ID	Date	Elevation (TOC) (ft AMSL)	Depth to Water (ft btoc)	Groundwater Level (ft AMSL)
CGW10MW01	02/07/04	36.57	40.36	-3.79
CGW10MW02	02/07/04	30.44	34.28	-3.84
CGW10MW03	02/07/04	30.30	34.02	-3.72
CGW10MW04	02/07/04	30.68	34.26	-3.58
CGW10MW05	02/07/04	30.30	33.88	-3.58

Notes:
ft btoc = feet below top of casing
AMSL = Above Mean Sea Level
TOC = top of casing

TABLE 9-4
Summary of Final Field Parameter Measurements Taken Prior to Groundwater Sample Collection – 2/9-11/2004
SWMU 10, East Vieques, Puerto Rico

Well ID	Purged Vol. (gals)	pH	Cond. µmhos/cm	Temp., °C	DO	ORP	Turbidity
CGW10MW01	5.1	6.73	6,620	30.75	4.86	165.0	8.8
CGW10MW02	3.3	6.16	20,925	28.20	2.67	111.0	3.94
CGW10MW03	3.0	7.25	5,200	27.40	1.32	182.00	2.01
CGW10MW04	7.8	6.73	8,117	29.12	7.15	127.00	0.92
CGW10MW05	14.0	6.75	7,776	29.95	1.60	59.13	8.15

9.3 Laboratory Analytical Results

9.3.1 Surface Soil

Figure 9-1 shows the locations of the surface soil samples collected during 2000 and 2004. Table 9-5 summarizes the TCLP data for the surface soil samples collected in 2000. Table 9-6 summarizes the surface soil constituent detections for the 2004 Phase I RFI.

9.3.2 Subsurface Soils

Figure 9-1 shows the locations of the subsurface soil samples collected during 2000 and 2004. Table 9-7 summarizes the TCLP data for the subsurface soil samples collected in 2000. Table 9-8 summarizes the subsurface soil constituent detections for the 2004 Phase I RFI.

9.3.3 Groundwater

Figure 9-1 shows the locations of the monitoring wells installed and sampled during the Phase I RFI. Table 9-9 summarizes the groundwater constituent detections.

9.3.4 Wastewater

Figure 9-1 shows the locations of the wastewater sample collected in 2000. Table 9-10 summarizes the wastewater constituent detections.

TABLE 9-5

Surface Soil Analytical Data Detection Summary

SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

	StationID	CGWWTPSS001	CGWWTPSS002	CGWWTPSS003	CGWWTPSS004
	SampleID	NDD001	NDD002	NDD003	NDD004
	Depth	0 to 0.5 feet	0 to 0.5 feet	0 to 0.5 feet	0 to 0.5 feet
	DateCollected	06/07/2000	06/07/2000	06/07/2000	06/07/2000
	SampleType	N	N	N	N
Parameter	**Units**				
TCLP Metals					
Barium	µg/L	577 J	1250 J	1620 J	897 J
Lead	µg/L	25 J	ND	ND	ND

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

ND = Not detected.

N = Normal field sample.

CGWWTP samples collected in 2000

TABLE 9-6
Surface Soil Analytical Data Detection Summary
SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

StationID		CGW10SS05		CGW10SS06		CGW10SS07	CGW10SS08	CGW10SS09	CGW10SS10	CGW10SS11	CGW10SS12	CGW10SS13
SampleID		CGW10SS05-R01		CGW10SS06-R01		CGW10SS07-R01	CGW10SS08-R01	CGW10SS09-R01	CGW10SS10-R01	CGW10SS11-R01	CGW10SS12-R01	CGW10SS13-R01
Depth		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet
DateCollected		01/22/2004		01/20/2004		01/20/2004	01/22/2004	01/20/2004	01/20/2004	01/20/2004	01/20/2004	01/20/2004
SampleType		N		N		N	N	N	N	N	N	N
Parameter												
Metals												
Antimony	mg/kg	0.437	J	0.946	J	0.834 J	0.354 J	0.899 J	1.2 J	1 J	0.781 J	0.469 J
Arsenic	mg/kg	0.24	J	0.533	J	0.36 J	0.214 J	0.368 J	0.355 J	0.404 J	0.37 J	0.48 J
Barium	mg/kg	71.4	=	51.8	=	53.8 =	83.2 =	94.1 =	92.7 =	69.9 =	61.8 =	59.6 =
Beryllium	mg/kg	0.192	J	0.234	J	0.236 J	0.24 J	0.247 J	0.273 J	0.231 J	0.161 J	0.228 J
Cadmium	mg/kg	0.234	J	ND		0.0377 J	0.566 J	0.299 J	0.348 J	0.103 J	0.175 J	ND
Chromium, total	mg/kg	13.6	J	14.4	=	15.4 =	16 J	16.5 =	19.4 =	16.4 =	14.7 =	16.3 =
Cobalt	mg/kg	9.33	J	9.16	=	9.51 =	10.7 J	10.4 =	12.1 =	10.3 =	8.06 =	9.34 =
Copper	mg/kg	39.7	=	36.2	=	39.4 =	49.4 =	50.5 =	60 =	44.3 =	37.2 =	47.8 =
Lead	mg/kg	10.1	=	4.2	=	3.77 =	7.63 =	5.88 =	7.48 =	4.99 =	8.01 =	1.34 =
Mercury	mg/kg	0.0398	=	0.0325	J	0.0171 J	0.0432 =	0.0654 =	0.0519 =	0.0403 =	0.0595 =	0.011 J
Nickel	mg/kg	5.24	J	4.95	J	5.37 J	6.06 J	6.29 J	7.46 J	6.02 J	5.36 J	6.41 J
Selenium	mg/kg	0.743	J	0.181	J	0.268 J	1.04 =	0.354 J	0.76 =	0.378 J	0.412 J	0.344 J
Silver	mg/kg	0.248	J	0.1	J	0.161 J	0.291 J	0.263 J	0.393 J	0.251 J	0.514 J	0.0573 J
Thallium	mg/kg	ND		0.795	J	0.763 J	ND	0.701 J	1.02 J	0.769 J	0.71 J	0.759 J
Tin	mg/kg	4.93	J	2.13	J	2.63 J	9.19 =	6.22 J	9.46 =	4.5 J	9.38 =	0.272 J
Vanadium	mg/kg	75.1	=	76.8	=	83.5 =	84.5 =	79 =	98.8 =	91.2 =	77 =	93.1 =
Zinc	mg/kg	137	=	55.3	=	90.5 =	234 =	206 =	281 =	135 =	204 =	24.5 =
Pesticides												
Dieldrin	mg/kg	ND		ND		ND	ND	0.00037 J	ND	ND	0.00074 J	ND
p,p'-DDD	mg/kg	0.00026	J	0.00019	J	ND	0.0003 J	0.011 J	0.00044 J	0.0005 J	0.0006 J	ND
p,p'-DDE	mg/kg	0.11	J	0.074	J	0.028 J	0.047 J	0.12 J	0.07 J	0.1 J	0.04 J	0.0058 J
p,p'-DDT	mg/kg	0.00092	J	9.70E-04	J	ND	ND	ND	ND	ND	ND	ND
Semi-Volatiles												
4-Bromophenyl phenyl ether	mg/kg	0.348	J	ND		ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	mg/kg	ND		6.94E-02	J	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	mg/kg	0.0507	J	0.045	J	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	mg/kg	ND		0.0483	J	ND	ND	ND	ND	ND	ND	ND
Chrysene	mg/kg	ND		0.0768	J	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	mg/kg	0.1	J	ND		ND	ND	ND	ND	ND	ND	0.391 =
Fluoranthene	mg/kg	ND		0.0475	J	ND	ND	ND	ND	ND	ND	ND
Pyrene	mg/kg	ND		0.0536	J	ND	ND	ND	ND	ND	ND	ND
Chemistry												
Cyanide	mg/kg	NA		ND		ND	NA	NA	ND	ND	NA	0.378 J
Sulfide	mg/kg	NA		ND		ND	NA	NA	15.7 J	ND	NA	15.4 J
Dioxins												
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		0.0000495	=	7.1E-05 =	NA	NA	0.000154 =	6.73E-05 =	NA	0.0000026 =
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		ND		ND	NA	NA	0.0000031 =	ND	NA	ND
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		ND		ND	NA	NA	0.000004 =	2.7E-06 =	NA	ND
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.0000968	=	0.00016 =	NA	NA	0.000364 =	0.000147 =	NA	0.0000054 =
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.0000147	=	2.4E-05 =	NA	NA	0.0000509 =	2.58E-05 =	NA	ND
Octachlorodibenzo-p-dioxin	mg/kg	NA		0.000464	=	0.00084 =	NA	NA	0.00141 =	0.000687 =	NA	0.0000234 =
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.000003	=	ND	NA	NA	0.000002 =	0.000005 =	NA	ND
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.000007	=	ND	NA	NA	0.0000806 =	2.54E-05 =	NA	ND

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is available.
N = Normal field sample.
CGW10 samples collected in 2004

TABLE 9-6
Surface Soil Analytical Data Detection Summary
SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

StationID		CGW10SS05		CGW10SS06	CGW10SS14	CGW10SS15	CGW10SS16	CGW10SS17	CGW10SS18	CGW10SS19	CGW10SS20
SampleID		CGW10SS05-R01		CGW10SS06-R0	CGW10SS14-R01	CGW10SS15-R01	CGW10SS16-R01	CGW10SS17-R01	CGW10SS18-R01	CGW10SS19-R01	CGW10SS20-R01
Depth		0 to 0.7 feet		0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet	0 to 0.7 feet
DateCollected		01/22/2004		01/20/2004	01/20/2004	01/20/2004	01/22/2004	01/22/2004	01/22/2004	01/20/2004	01/22/2004
SampleType		N		N	N	N	N	N	N	N	N
Parameter											
Metals											
Antimony	mg/kg	0.437	J	0.946	0.593 J	0.729 J	0.253 J	0.488 J	0.508 J	0.756 J	0.647 J
Arsenic	mg/kg	0.24	J	0.533	0.429 J	0.463 J	0.381 J	0.404 J	0.464 J	0.508 J	0.587 J
Barium	mg/kg	71.4	=	51.8	72.2 =	104 =	65.8 =	49.4 =	61.8 =	57.7 =	62.8 =
Beryllium	mg/kg	0.192	J	0.234	0.255 J	0.238 J	0.23 J	0.166 J	0.232 J	0.201 J	0.238 J
Cadmium	mg/kg	0.234	J	ND	ND	ND	0.154 J	0.161 J	0.2 J	ND	0.256 J
Chromium, total	mg/kg	13.6	J	14.4	16.9 =	15.7 =	15 J	12.1 J	13.5 J	14.8 =	12.5 J
Cobalt	mg/kg	9.33	J	9.16	11.4 =	11 =	10.6 J	6.59 J	8.36 J	8.65 =	9.31 J
Copper	mg/kg	39.7	=	36.2	51.3 =	45.1 =	46.8 =	28.7 =	34.3 =	40.6 =	36 =
Lead	mg/kg	10.1	=	4.2	2.05 =	2.15 =	3.54 =	5.4 =	5.11 =	4.56 =	6.21 =
Mercury	mg/kg	0.0398	=	0.0325	0.0105 J	0.0113 J	0.0118 J	0.0146 J	0.0174 J	0.0159 J	0.0165 J
Nickel	mg/kg	5.24	J	4.95	6.85 J	6.21 J	5.95 J	3.48 J	4.5 J	5.1 J	4.71 J
Selenium	mg/kg	0.743	J	0.181	0.313 J	0.343 J	0.551 J	0.524 J	0.704 J	0.23 J	0.829 J
Silver	mg/kg	0.248	J	0.1	0.0614 J	0.0842 J	ND	0.0412 J	0.0671 J	0.0504 J	0.0819 J
Thallium	mg/kg	ND		0.795	0.732 J	0.786 J	ND	ND	ND	0.299 J	ND
Tin	mg/kg	4.93	J	2.13	0.36 J	0.574 J	ND	0.625 J	1.1 J	0.351 J	0.791 J
Vanadium	mg/kg	75.1	=	76.8	99.1 =	86.8 =	86.4 =	58.7 =	66 =	77.2 =	65.5 =
Zinc	mg/kg	137	=	55.3	31.6 =	32.7 =	19.2 =	31.2 =	42.6 =	32.3 =	33.1 =
Pesticides											
Dieldrin	mg/kg	ND		ND	ND	ND	ND	ND	ND	ND	ND
p,p'-DDD	mg/kg	0.00026	J	0.00019	ND	0.00023 J	ND	0.01 J	0.00016 J	0.00054 J	0.00033 J
p,p'-DDE	mg/kg	0.11	J	0.074	0.012 J	0.017 J	0.0048 J	0.073 J	0.019 J	0.066 J	0.02 J
p,p'-DDT	mg/kg	0.00092	J	9.70E-04	ND	ND	0.0003 J	0.084 =	0.00039 J	ND	0.00044 J
Semi-Volatiles											
4-Bromophenyl phenyl ether	mg/kg	0.348	J	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	mg/kg	ND		6.94E-02	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	mg/kg	0.0507	J	0.045	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	mg/kg	ND		0.0483	ND	ND	ND	ND	ND	ND	ND
Chrysene	mg/kg	ND		0.0768	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	mg/kg	0.1	J	ND	0.33 J	0.238 J	0.0904 J	0.0806 J	0.0766 J	ND	0.0716 J
Fluoranthene	mg/kg	ND		0.0475	ND	ND	ND	ND	ND	ND	ND
Pyrene	mg/kg	ND		0.0536	ND	ND	ND	ND	ND	ND	ND
Chemistry											
Cyanide	mg/kg	NA		ND	NA	ND	NA	NA	NA	ND	NA
Sulfide	mg/kg	NA		ND	NA	ND	NA	NA	NA	ND	NA
Dioxins											
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		0.0000495	NA	0.0000449 =	NA	NA	NA	3.31E-05 =	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		ND	NA	ND	NA	NA	NA	ND	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		ND	NA	ND	NA	NA	NA	ND	NA
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.0000968	NA	0.0000905 =	NA	NA	NA	0.000107 =	NA
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.0000147	NA	0.0000183 =	NA	NA	NA	1.35E-05 =	NA
Octachlorodibenzo-p-dioxin	mg/kg	NA		0.000464	NA	0.000435 =	NA	NA	NA	0.000381 =	NA
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.000003	NA	0.000001 =	NA	NA	NA	0.000001 =	NA
Tetrachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		0.000007	NA	0.000004 =	NA	NA	NA	0.000003 =	NA

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is available.
N = Normal field sample.
CGW10 samples collected in 2004

TABLE 9-7

Subsurface Soil Analytical Data Detection Summary

SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

StationID		CGWWTPSB001	CGWWTPSB002	CGWWTPSB003	CGWWTPSB004
SampleID		NDD005	NDD006	NDD007	NDD008
Depth		0 to 0.5 feet	0 to 0.5 feet	0 to 0.5 feet	0 to 0.5 feet
DateCollected		06/07/2000	06/07/2000	06/07/2000	06/07/2000
SampleType		N	N	N	N
Parameter	**Units**				
TCLP Metals					
Barium	µg/L	1430 J	1190 J	1850 J	1790 J

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

N = Normal field sample.

CGWWTP samples collected in 2000

TABLE 9-8
Subsurface Soil Analytical Data Detection Summary
SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

	StationID	CGWWTPSB001		CGWWTPSB002		CGWWTPSB003		CGWWTPSB004		CGWWTPSB005		CGWWTPSB006	
	SampleID	NDD009		NDD010		NDD012		NDD011		CGW10SB05-R01-5		CGW10SB06-R01-5	
	Depth	4 to 5 feet		4 to 5 feet		4 to 5 feet		4 to 5 feet		4 to 6 feet		4 to 6 feet	
	DateCollected	06/07/2000		06/07/2000		06/07/2000		06/07/2000		01/22/2004		01/20/2004	
	SampleType	N		N		N		N		N		N	
Parameter	**Units**												
Metals													
Antimony	mg/kg	ND		ND		ND		ND		ND		0.685	J
Arsenic	mg/kg	0.56	J	ND		2.9	=	0.69	J	0.315	J	0.248	J
Barium	mg/kg	171	=	167	=	241	=	168	J	85.3	=	99.2	J
Beryllium	mg/kg	ND		ND		ND		ND		0.289	J	0.214	J
Cadmium	mg/kg	ND		ND		ND		ND		0.137	J	ND	
Chromium, total	mg/kg	19.2	=	24.3	=	19.3	=	16.6	=	13.9	J	14.2	=
Cobalt	mg/kg	ND		ND		ND		ND		11.1	J	10.6	=
Copper	mg/kg	60.9	=	73.9	=	74.2	=	71.7	=	48.1	=	66.2	=
Lead	mg/kg	1.5	=	1.1	=	2.4	=	1.4	=	2.81	=	0.836	=
Mercury	mg/kg	ND		ND		ND		ND		0.0237	J	0.00912	J
Nickel	mg/kg	8.2	J	9	=	14.4	=	7.8	J	6.05	J	8.27	J
Selenium	mg/kg	1.1	=	1.1	J	1	J	0.87	J	0.818	=	0.239	J
Silver	mg/kg	ND		ND		ND		ND		0.0447	J	ND	
Thallium	mg/kg	ND		ND		ND		ND		ND		0.725	J
Tin	mg/kg	ND		ND		ND		ND		ND		0.314	J
Vanadium	mg/kg	ND		ND		ND		ND		80.7	=	84.4	=
Zinc	mg/kg	92.6	J	91.6	J	91.7	J	95.6	J	21.6	=	26.8	=
Pesticides													
p,p'-DDE	mg/kg	ND		ND		ND		ND		0.14	J	0.0029	J
p,p'-DDT	mg/kg	ND		ND		ND		ND		ND		ND	
Semi-Volatiles													
bis(2-Ethylhexyl) phthalate	mg/kg	ND		ND		ND		ND		ND		0.174	J
Di-n-butyl phthalate	mg/kg	ND		ND		ND		ND		ND		ND	
Volatiles													
m,p-Xylene (sum of isomers)	mg/kg	0.001	J	0.0004	J	ND		ND		ND		ND	
Toluene	mg/kg	ND		0.0005	J	ND		ND		ND		ND	
Xylenes, total	mg/kg	0.001	J	0.0004	J	ND		ND		ND		ND	
Chemistry													
Sulfide	mg/kg	NA		NA		NA		NA		NA		ND	
Dioxins													
1,2,3,4,6,7,8-Heptachlorodibenzo	mg/kg	NA		NA		NA		NA		NA		ND	
Heptachlorinated dibenzo-p-diox	mg/kg	NA		NA		NA		NA		NA		3.2E-06	=
Hexachlorinated dibenzo-p-dioxi	mg/kg	NA		NA		NA		NA		NA		ND	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		NA		1.24E-05	=
Tetrachlorinated dibenzo-p-dioxi	mg/kg	NA		NA		NA		NA		NA		ND	

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is available.
N = Normal field sample.
CGWWTP samples collected in 2000

TABLE 9-8

Subsurface Soil Analytical Data Detection Summary

SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

StationID		CGWWTPSB001	CGWWTPSB007		CGWWTPSB008		CGWWTPSB009		CGWWTPSB010		CGWWTPSB011		CGWWTPSB012	
SampleID		NDD009	CGW10SB07-R01-5		CGW10SB08-R01-5		CGW10SB09-R01-5		CGW10SB10-R01-5		CGW10SB11-R01-5		CGW10SB12-R01-5	
Depth		4 to 5 feet	4 to 6 feet		4 to 6 feet		4 to 6 feet		4 to 6 feet		4 to 6 feet		4 to 6 feet	
DateCollected		06/07/2000	01/20/2004		01/22/2004		01/20/2004		01/20/2004		01/20/2004		01/20/2004	
SampleType		N	N		N		N		N		N		N	
Parameter	**Units**													
Metals														
Antimony	mg/kg	ND	0.525	J	0.136	J	0.641	J	1.02	J	0.454	J	0.606	J
Arsenic	mg/kg	0.56	0.34	J	0.189	J	0.327	J	0.456	J	0.234	J	0.426	J
Barium	mg/kg	171	94.7	J	48.7	=	70.5	J	64.1	J	58.2	J	78.1	J
Beryllium	mg/kg	ND	0.219	J	0.243	J	0.212	J	0.261	J	0.197	J	0.224	J
Cadmium	mg/kg	ND	ND		0.0768	J	ND		ND		ND		ND	
Chromium, total	mg/kg	19.2	15.7	=	12.1	J	15.2	=	18.6	=	16.1	=	17.5	=
Cobalt	mg/kg	ND	8.37	=	5.93	J	10.6	=	9.82	=	8.21	=	9.78	=
Copper	mg/kg	60.9	38.5	=	32.7	=	37.6	=	44.7	=	34.4	=	41	=
Lead	mg/kg	1.5	2.2	=	1.91	=	1.19	=	2.08	=	1.21	=	1.38	=
Mercury	mg/kg	ND	0.0209	J	0.0118	J	0.0129	J	0.0167	J	0.0104	J	0.0103	J
Nickel	mg/kg	8.2	5.64	J	4.31	J	5.69	J	6.64	J	5.43	J	6.43	J
Selenium	mg/kg	1.1	0.29	J	0.231	J	0.312	J	0.244	J	0.237	J	0.52	J
Silver	mg/kg	ND	0.0886	J	0.0569	J	0.0579	J	0.082	J	0.0588	J	0.0407	J
Thallium	mg/kg	ND	0.729	J	ND		0.927	J	1.31	J	0.876	J	1.16	J
Tin	mg/kg	ND	1.33	J	0.605	J	ND		1.16	J	0.599	J	0.308	J
Vanadium	mg/kg	ND	75.1	=	52.9	=	86.5	=	89.2	=	81.2	=	88.3	=
Zinc	mg/kg	92.6	61.8	=	28.3	=	20.2	=	47.1	=	28.8	=	22.9	=
Pesticides														
p,p'-DDE	mg/kg	ND	0.012	J	0.0061	J	0.013	J	0.018	J	0.0024	J	0.0094	J
p,p'-DDT	mg/kg	ND	ND		ND		ND		ND		ND		ND	
Semi-Volatiles														
bis(2-Ethylhexyl) phthalate	mg/kg	ND	ND		0.118	J	ND		ND		ND		ND	
Di-n-butyl phthalate	mg/kg	ND	ND		0.0858	J	ND		ND		ND		ND	
Volatiles														
m,p-Xylene (sum of isomers)	mg/kg	0.001	ND		ND		ND		ND		ND		ND	
Toluene	mg/kg	ND	ND		ND		ND		ND		ND		ND	
Xylenes, total	mg/kg	0.001	ND		ND		ND		ND		ND		ND	
Chemistry														
Sulfide	mg/kg	NA	NA		NA		NA		NA		38.6	J	NA	
Dioxins														
1,2,3,4,6,7,8-Heptachlorodibenzo	mg/kg	NA	NA		NA		NA		NA		0.0000074	=	NA	
Heptachlorinated dibenzo-p-diox	mg/kg	NA	NA		NA		NA		NA		0.0000167	=	NA	
Hexachlorinated dibenzo-p-dioxi	mg/kg	NA	NA		NA		NA		NA		0.0000028	=	NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA	NA		NA		NA		NA		0.0000761	=	NA	
Tetrachlorinated dibenzo-p-dioxi	mg/kg	NA	NA		NA		NA		NA		0.000002	=	NA	

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

ND = Not detected.

NA = Not analyzed

Blank spaces in screening criteria columns signify that no screening criteria value is avail

N = Normal field sample.

CGWWTP samples collected in 2000

TABLE 9-8
Subsurface Soil Analytical Data Detection Summary
SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

StationID		CGWWTPSB001	CGWWTPSB013		CGWWTPSB014		CGWWTPSB015		CGWWTPSB016		CGWWTPSB017	
SampleID		NDD009	CGW10SB13-R01-5		CGW10SB14-R01-5		CGW10SB15-R01-5		CGW10SB16-R01-5		CGW10SB17-R01-5	
Depth		4 to 5 feet	4 to 6 feet		4 to 6 feet		4 to 6 feet		4 to 6 feet		4 to 6 feet	
DateCollected		06/07/2000	01/20/2004		01/20/2004		01/20/2004		01/22/2004		01/22/2004	
SampleType		N	N		N		N		N		N	
Parameter	**Units**											
Metals												
Antimony	mg/kg	ND	0.461	J	0.508	J	0.793	J	0.0986	J	0.184	J
Arsenic	mg/kg	0.56	0.422	J	0.367	J	0.18	J	ND		0.487	J
Barium	mg/kg	171	95.9	J	109	J	55.6	J	91.4	=	98.9	=
Beryllium	mg/kg	ND	0.308	J	0.157	J	0.178	J	0.282	J	0.268	J
Cadmium	mg/kg	ND	ND		ND		ND		ND		0.141	J
Chromium, total	mg/kg	19.2	23	=	13.7	=	25	=	16.8	J	15.2	J
Cobalt	mg/kg	ND	10.5	=	8.71	=	9.86	=	13.9	J	11.1	J
Copper	mg/kg	60.9	43.7	=	34	=	43.7	=	47.6	=	43.6	=
Lead	mg/kg	1.5	1.93	=	0.905	=	ND		2.16	=	2.04	=
Mercury	mg/kg	ND	0.00223	J	0.00447	J	0.00246	J	ND		0.00709	J
Nickel	mg/kg	8.2	7.3	J	6.09	J	6.57	J	7.49	=	5.94	=
Selenium	mg/kg	1.1	ND		0.204	J	ND		0.436	J	0.438	J
Silver	mg/kg	ND	0.0661	J	0.0277	J	0.0323	J	0.0627	J	0.041	J
Thallium	mg/kg	ND	1.29	J	1.29	=	1.62	=	ND		ND	
Tin	mg/kg	ND	ND		ND		ND		0.306	J	ND	
Vanadium	mg/kg	ND	104	=	85	=	157	=	103	=	108	=
Zinc	mg/kg	92.6	32.1	=	16	=	20.8	=	21.7	=	17.8	=
Pesticides												
p,p'-DDE	mg/kg	ND	0.000076	J	0.002	J	0.0014	J	0.0025	J	0.0046	J
p,p'-DDT	mg/kg	ND	ND		ND		ND		ND		0.00031	J
Semi-Volatiles												
bis(2-Ethylhexyl) phthalate	mg/kg	ND	ND		ND		ND		ND		0.132	J
Di-n-butyl phthalate	mg/kg	ND	ND		ND		ND		ND		0.102	J
Volatiles												
m,p-Xylene (sum of isomers)	mg/kg	0.001	ND		ND		ND		ND		ND	
Toluene	mg/kg	ND	ND		ND		ND		ND		ND	
Xylenes, total	mg/kg	0.001	ND		ND		ND		ND		ND	
Chemistry												
Sulfide	mg/kg	NA	15	J	NA		NA		NA		NA	
Dioxins												
1,2,3,4,6,7,8-Heptachlorodibenzo	mg/kg	NA	ND		NA		NA		NA		NA	
Heptachlorinated dibenzo-p-diox	mg/kg	NA	ND		NA		NA		NA		NA	
Hexachlorinated dibenzo-p-dioxi	mg/kg	NA	ND		NA		NA		NA		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA	ND		NA		NA		NA		NA	
Tetrachlorinated dibenzo-p-dioxi	mg/kg	NA	ND		NA		NA		NA		NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is avail
N = Normal field sample.
CGWWTP samples collected in 2000

TABLE 9-8
Subsurface Soil Analytical Data Detection Summary
SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

	StationID	CGWWTPSB001	CGWWTPSB018		CGWWTPSB019		CGWWTPSB020	
	SampleID	NDD009	CGW10SB18-R01-5		CGW10SB19-R01-5		CGW10SB20-R01-5	
	Depth	4 to 5 feet	4 to 6 feet		4 to 6 feet		4 to 6 feet	
	DateCollected	06/07/2000	01/22/2004		01/20/2004		01/22/2004	
	SampleType	N	N		N		N	
Parameter	**Units**							
Metals								
Antimony	mg/kg	ND	0.214	J	0.517	J	ND	
Arsenic	mg/kg	0.56	0.164	J	0.304	J	0.454	J
Barium	mg/kg	171	76.3	=	77.8	J	82.2	=
Beryllium	mg/kg	ND	0.141	J	0.214	J	0.221	J
Cadmium	mg/kg	ND	ND		ND		0.16	J
Chromium, total	mg/kg	19.2	9.75	J	14.4	=	12.1	J
Cobalt	mg/kg	ND	8.43	J	9.06	=	10.4	J
Copper	mg/kg	60.9	38.1	=	36.9	=	37.9	=
Lead	mg/kg	1.5	1.81	=	1.1	=	1.83	=
Mercury	mg/kg	ND	0.00525	J	0.00366	J	0.00261	J
Nickel	mg/kg	8.2	4.36	J	5.54	J	5.61	J
Selenium	mg/kg	1.1	ND		0.419	J	0.386	J
Silver	mg/kg	ND	0.0239	J	ND		ND	
Thallium	mg/kg	ND	ND		0.965	J	ND	
Tin	mg/kg	ND	ND		ND		ND	
Vanadium	mg/kg	ND	68.8	=	89.9	=	77.2	=
Zinc	mg/kg	92.6	20.7	=	18.9	=	17.8	=
Pesticides								
p,p'-DDE	mg/kg	ND	0.0045	J	0.0022	J	0.00087	J
p,p'-DDT	mg/kg	ND	ND		ND		ND	
Semi-Volatiles								
bis(2-Ethylhexyl) phthalate	mg/kg	ND	ND		0.479	=	ND	
Di-n-butyl phthalate	mg/kg	ND	0.073	J	ND		0.083	J
Volatiles								
m,p-Xylene (sum of isomers)	mg/kg	0.001	ND		ND		ND	
Toluene	mg/kg	ND	ND		ND		ND	
Xylenes, total	mg/kg	0.001	ND		ND		ND	
Chemistry								
Sulfide	mg/kg	NA	NA		ND		NA	
Dioxins								
1,2,3,4,6,7,8-Heptachlorodibenzo	mg/kg	NA	NA		2.9E-06	=	NA	
Heptachlorinated dibenzo-p-diox	mg/kg	NA	NA		0.000006	=	NA	
Hexachlorinated dibenzo-p-dioxi	mg/kg	NA	NA		ND		NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA	NA		2.93E-05	=	NA	
Tetrachlorinated dibenzo-p-dioxi	mg/kg	NA	NA		ND		NA	

Data Flags:
U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is avail
N = Normal field sample.
CGWWTP samples collected in 2000

TABLE 9-9

Groundwater Analytical Data Detection Summary

SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

	StationID	CGW10MW01		CGW10MW02		CGW10MW03		CGW10MW04		CGW10MW05	
	SampleID	CGW10GW01-R01		CGW10GW02-R01		CGW10GW03-R01		CGW10GW04-R01		CGW10GW05-R01	
	Depth										
	DateCollected1	02/11/2004		02/10/2004		02/10/2004		02/09/2004		02/09/2004	
	SampleType	N		N		N		N		N	
Parameter	**Units**	Background									
Dissolved Metals											
Antimony, dissolved	µg/L	ND		ND		ND		3.26	J	2.66	J
Barium, dissolved	µg/L	357	=	203	J	139	J	367	=	416	=
Chromium, dissolved	µg/L	2.84	J	3.12	J	1.31	J	0.661	J	1.88	J
Cobalt, dissolved	µg/L	0.921	J	7.91	J	ND		ND		ND	
Copper, dissolved	µg/L	3.73	J	ND		2.18	J	2.96	J	1.33	J
Mercury, dissolved	µg/L	ND		0.245	=	ND		0.0215	J	ND	
Nickel, dissolved	µg/L	7.57	J	8.32	J	6.51	J	3.87	J	4.48	J
Selenium, dissolved	µg/L	ND		19	J	2.64	J	3.49	J	3.76	J
Silver, dissolved	µg/L	ND		ND		ND		ND		0.585	J
Thallium, dissolved	µg/L	ND		15.1	J	2.76	J	ND		ND	
Tin, dissolved	µg/L	ND		5.01	J	ND		ND		ND	
Vanadium, dissolved	µg/L	10.5	J	4.05	J	16.3	J	9.53	J	11.7	J
Zinc, dissolved	µg/L	ND		ND		0.607	J	ND		ND	
Metals											
Arsenic	µg/L	ND		12	J	ND		ND		ND	
Barium	µg/L	364	=	204	J	146	J	372	=	405	=
Chromium, total	µg/L	10.2	=	2.99	J	3.06	J	1.06	J	2.17	J
Cobalt	µg/L	1.83	J	6.59	J	ND		ND		0.707	J
Copper	µg/L	5.6	J	6.34	J	1.86	J	2.35	J	ND	
Mercury	µg/L	ND		0.453	=	ND		ND		ND	
Nickel	µg/L	11.1	J	8.8	J	6	J	4.43	J	5.04	J
Selenium	µg/L	4.14	J	10.9	J	4.37	J	2.61	J	2.48	J
Thallium	µg/L	ND		17.3	J	ND		ND		ND	
Vanadium	µg/L	15.2	J	3.09	J	17.1	J	10.2	J	12.6	J
Volatiles											
Toluene	µg/L	0.52	J	0.26	J	ND		ND		ND	
Chemistry											
Cyanide	µg/L	NA		NA		NA		ND		4.79	J

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

ND = Not detected.

NA = Not analyzed

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample.

CGW10 samples collected in 2004

TABLE 9-10

Wastewater Analytical Data Detection Summary

SWMU 10, Sewage Treatment Lagoons, Campa García, Vieques, PR

	StationID	CGWWTPWW001	
	SampleID	NDD016	
	DateCollected	06/07/2000	
	SampleType	N	
Parameter	**Units**		
Metals			
Barium	µg/L	54.8	J
Copper	µg/L	13.4	J
Zinc	µg/L	77.4	J
TPH	µg/L		
Petroleum hydrocarbons	µg/L	3900	J
Volatiles	µg/L		
Toluene	µg/L	2	=
Chemistry	µg/L		
Cyanide	µg/L	11.6	=
Nitrogen, nitrate-nitrite	µg/L	109	=
Sulfate (as SO4)	µg/L	23000	=
Sulfide	µg/L	3320	=
Data Flags:			

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

N = Normal field sample.

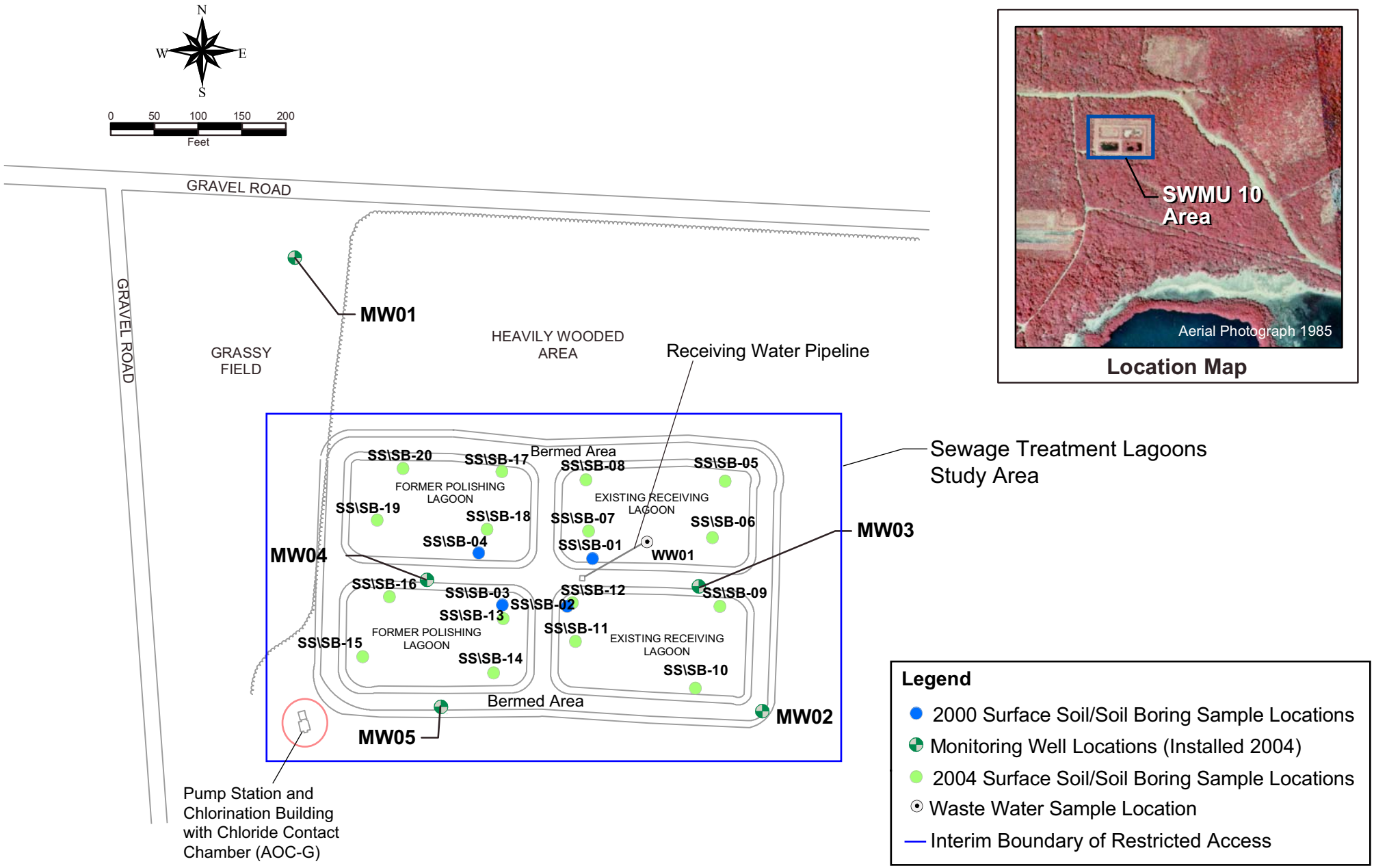


Figure 9-1
Surface and Subsurface Soil and Groundwater Sample Location Map
SWMU 10, Former AFWTF, Puerto Rico

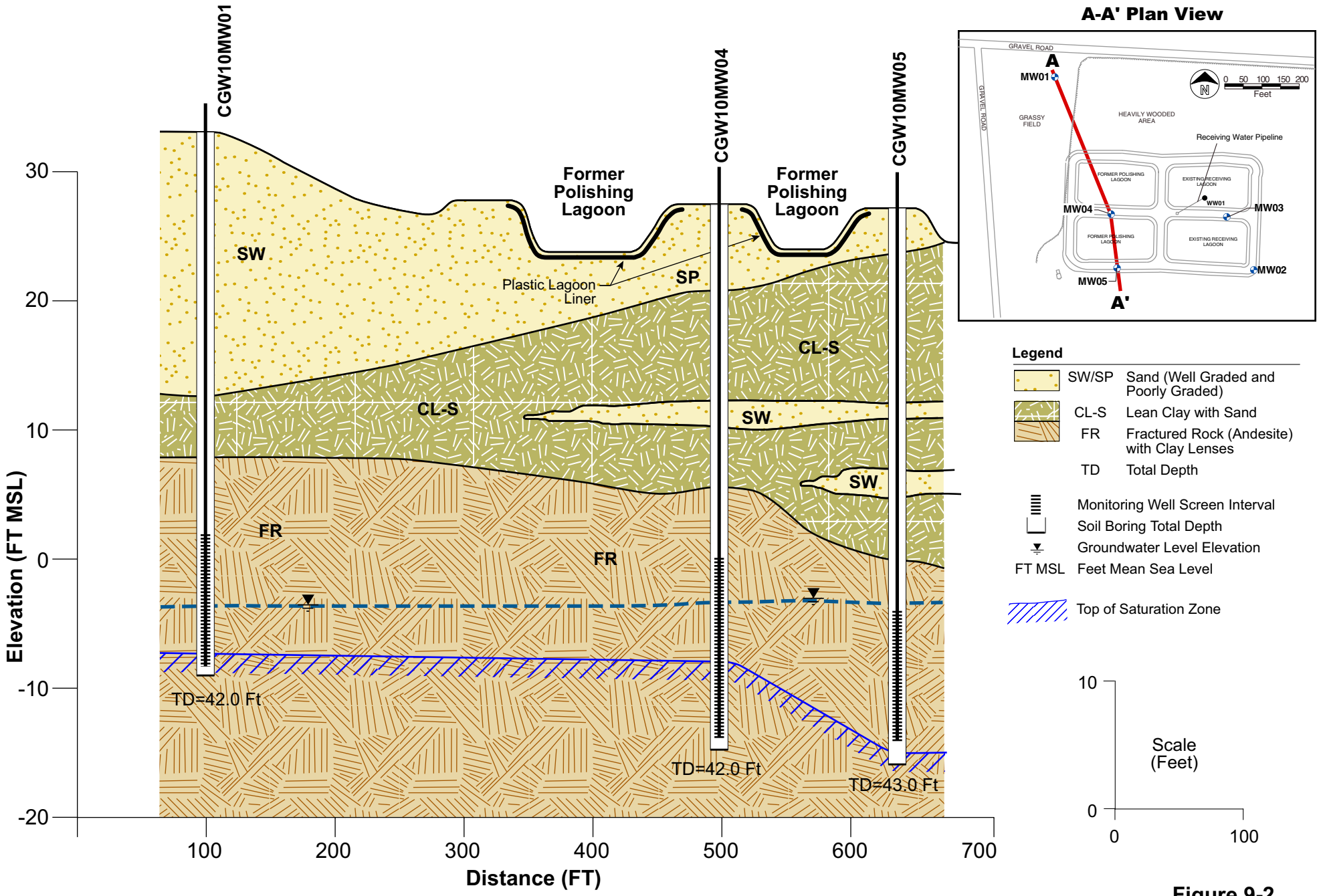
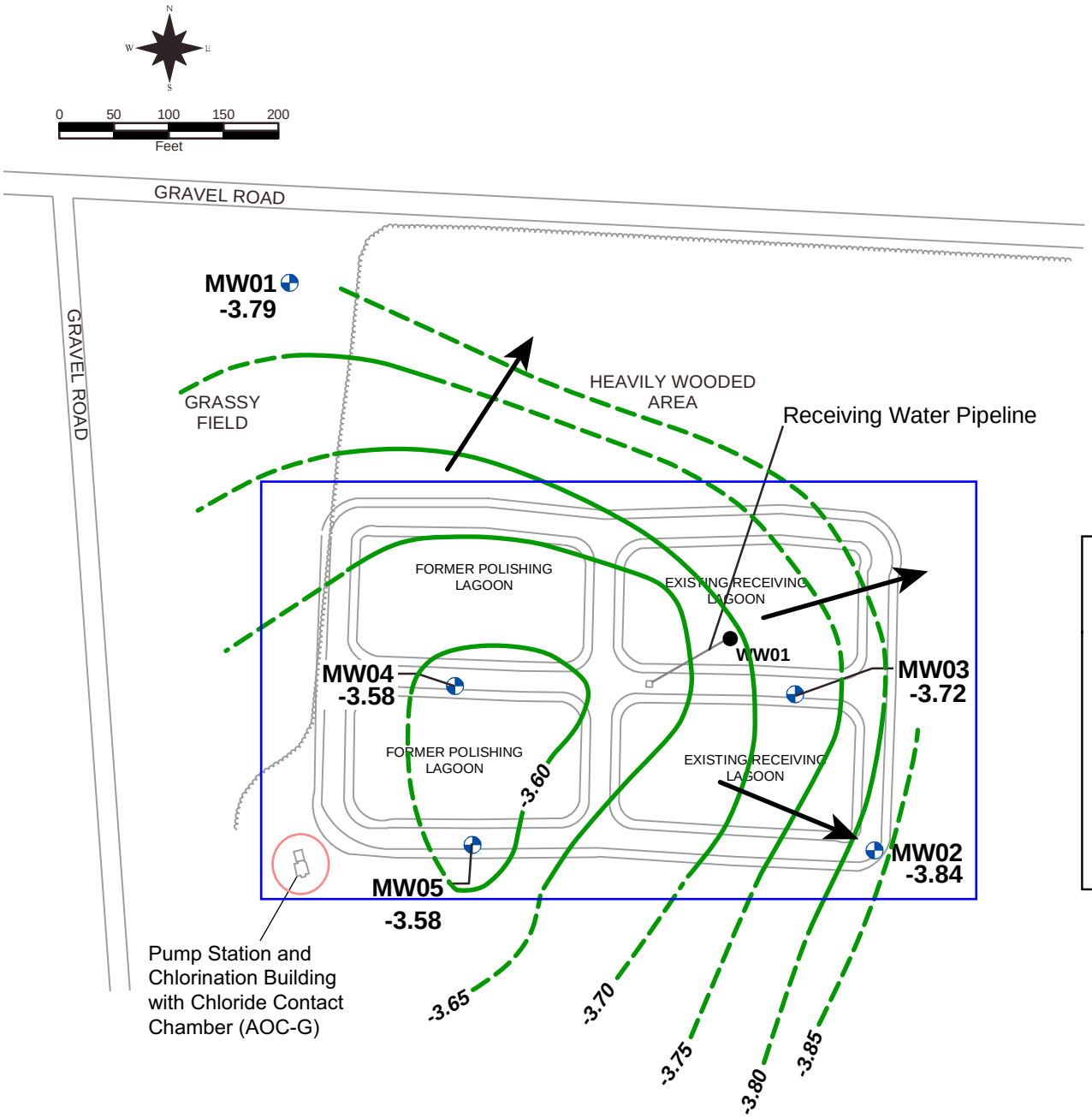
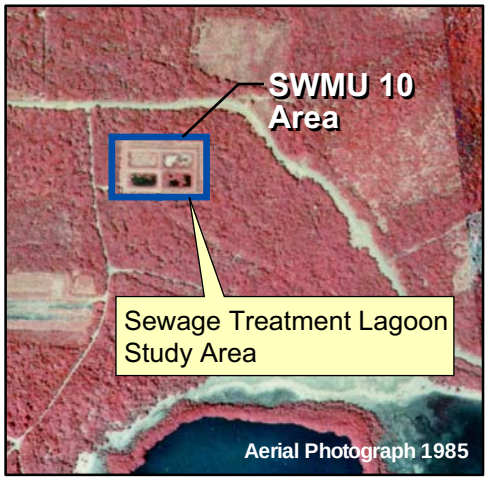


Figure 9-2
Geologic Cross Section A-A'
SWMU 10, Former AFWTF, Vieques, Puerto Rico





Location Map

LEGEND

- Monitoring Well Locations
- Direction of Groundwater Flow
- Estimated Groundwater Contours in 0.05' Intervals
- Interim Boundary of Restricted Access

Groundwater Elevations in Ft MSL
Water Level Readings taken on 2/7/04

Figure 9-3
Groundwater Flow Map
SWMU 10, Former AFWTF, Puerto Rico

SECTION 10

SWMU 12 – Solid Waste Collection Unit Area

This section presents the results of the Phase I RFI performed in January 2004 at SWMU 12, a solid waste collection unit area, also referred to as AOC B in the 1988 RFA report (Kearney, 1988). This section includes a site description, results of the field investigation, and a summary of laboratory results.

Samples from selected locations (see Section 2 of this Data Summary Report) were split and sent for independent analysis by the three involved agencies (the Navy, EPA, and PREQB). This report addresses only the samples collected and analyzed by the Navy.

10.1 Site Description

This area was formerly referred to as AOC B in the 1988 RFA (Kearney, 1988), but in accordance with the Consent Order, this area was designated as a waste management unit and identified as SWMU 12.

The solid waste collection unit area served as a solid waste storage and transfer area, prior to pickup of the solid waste for disposal at the Vieques Island landfill. Containers used to store solid wastes collected at the site include wooden boxes, wooden trailers, and metal dumpsters, and metal cans. The two RFA reports (Kearney, 1988; PREQB, 1995) suggested no further action for this site because no known hazardous constituents were staged there. Results of the visual inspection by the Navy's contractor, CH2M HILL, in February 2000 indicated that SWMU 12 consisted of two trailers potentially used for storage of domestic waste from OP-1 that was subsequently transported to the landfill at the former NSRR (now referred to as NAPR). Figure 10-1 presents a photograph of SWMU 12. During the 2004 sampling event, no trailers or any signs of waste were present in the area of SWMU 12. The trailers were removed as part of the Navy's closure of AFWTF in 2003.

10.2 Field Investigation Results

SWMU 12 was sampled by collecting five surface soil samples around the waste collection units on January 19, 2004. Samples were collected from a depth of 0 to about 8 inches and were analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. One of the samples, collected from station CGW12SS05, was also analyzed for cyanide, sulfide and dioxins. Figure 10-2 illustrates the sample locations**.**

Although historical operations information for SWMU 12 does not indicate the presence of material containing explosives or related residues at this site, they were included in the sample analyses because this location is within the area that could be impacted by munitions as indicated in the Preliminary Range Assessment (CH2M HILL, 2003a). Split sample locations are listed in Table 2-1.

10.3 Laboratory Analytical Results

Figure 10-2 shows the locations of the surface soil samples collected at SWMU 12 during the Phase I RFI. Table 10-1 summarizes the surface soil constituent detections.

Table 10-1

Surface Soil Analytical Data Detection Summary

SWMU 12, Solid Waste Collection Unit Area, Observation Post (OP) - 1, Inner Range, Vieques, PR

	StationID	CGW12SS01		CGW12SS02		CGW12SS03		CGW12SS04		CGW12SS05	
	SampleID	CGW12SS01-R01		CGW12SS02-R01		CGW12SS03-R01		CGW12SS04-R01		CGW12SS05-R01	
	Depth	0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
	DateCollected	01/19/2004		01/19/2004		01/19/2004		01/19/2004		01/19/2004	
	SampleType	N		N		N		N		N	
Parameter	**Units**										
Metals											
Antimony	mg/kg	0.532	J	0.425	J	0.39	J	0.375	J	1.01	J
Arsenic	mg/kg	7.11	=	5.23	=	10.9	=	10.6	=	9.2	=
Barium	mg/kg	86.7	=	107	=	148	=	153	=	102	=
Beryllium	mg/kg	0.275	J	0.388	J	0.285	J	0.27	J	0.304	J
Chromium, total	mg/kg	11.5	J	5.12	J	14.4	J	12	J	9.17	J
Cobalt	mg/kg	10.7	J	11	J	15.5	J	15.4	J	13.1	J
Copper	mg/kg	22.8	=	15.6	=	50.7	=	53.8	=	23.3	=
Lead	mg/kg	2.17	J	0.53	J	2.19	J	0.945	J	ND	
Mercury	mg/kg	0.0236	J	0.0227	J	0.0206	J	0.0181	J	0.0569	=
Nickel	mg/kg	5.1	J	3.92	J	8	J	7.97	J	6.6	J
Selenium	mg/kg	0.818	J	0.632	J	1.39	=	0.575	J	0.529	J
Silver	mg/kg	0.149	J	0.122	J	0.166	J	0.14	J	0.118	J
Thallium	mg/kg	0.802	J	1.24	J	0.438	J	1.2	J	0.516	J
Vanadium	mg/kg	53	=	52.5	=	76.1	=	91.1	=	69.6	=
Zinc	mg/kg	67.9	=	91.4	=	82.8	=	93.9	=	89	=
Semi-Volatiles											
Di-n-butyl phthalate	mg/kg	ND		0.0837	J	ND		0.0575	J	ND	
Dioxins											
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		NA		0.000008	=

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

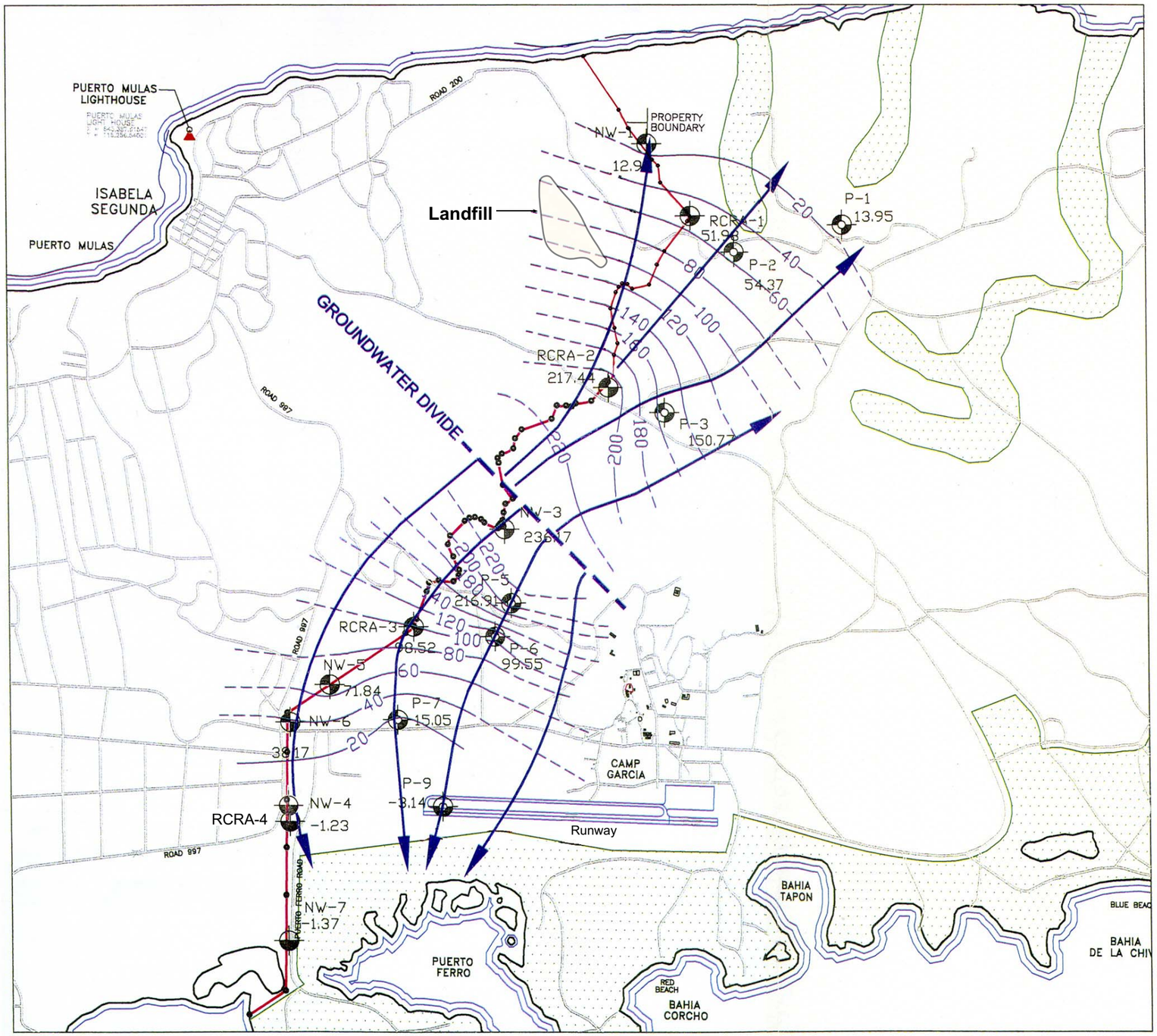
= - Detected value as shown.

ND = Not detected.

NA = Not analyzed

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample.



Groundwater Elevation Measurements

Point ID	GW Elevation Measured 8/26
NW-1	12.906
NW-3	236.172
NW-4	-1.230
NW-5	71.838
NW-6	38.166
NW-7	-1.367
NW-8	-0.876
P-1	13.954
P-2	54.365
P-3	150.771
P-5	216.909
P-6	99.545
P-7	15.049
P-8	-3.475
P-9	-3.142
RCRA-1	51.981
RCRA-2	217.439
RCRA-3	98.517
RCRA-4	-1.059

Source: Baker, 1999

Note:
GW = Groundwater

LEGEND

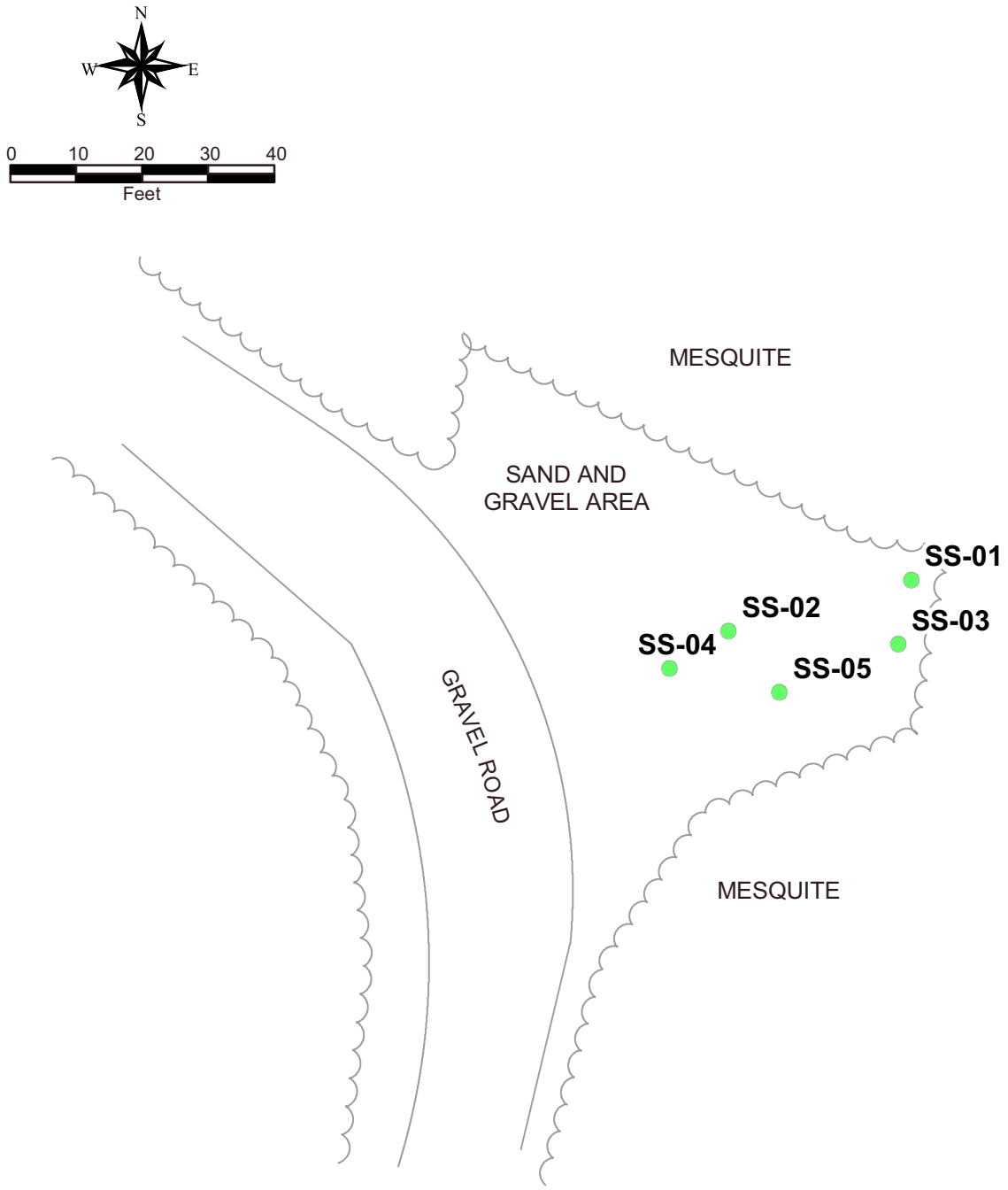
- AFWTF PROPERTY LINE
- --20-- INFERRED GROUNDWATER ELEVATION CONTOURS
- —40— INTERPRETED GROUNDWATER ELEVATION CONTOURS
- INTERPRETED GROUNDWATER FLOW DIRECTION
- NW-1 12.91 MONITORING WELL WITH POSTED GROUNDWATER ELEVATION (MSL)
- P-1 13.95 PIEZOMETER WITH POSTED GROUNDWATER ELEVATION (MSL)
- CONSERVATION ZONES

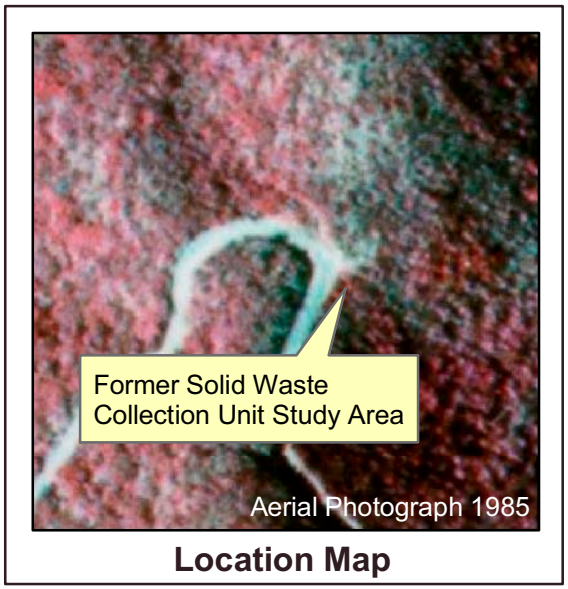
0 8,000 16,000
Feet

N W E S

Source: Baker Environmental

Figure 1-10
Groundwater Contour Map
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico





Location Map

Legend

- Surface Soil Sample Locations

Figure 10-2
Surface Soil Sample Location Map
SWMU 12, Former AFWTF, Puerto Rico

SECTION 11

AOC A – Diesel Fuel Fill Pipe Area

This section presents the results of the Phase I RFI performed at AOC A – Diesel Fuel Fill Pipe Area at OP-1 the former AFWTF. Field sampling activities associated with this site were performed in March 1997 (IT, 1997) and April 2003. This report includes data from both investigations for the purpose of evaluating site environmental conditions.

This section includes a site description, results of the field investigations, and a summary of laboratory results.

11.1 Site Description

According to the 1988 RFA Report (Kearney, 1988), this area contained the fuel fill pipe for the 15,000 gallon diesel fuel underground storage tank (UST) located at the OP-1 in the Cerro Matías area of the VNTR. The UST was located 25 ft southwest and downgradient of the fill pipe.

The UST and fuel fill pipe entered service in approximately 1978. The 1995 RFA Report (PREQB, 1995) stated that the soil surrounding the fill pipe was stained, apparently as a result of fuel releases that had occurred during tank refueling. The total impacted area was approximately 6 ft by 6 ft. No fuel releases from leaking of the UST were apparent, and no release controls were found at this site (PREQB, 1995). The 1995 RFA Report stated that the following:

> "Given the limited amount of fuel spilled to the soil, sampling and analysis of soil is not suggested at this time. A general cleanup of the area, however, would help reduce the potential of a release."

The 15,000-gallon diesel fuel UST, associated piping including the fill pipe, and surrounding soil were excavated and removed for disposal in 1997. A new UST was installed at that time.

11.2 Field Investigation Results

After removal of the UST and contaminated soil, four confirmatory soil samples were collected from the excavation pit and analyzed for petroleum-related constituents (benzene, ethylbenzene, toluene, and xylenes [BTEX] and total recoverable petroleum hydrocarbon [TRPH]. No petroleum-related constituents were detected in any of the four soil samples. The closure report indicated that four samples were collected after the lines and tank were removed, but does not include sample collection depths or actual collection locations. Although the removal actions were completed earlier, the closure report was finalized in April 2000 after comments were received from PREQB.

The new UST installed in 1997 was removed in 2003 in response to the closure of VNTR and the transfer the property to the DOI. Soil samples were collected from 10 locations: six different locations around the former tank (two at the bottom of the excavation and one on

each of the four sides of the tank excavation), and from four locations along the length of the bottom of the former fuel line that connected the tank to the generator. The samples around the side walls of the tank excavation were collected from approximately 4 to 5 ft bls, while samples from the bottom of the tank excavation were collected from approximately 8 to 10 ft bls. Samples from the excavation of the former fuel line were collected from approximately 2 ft bls. The soil samples were analyzed for BTEX/MTBE, total petroleum hydrocarbon (TPH) Diesel Range Organics (DRO), naphthalene, and lead**.** Figure 11-1 shows the locations sampled during the 2003 event.

No additional sampling was conducted at AOC A during the 2004 Phase I RFI field investigation.

11.3 Laboratory Analytical Results

Figure 11-1 shows the locations of the subsurface soil samples collected at AOC A. Table 11-1 summarizes the subsurface soil sample constituent detections.

Table 11-1

Soil Analytical Data Detection Summary

AOC A, Diesel Fuel Fill Pipe Area, Observation Post (OP) - 1, Inner Range, Vieques, PR

	StationID	CGAAUST01	CGAAUST02	CGAAUST03	CGAAUST04	CGAAUST05	CGAAUST07	CGAAUST08	CGAAUST09	CGAAUST10
	SampleID	001	002	003	004	005	007	008	009	010
	Depth	8 to 10 feet	8 to 10 feet	4 to 5 feet	4 to 5 feet	4 to 5 feet	2 to 3 feet	2 to 3 feet	2 to 3 feet	2 to 3 feet
	DateCollected	04/14/2003	04/14/2003	04/14/2003	04/14/2003	04/14/2003	04/14/2003	04/14/2003	04/14/2003	04/14/2003
	SampleType	N	N	N	N	N	N	N	N	N
Parameter	**Units**									
Metals										
Lead	mg/kg	2.04 =	1.57 =	1.94 =	2.94 =	2.09 =	6.87 =	4.06 =	3.1 =	2.96 =
TPH										
Diesel Range Organics (C10-C28)	mg/kg	50.1 =	ND	15.6 =	11.4 =	2 J	121 =	976 =	2040 =	440 =
Volatiles										
m,p-Xylene (sum of isomers)	mg/kg	ND	ND	ND	ND	ND	ND	0.003 J	ND	ND
o-Xylene (1,2-Dimethylbenzene)	mg/kg	ND	ND	ND	ND	ND	ND	0.007 =	0.0045 J	0.00046 J
Xylenes, total	mg/kg	ND	ND	ND	ND	ND	ND	0.01 =	0.0045 J	ND

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

R = Data was unusable.

= - Detected value as shown.

ND = Not detected.

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample.

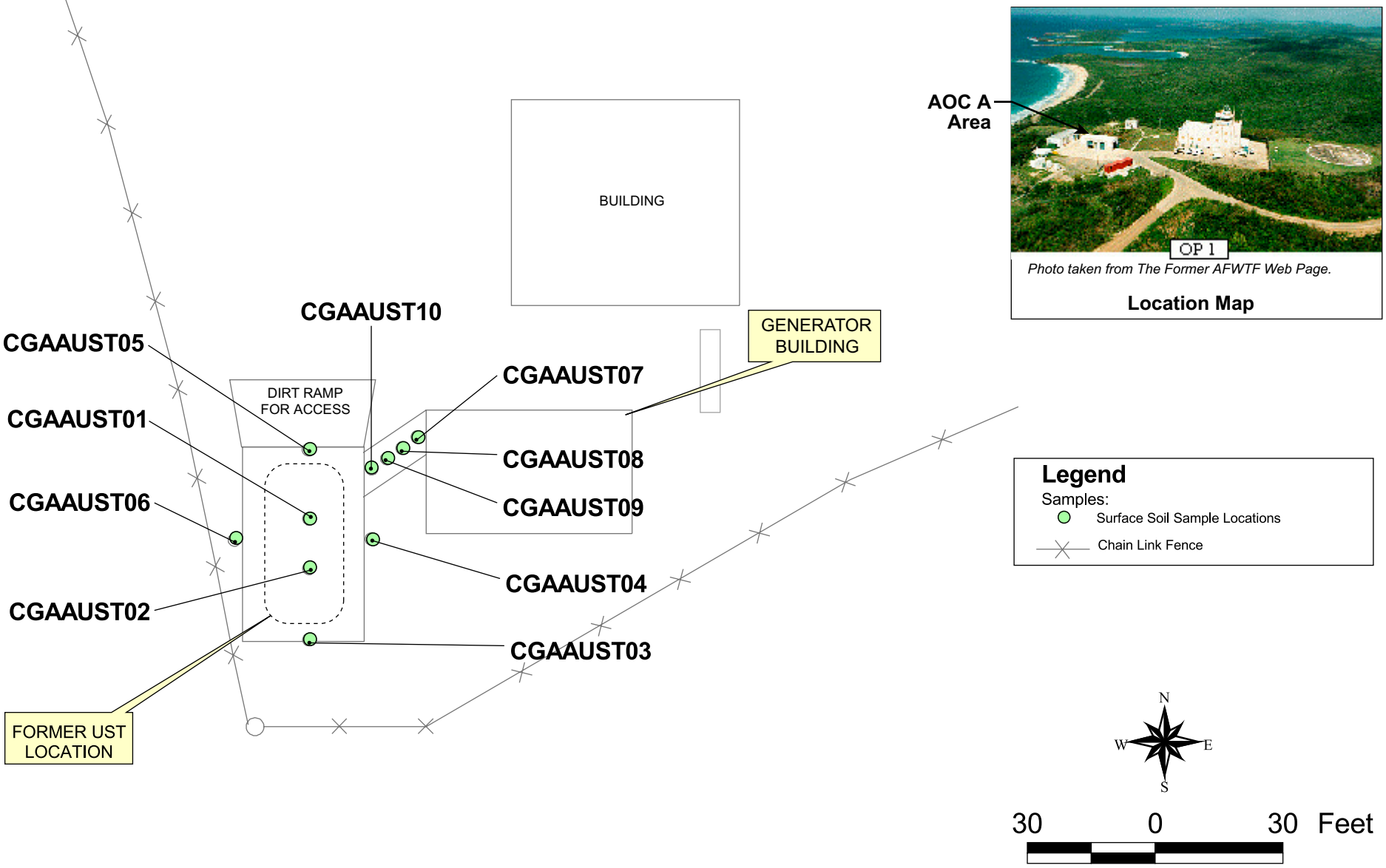


Figure 11-1
Subsurface Soil Sample Location Map
AOC A, Former AFWTF, Puerto Rico

SECTION 12

AOC F – Rock Quarry (Camp García)

This section presents the results of the Phase I RFI performed in June 2000 at AOC F, the rock quarry located southwest of the former Camp Garcia landfill. It includes a site description, results of the field investigation, and a summary of laboratory results.

12.1 Site Description

The rock quarry is located southwest of the former Camp García landfill. This site was used by the Navy as a source of gravel for road construction and other projects. The 1995 RFA Report noted that used tires and some paper waste were visible at this location (PREQB, 1995). The two RFA reports prepared for this site recommended no further action (Kearney, 1988; PREQB, 1995).

During the February 2000 site inspection by the Navy's contractor, CH2M HILL, no waste tires or other waste materials were observed at the quarry site, and the quarry was not active. No additional historical usage information is known for this AOC.

A surface soil sampling investigation was conducted in June 2000 as part of the transfer of Navy Public Works operations from West Vieques to East Vieques. Following this transfer, the rock quarry was used for road maintenance activities.

12.2 Field Investigation Results

A sampling investigation was conducted in June 2000 to determine whether hazardous constituents existed in the surface soil where Navy personnel were to remove quarry material. Five surface soil samples (0 to about 8 inches bls) were collected from the quarry at sampling locations illustrated in Figure 12-1**.** The samples were analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. VOCs were collected with the En Core™ sampling device. Analytical results from this effort were preliminarily reported in August 2000 in a Quarterly Report (CH2M HILL, August 2000), and are included in this report. No additional sampling was conducted at this site during the Phase I RFI in 2004.

12.3 Laboratory Analytical Results

Figure 12-1 shows the locations of the surface soil samples collected in 2000 at AOC F. Table 12-1 summarizes the surface soil constituent concentrations.

Table 12-1

Surface Soil Analytical Data Detection Summary

AOC F, Rock Quarry, Camp García, Vieques, PR

	StationID	CGAOCFSS001		CGAOCFSS002		CGAOCFSS003		CGAOCFSS004		CGAOCFSS005	
	SampleID	NDD044		NDD045		NDD046		NDD047		NDD048	
	Depth	0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
	DateCollected	06/14/2000		06/14/2000		06/14/2000		06/14/2000		06/14/2000	
	SampleType	N		N		N		N		N	
Parameter	**Units**										
Metals											
Arsenic	mg/kg	2.1	=	2.9	=	4.2	=	3	=	3.1	=
Barium	mg/kg	160	=	268	=	238	=	61.8	=	218	=
Beryllium	mg/kg	0.34	=	0.32	=	0.53	=	0.37	=	0.37	=
Chromium, total	mg/kg	8.1	=	9.8	=	21.5	=	10.4	=	20.2	=
Cobalt	mg/kg	16.7	=	20	=	25.9	=	15.2	=	22.7	=
Copper	mg/kg	9.2	=	19.2	=	34.7	=	29.4	=	30.7	=
Lead	mg/kg	1.6	=	2.2	=	3.2	=	2.7	=	2.4	=
Mercury	mg/kg	0.05	J	ND		ND		ND		ND	
Nickel	mg/kg	4.9	J	4.5	J	10.9	=	3.7	J	9.7	=
Selenium	mg/kg	0.84	J	1.1	J	1.4	J	0.86	J	1.3	J
Vanadium	mg/kg	73.8	=	81.5	=	118	=	96.9	=	99.7	=
Zinc	mg/kg	18.1	=	15.3	=	17.7	=	10.5	=	13.9	=
Herbicides											
2,4,5-t (trichlorophenoxyacetic acid)	mg/kg	ND		ND		0.0052	J	ND		ND	

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.

UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.

J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.

B = Analyte was detected in the associated method blank.

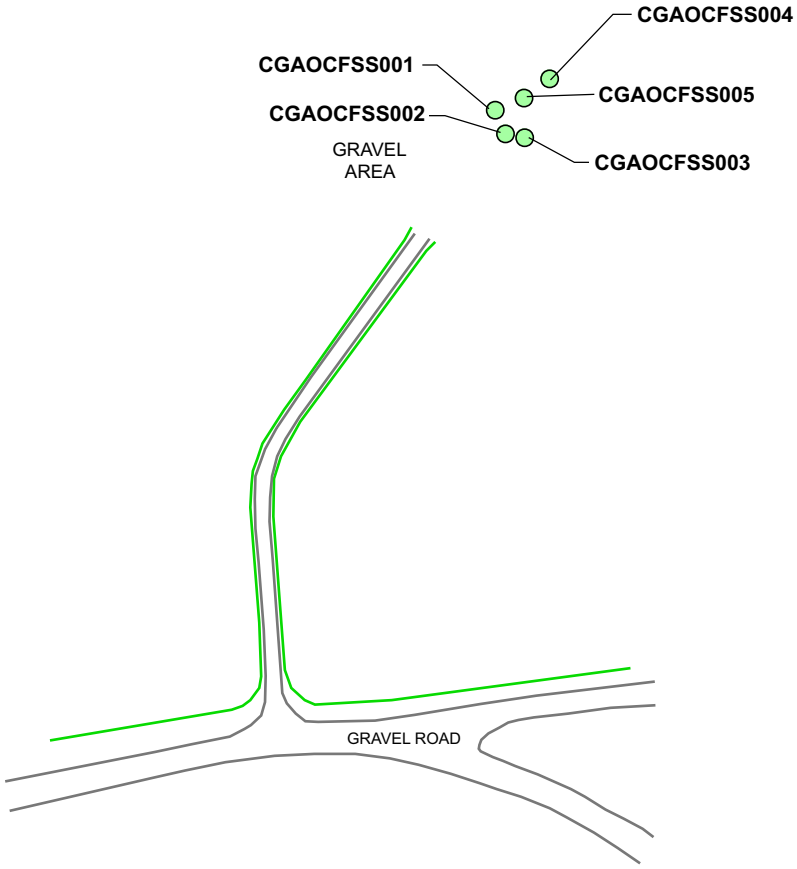
R = Data was unusable.

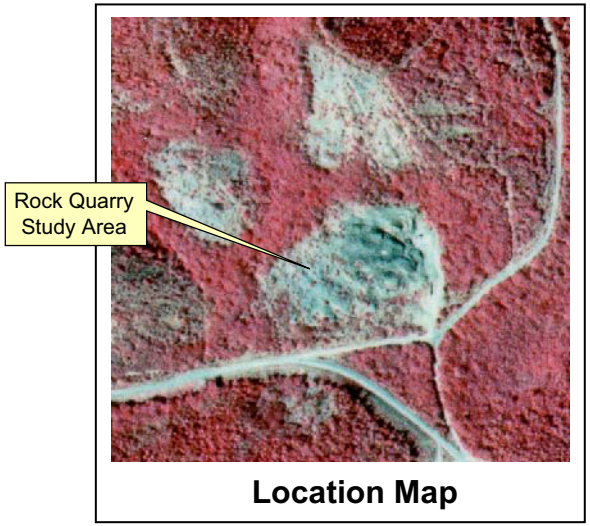
= - Detected value as shown.

ND = Not detected.

Blank spaces in screening criteria columns signify that no screening criteria value is available.

N = Normal field sample.





Legend

Samples:

Surface Soil Sample Locations

N
W
E
S

100 0 100 Feet

Figure 12-1
Surface Soil Sample Location Map
AOC F, Former AFWTF, Puerto Rico

SECTION 13

AOC G – Pump Station and Chlorination Building at Sewage Lagoons (Camp García)

This section presents the results of the Phase I RFI performed in January 2004 at SWMU 13 – Pump Station and Chlorination Building at Sewage Lagoons at Camp García. It includes a site description, results of the field investigation, and a summary of laboratory results.

13.1 Site Description

AOC G is located adjacent to the sewage treatment lagoons at Camp García, and consists of a building that housed a pump station and chlorination equipment used for the chlorination of the lagoon system effluent. These facilities were placed into operation in the 1950s. Operations ceased in 1978, and the facilities are no longer in service.

The building was constructed of concrete, and was built partially below grade. Use of the unit ceased completely in 1978 when the activity of the base decreased. During the 1988 RFA, stains were reportedly visible on the concrete floor in the building, indicating that wastewater might have overflowed. However, no signs of vegetation stress or staining were apparent in the grassy area surrounding the building at the time of the RFA. The 1988 and 1995 RFA reports both recommended no further action for this site (Kearney, 1988; PREQB, 1995).

During the February 2000 site inspection conducted by the Navy's contractor CH2M HILL, no staining was observed in the chlorination building, and the site was inactive and overgrown with vegetation. The building was still in place, although not in use.

Site conditions during the January 2004 site visit were the same as those observed in February 2000.

13.2 Field Investigation Results

Under the direction of LANTDIV, CH2M HILL collected five surface soil samples (0 to about 8 inches bls) in the area of the chlorination building and the nearby chlorine contact chamber as shown in Figure 13-1. All soil samples were analyzed for VOCs, SVOCS, metals, explosives, herbicides, pesticides, PCBs, and perchlorate. One sample, collected from station CGAGSS04, was also analyzed for cyanide, sulfide and dioxins.

Although historical information for AOC G does not indicate the potential presence of explosives or related residues at this site, explosives were included in the sample analyses to confirm that no munitions operations were conducted within this area.

13.3 Laboratory Analytical Results

Figure 13-1 shows the locations of the surface soil samples collected at AOC G during the Phase I RFI. Table 13-1 summarizes the surface soil constituent detections.

Table 13-1
Surface Soil Analytical Data Detection Summary
AOC G, Pump Station and Chlorination Building at Sewage Treatment Lagoons, Camp García, Vieques, PR

	StationID	CGAGSS01		CGAGSS02		CGAGSS03		CGAGSS04		CGAGSS05	
	SampleID	CGAGSS01-R01		CGAGSS02-R01		CGAGSS03-R01		CGAGSS04-R01		CGAGSS05-R01	
	Depth	0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet		0 to 0.7 feet	
	DateCollected	01/22/2004		01/22/2004		01/22/2004		01/22/2004		01/22/2004	
	SampleType	N		N		N		N		N	
Parameter	**Units**										
Metals											
Antimony	mg/kg	0.36	J	0.114	J	0.289	J	0.289	J	0.254	J
Arsenic	mg/kg	0.937	J	0.768	J	0.696	J	0.935	J	0.718	J
Barium	mg/kg	62.7	=	59.8	=	76.4	=	83.4	=	110	=
Beryllium	mg/kg	0.207	J	0.204	J	0.216	J	0.254	J	0.231	J
Cadmium	mg/kg	0.362	J	0.267	J	0.366	J	0.355	J	0.334	J
Chromium, total	mg/kg	13.2	J	13.1	J	13.9	J	15.3	J	14.3	J
Cobalt	mg/kg	9.64	J	8.47	J	9.14	J	12.9	J	12.9	J
Copper	mg/kg	51.4	=	42.4	=	40.7	=	70.7	=	41.9	=
Lead	mg/kg	10.9	=	11.9	=	5.04	=	8.23	=	6.32	=
Mercury	mg/kg	0.0946	=	0.14	=	0.0258	=	0.0235	=	0.114	=
Nickel	mg/kg	5.97	J	5.09	J	5.63	J	6.69	J	6	J
Selenium	mg/kg	0.591	J	0.605	J	0.201	J	0.73	J	0.763	J
Silver	mg/kg	0.0386	J	ND		0.053	J	0.0285	J	0.0306	J
Tin	mg/kg	0.479	J	0.311	J	ND		0.538	J	0.53	J
Vanadium	mg/kg	72.1	=	66.8	=	76.2	=	84.1	=	79.7	=
Zinc	mg/kg	76.3	=	88.3	=	41.2	=	59.2	=	79.8	=
Pesticides											
p,p'-DDD	mg/kg	0.00017	J	0.00031	J	0.00033	J	0.00093	J	0.00072	J
p,p'-DDE	mg/kg	0.013	J	0.0058	J	0.0092	J	0.031	J	0.012	J
p,p'-DDT	mg/kg	0.0024	J	0.0014	J	0.0014	J	0.002	J	0.0012	J
Semi-Volatiles											
Benzo(a)pyrene	mg/kg	ND		0.0373	J	ND		ND		ND	
Benzo(b)fluoranthene	mg/kg	ND		0.0888	J	ND		ND		ND	
Benzo(g,h,i)perylene	mg/kg	ND		0.0399	J	ND		ND		ND	
Benzo(k)fluoranthene	mg/kg	ND		0.0586	J	ND		ND		ND	
Chrysene	mg/kg	ND		0.0583	J	ND		ND		ND	
Indeno(1,2,3-c,d)pyrene	mg/kg	ND		0.043	J	ND		ND		ND	
Kepone	mg/kg	0.956	=	ND		ND		ND		ND	
Pyrene	mg/kg	ND		0.0431	J	ND		ND		ND	
Chemistry											
Cyanide	mg/kg	NA		NA		NA		0.307	J	NA	
Sulfide	mg/kg	NA		NA		NA		27.2	J	NA	
Dioxins											
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		0.000123	=	NA	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		0.000003	=	NA	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		0.0000036	=	NA	
Heptachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		0.00026	=	NA	
Hexachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		0.00004	=	NA	
Octachlorodibenzo-p-dioxin	mg/kg	NA		NA		NA		0.00140	=	NA	
Pentachlorinated dibenzo-p-dioxins, (total)	mg/kg	NA		NA		NA		0.000002	=	NA	

Data Flags:

U = Undetected; analyte was analyzed but not detected above the MDL.
UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected.
J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit.
B = Analyte was detected in the associated method blank.
R = Data was unusable.
= - Detected value as shown.
ND = Not detected.
NA = Not analyzed
Blank spaces in screening criteria columns signify that no screening criteria value is available.
N = Normal field sample.

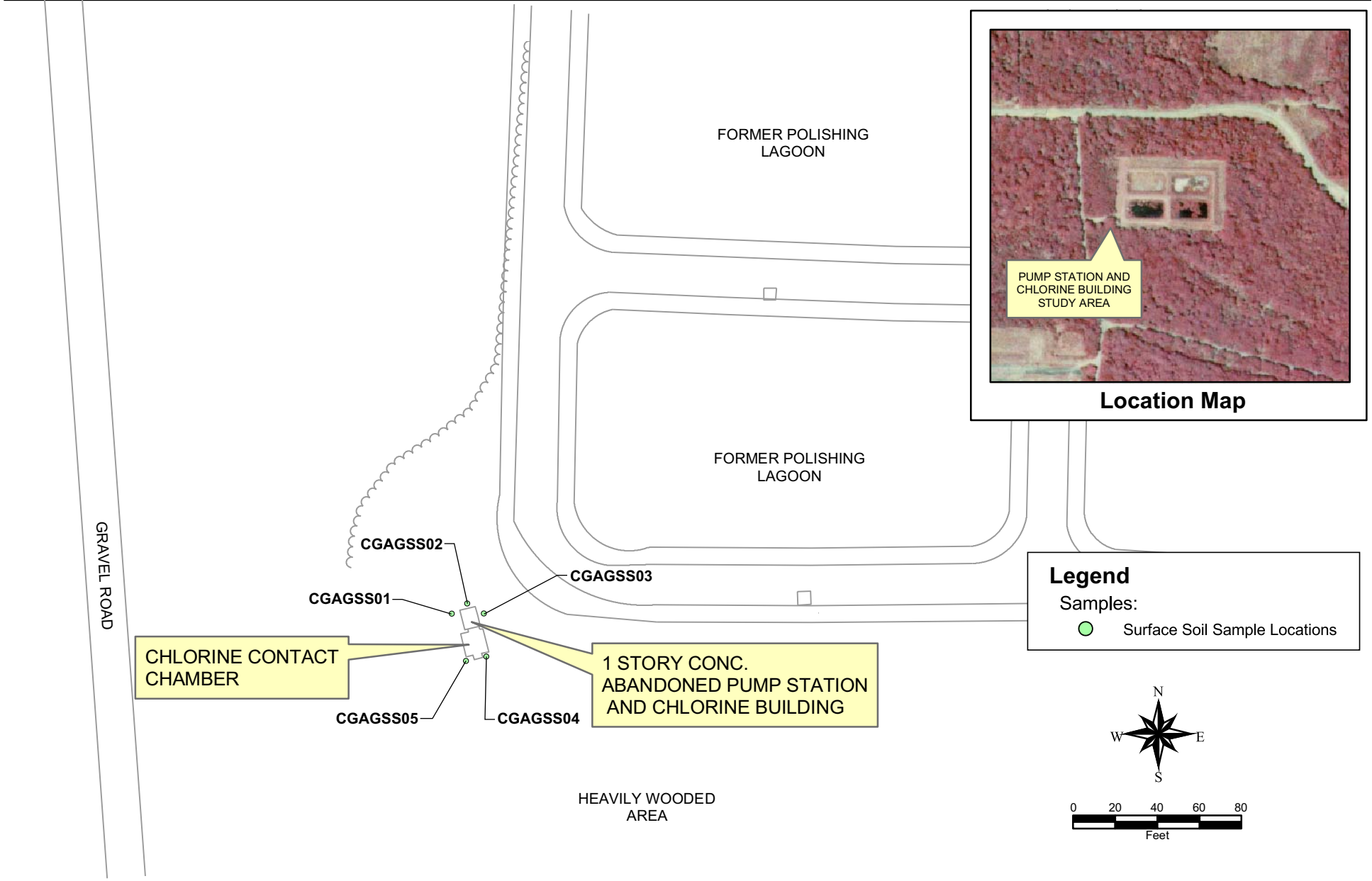


Figure 13-1
Surface Soil Sample Location Map
AOC G, Former AFWTF, Puerto Rico

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