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FINAL FULL RCRA FACILITY INVESTIGATION SWMU 29 –INDUSTRIAL AREA WASTEWATER TREATMENT PLANT SLUDGE DRYING BEDS

For NAVAL ACTIVITY PUERTO RICO
EPA I.D. No. PR2170027203
CEIBA, PUERTO RICO

Prepared for:

Department of the Navy
NAVFAC SOUTHEAST
North Charleston, South Carolina

Prepared by:

Michael Baker Jr., Inc.
Moon Township, PA

Contract No. N62470-07-D-0502
DO 0002

August 28, 2008

IQC for A/E Services for Multi-Media Environmental Compliance Engineering Support

FINAL

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Prepared by:

MICHAEL BAKER JR., INC.
Moon Township, Pennsylvania

I certify under penalty of law that I have examined and am familiar with the information submitted in this document and all attachments and that this document and its attachments were prepared either by me personally or under my direction or supervision in a manner designed to ensure that qualified and knowledgeable personnel properly gather and present the information contained therein. I further certify, based on my personal knowledge or on my inquiry of those individuals immediately responsible for obtaining the information, that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowingly and willfully submitting a materially false statement.

Signature

Name: David Criswell, P.E.

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Date: August 28, 2008

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LIST OF ACRONYMS AND ABBREVIATIONS

AFWTF	Atlantic Fleet Weapons Training Facility
AOC	Areas of Concern
Baker	Michael Baker Jr., Inc.
bgs	below ground surface
BRAC	Base Realignment and Closure
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
C.F.R.	Code of Federal Regulations
COPC	Chemicals of Potential Concern
CRQL	Contract Required Quantitation Limit
CSF	Carcinogenic Slope Factor
CMS	Corrective Measures Study
DoN	Department of the Navy
DPT	Direct Push Technology
DRMO	Defense Restoration and Marketing Office
EA	Environmental Assessment
Eco-SSLs	Ecological Soil Screening Levels
ECP	Environmental Condition of Property
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
E2SS3	Estuarine, Intertidal, Scrub-Shrub, Broad-Leaved Evergreen
F	Fahrenheit
GPS	Global Positioning System
HI	Hazard Index
HSWA	Hazardous and Solid Waste Amendments (to RCRA)
IAS	Initial Assessment Study
ILCR	Incremental Lifetime Cancer Risk
Inc.	Incorporated
IR	Installation Restoration
mgd	Million Gallons per Day
MHSPE	Ministry of Housing, Spatial Planning and Environment
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPR	Naval Activity Puerto Rico
NAVFAC	Naval Facilities Engineering Command Atlantic Division
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
NSRR	Naval Station Roosevelt Roads
PMO	Program Management Office
ppt	parts per thousand

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

PRG	Preliminary Remediation Goal
PRDNR	Puerto Rico Department of Natural Resources
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RFI	RCRA Facility Investigation
SDG	Sample Delivery Group
SWMU	Solid Waste Management Unit
UNEP	United Nations Environmental Program
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tank
VSI	Visual Site Inspection
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

Based on results obtained during the Phase I Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) conducted in November 2006 at the Solid Waste Management Unit (SWMU) 29 - Industrial Area Waste Water Treatment Plant (WWTP) Sludge Drying Beds located at Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico a Full RFI was performed. This document contains the screening data collected from the Phase I investigation and the additional data collected during the Full RFI.

This document was prepared by Michael Baker Jr. Inc. (Baker), for the Navy Base Realignment and Closure (BRAC) Program Management Office (PMO) Southeast. This RFI Report is being developed under IQC for A/E Services for Multi-Media Environmental Compliance Engineering Support, Contract Number N62470-07-D-0502 Delivery Order 0002. This Full RFI Report was developed in accordance with the RCRA § 7003 Administrative Order on Consent (United States Environmental Protection Agency [USEPA] Docket No. 02-2007-7301).

1.1 Purpose

This report has been prepared to document the findings of the 2008 Full RFI field work. The data is compared against current evaluation criteria to identify chemicals of potential concern (COPC) and conduct preliminary screening of human health and ecological criteria.

1.2 Objectives

The objectives of the Full RFI are to delineate contaminants identified during the Phase I RFI from past operation of the sludge drying beds, as described in the USEPA approved 2007 Full RFI Work Plan (Baker, 2007).

Specific elements of the 2008 field effort performed to support this Full RFI include:

- Surface soil sampling collected from eight locations;
- Subsurface soil sampling collected from eight locations.

1.3 Organization of the RFI Report

This report is organized into seven sections. Section 1.0 of this document discusses the purpose and objectives of this Full RFI. Section 2.0 provides a description of the current conditions of the site, including the history of SWMU 29, and a summary of previous investigations. Section 3.0 provides a description of the physical characteristics of the study area including climatology, topography, geology, hydrology, hydrogeology, and potential receptors. The scope of field investigation that was conducted in 2008 is provided in Section 4.0 (work plan summary) – this includes a surface and subsurface soil sampling and analysis program, and a quality assurance/quality control (QA/QC) sampling program, as well as other investigation considerations. The nature and extent of contamination as determined from the results is reported in Section 5.0. Section 6.0 presents the conclusions and recommendations from the Full RFI, while Section 7.0 lists the relative report references.

2.0 FACILITY BACKGROUND

This section provides the history and description of NAPR and SWMU 29, as well as the current conditions at SWMU 29.

2.1 NAPR Description and History

NAPR occupies over 8,890 acres of the northern portion of the east coast of Puerto Rico, along Vieques Passage with Vieques Island lying to the east about 10 miles off the harbor entrance, see Figure 2-1. NAPR also occupies the immediately adjacent islands of Piñeros and Cabeza de Perro. The northern entrance to NAPR is about 35 miles east along the coast road (Route 3) from San Juan. The property consists of 3,938 acres of upland (developable) property and 4,955 acres of environmentally sensitive areas including wetlands, mangrove, and wildlife habitat. The closest large town is Fajardo (population approximately 37,000), which is about 5 miles north of NAPR off Route 3. Ceiba (population approximately 17,000) adjoins the west boundary of NAPR.

The facility was commissioned in 1943 as a Naval Operations Base and re-designated Naval Station Roosevelt Roads (NSRR) in 1957. NSRR operated until March 31, 2004 when NSRR underwent operational closure. On April 1, 2004 NSRR was re-designated as NAPR. The current primary mission of NAPR is to protect the physical assets remaining, comply with environmental regulations, and sustain the value of the property until final disposal of the property.

On October 20, 1994, a Final RCRA Part B permit was issued by USEPA Region II to NSRR. This permit listed 52 SWMUs and 4 Areas of Concern (AOCs) and contained requirements for RFI activities at 24 of these SWMUs and three of these AOCs. An additional 25 SWMUs and 2 AOCs were added to the program over the years. Figure 2-2 shows the locations of all SWMUs and AOCs at NAPR. Prior to 1993, environmental activities at NSRR, exclusive of underground storage tanks (USTs), were conducted in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations under the Department of the Navy's Installation Restoration (IR) Program. The RCRA Part B permit, issued for the Defense Reutilization and Marketing Office (DRMO) at NSRR, included provisions for corrective action under the Hazardous and Solid Waste Amendments (HSWA) to RCRA.

The USEPA issued a RCRA 7003 Administrative Order on Consent (EPA Docket No. RCRA-02-2007-7301), which became effective on January 29, 2007. SWMU 29 is identified as one of three SMWUs/treatment plants containing sludge drying beds that warrant Phase I RFIs, because of the NAPR closure. A Phase I RFI was conducted in November 2006 at SWMU 29 and based on the Phase I RFI data evaluation, a "Full" RFI was recommended by the Navy; EPA concurred in a comment letter dated June 28, 2007.

2.2 SWMU 29 Description and History

SWMU 29 consists of the sludge drying beds at the wastewater treatment plant for the "Industrial Area" of the base. The Industrial Area WWTP was placed into operation around 1963 and included three sludge drying beds. An upgrade to these three sludge drying beds occurred around 1969. Two additional sludge drying beds were added to the plant in 1996 for a total of five drying beds which are still present at the facility. The focus of this investigation is limited to the sludge drying beds located adjacent to the treatment plant. No visual evidence of releases of hazardous wastes or constituents was observed during the 1988 Visual Site Inspection (VSI) or

1993 follow-up inspection. The sludges generated by this unit have been tested since 1988 for "Characteristics of Hazardous Waste" pursuant to 40 Code of Federal Regulations (C.F.R.) Part 261, and found not to be hazardous by characteristic. Permitee has verbally indicated it has no knowledge or evidence of systemic and routine releases of hazardous wastes or constituents from this unit.

2.3 Current Conditions/Site Usage

The Industrial Area sludge drying beds are currently used on a limited basis due to the minimal amount of flow moving through the plant since the operational closure of Naval Station Roosevelt Roads on March 31, 2004 and the transition of the facility into caretaker status. A total of five concrete sludge drying beds are located in the southern portion of the plant as shown on Figure 2-3. The area to the west is concrete and grass while the areas to the south and east are grassy and open water. Grass is located along the northern side of the beds.

2.4 Previous Investigations

SWMU 29 was identified in the RCRA/HSWA Permit dated October 20, 1994. No RFI was required for this SWMU based on verbal statements and Navy letters of August 31, 1993 and June 30, 1992 stating that no knowledge or evidence of systematic and routine releases of hazardous wastes or constituents was known from this SWMU. The NAPR RCRA § 7003 Order on Consent dated January 2007 required a Phase I RFI for all sludge drying beds at SWMUs 27, 28, and 29.

In anticipation of the requirements outlined in the RCRA § 7003 Administrative Order on Consent, a Phase I RFI Work Plan was developed. On September 15, 2006 the Phase I RFI Work Plans (Baker, 2006a) were developed and later approved by the USEPA on October 20, 2006. Mobilization for the RFI field activities occurred November 12, 2006 with demobilization on November 20, 2006.

A Full RFI Investigation was recommended in order to delineate the Appendix IX metals site contamination above screening levels in surface soil and subsurface soil, as well as evaluate the potential for human health and ecological risk. No further study of the groundwater was warranted due to its low yield and low concentrations noted during the Phase I RFI Investigation. The Full RFI Work Plan for SWMU 29 was approved by EPA in a comment letter dated January 7, 2008. Mobilization for the Full RFI field activities occurred on February 11, 2008 with demobilization on February 19, 2008. This document presents the results of the Full RFI field activities.

3.0 PHYSICAL CHARACTERISTICS OF STUDY AREA

The physical setting of NAPR was documented in the 1984 Initial Assessment Study (IAS) (NEESA, 1984). This information is summarized in the paragraphs that follow. The physical results from the Phase I RFI and from this Full RFI also are incorporated into the descriptions of the site-specific hydrogeology given in Section 3.3.4.

3.1 Climatology

The climate associated with NAPR is characterized as warm and humid, with frequent showers occurring throughout the year. A major factor affecting the weather is the pattern of trade winds associated with the Bermuda High, the center of which is in the vicinity of 30^{o} North, 30^{o} West. The prevailing wind direction reflects the easterly trade winds. The area receives a surface flow varying between the northeast to the southeast about 75 percent of the year, and as much as 95 percent of the time in July when the easterly winds are strongest. The differential heating of the land and sea during the day tends to give a more northerly component to the flow on the northern side of the island and a more southerly component on the southern side. During the night, a land breeze causes a prevailing southeasterly flow in the north and a prevailing northeasterly flow over the southern coast. The mean annual wind velocity is 5.5 knots, with a minimum in November and a maximum in August. Gales associated with westward moving disturbances in the trade winds or hurricanes passing either north or south of the area have the highest probability of occurrence from June through October.

Uniform temperatures prevail, with small diurnal ranges as a result of insular exposure and the relatively small land areas. The warmest months are August and September, while the coolest are January and February. Mean annual maximum temperatures range from 82.0° Fahrenheit (F) in January to 88.2° F in August. The mean annual minimum temperatures vary from 64.0° F in January to 73.2° F in June. The highest maximum temperature recorded was 95.0° F, while the lowest minimum was 59.0° F. Rain usually occurs at least nine days in every month, with an average of 60 inches per year although a dry winter season occurs from December through April. About 22 thunderstorm-days occur per year, with maximum frequencies of 3 days per month from May through October.

In late summer, the mean sky cover begins a steady decrease from a monthly maximum average of 6.5-tenths coverage in September to a minimum monthly average of 4.4-tenths coverage in February. From March through August, the monthly average cloud cover increases steadily from 4.5- to 6.0 tenths coverage during the period. Over the open sea, a maximum of clouds (usually broken stratocumulus) occurs during early morning, with the skies clearing or becoming scattered with cumulus by afternoon. Completely clear or overcast skies are rare during daylight hours, while clear skies frequently occur at night.

The hurricane season is from mid-June through mid-September; maximum winds exceed 95 knots during severe hurricanes. An average of two tropical storms per year occurs in the study area, one of which usually reaches hurricane intensity.

3.2 Topography

The regional area of NAPR consists of an interrupted, narrow coastal plain with small valleys extending from the Sierra de Luquillo range, which has been severely eroded by streams into valleys several hundreds of feet deep. Slopes of up to 60^{o} are common.

In the immediate area of NAPR, elevations range from sea level to approximately 295 feet. Immediately to the north of the NAPR boundary, the hills rise abruptly to heights of 800 to 1,050 feet above sea level, with the tallest peak located within 2 kilometers of the NAPR boundary. There is a series of three hilly areas on NAPR, two of which separate the southern airfield area from the Port/Industrial, Housing, and Personnel Support areas. The third set of hills is in the Bundy area. These ridgelines not only separate sections of NAPR, but also dictate the degree of allowable development. The ridgeline south of the airfield provides an excellent barrier, which effectively decreases the aircraft-generated noise reaching the Unaccompanied Enlisted Personnel Housing areas to an acceptable level. Relief is low along the shoreline and lagoons and mangrove swamps are common.

3.3 Geology, Hydrology, and Hydrogeology

Subsections 3.3.1 through 3.3.4 below present descriptions of the geologic, hydrologic, and hydrogeologic conditions across NAPR. These are generally applicable, but may or may not be specifically-applicable, to the SWMU 29 area. In 2004, Baker conducted a series of Phase II Environmental Condition of Property (ECP) investigations across NAPR (NAVFAC, 2004). Subsection 3.3.4 discusses hydrogeologic information most relevant to SWMU 29 gained from the ECP investigations. Section 3.3.4 also incorporates information from the Phase I and Full RFIs.

3.3.1 Soils

The soil associations found at NAPR are predominantly of two types typical of humid areas, namely the Swamps-Marshes Association and the Mabi-Rio-Arriba-Cayagua Association, as well as the Descalabrado-Guayama Association, which is typical of dry areas. In addition, isolated areas of the Caguabo-Mucara-Naranjito Association, the Coloso-Toa-Bajura Association, and the Jacana Amelia-Fraternidad Association are found at NAPR.

The Swamps-Marshes and Mabi-Rio-Arriba-Cayagua associations cover over one half of NAPR's surface area and are equally distributed. Primarily the Descalabrado-Guayama and Caguabo-Mucara-Naranjito associations cover the remaining area.

The Swamps-Marshes Association consists of deep, very poorly drained soils. This association is found in level or nearly level areas that are slightly above sea level but are wet, and when the tide is high, are covered or affected by saltwater or brackish water. The soils are sandy or clayey, and contain organic materials from decaying mangrove trees. Coral, shells, and marl at varying depths underlie them. The high concentration of salt inhibits the growth of all vegetation except mangrove trees, and in small-scattered patches, other salt-tolerant plants.

The Mabi-Rio-Arriba-Cayagua Association consists generally of deep, somewhat poorly drained and moderately well drained, nearly level to moderately steep soils found on foot and side slopes, terraces, and alluvial fans. Soils of this association at NAPR are basically clayey.

The Descalabrado-Guayama Association generally consists of shallow, well drained, strongly sloping to very steep soils on volcanic uplands. Soils of this association are found primarily in the hilly areas located directly inland and adjacent to the soils of the Swamps-Marshes Association.

The Caguabo-Mucara-Naranjito Association consists generally of shallow and moderately deep, well drained, sloping to very steep soils on volcanic uplands. This association consists of soils

that formed in residual material weathered from volcanic rocks. This association is represented at NAPR by soils of the Sabana series, which are found on the side slopes and the hilly terrain west of Langley Drive in the Fort Bundy area. These soils are suited for pasture and woodland. Steep slopes, susceptibility to erosion, and depth to bedrock are the main limitations for farming and for recreation and urban areas.

The Coloso-Toa-Bajura Association consists of deep, moderately well drained to poorly drained, nearly level soils found on floodplains. This soil association extends along the western boundary of NAPR and around the airfield. The soils of this association formed in fine-textured and moderately fine-textured sediment of mixed origin on floodplains. The Coloso soils are deep and somewhat poorly drained; the Toa soils are deep and moderately well drained; and the Bajura soils and Maunabo soils are deep and poorly drained. The Reilly soils, also part of this association, are shallow sand and gravel and are excessively drained; they lie adjacent to streams. The minor soils are Talante, Vivi, Fortuna, Vega Alta, and Vega Baja. The Talante, Vivi, Fortuna, and Vega Baja soils are found on floodplains, while the Vega Alta soils occupy slightly higher positions on terraces.

The Jacana-Amelia-Fraternidad Association consists generally of moderately deep and deep, well drained and moderately well drained, nearly level to strongly sloping soils on terraces, alluvial fans, and foot slopes. This association is represented at NAPR by soils of the Jacana series, which consist of moderately deep, well-drained soils found on the foot slopes and low rolling hills along Langley Drive and just east of the airfield. These soils formed in fine-textured sediment and residuum derived from basic volcanic rocks.

3.3.2 Regional Geology

The underlying geology of NAPR area is predominantly volcanic (composed of lava and tuff), as well as sedimentary (rocks derived from discontinuous beds of limestone). These rocks all range in age from early Cretaceous to middle Eocene. The volcanic rocks and interbedded limestone have been complexly faulted, folded, metamorphosed, and variously intruded by dioritic rocks. This complex geological structuring occurred sometime after the deposition of the limestone during the middle Tertiary, when Puerto Rico was separated from the other major Antillean Islands by block faulting, and was arched, uplifted, and tilted to the northeast. Culebra, Vieques, and the Virgin Islands are part of the Puerto Rican block; they are separated from the main island simply because of the drowning that resulted from the tilting.

In addition to the predominant volcanic and sedimentary rock, unconsolidated alluvial and older deposits from the Quaternary period underlie the northwestern and western sectors of the base.

The primary geologic formations on and near NAPR are various beach deposits, alluvium, quartz diorite and granodiorite, quartz keratophyre, the Daguao Formation, and the Figuera Lava. The Peña Pobre fault zone traverses NAPR.

3.3.3 Regional Hydrology

The surface waters that flow across the northeastern plain of Puerto Rico, where NAPR is located, originate on the eastern slopes of the Sierra De Luquillo Mountains. Surface runoff is channeled into various rivers and streams that eventually flow into the Caribbean Sea. The Daguao River and Quebrada Seca Stream (a tributary to Rio Daguao) collect surface waters from the hills immediately north of NAPR and, in periods of heavy rain, flooding on NAPR occurs. The Daguao-Quebrada Seca watershed comprises an area of approximately 7.6 square miles

(4,900 acres), and the river falls some 700 feet from its source to sea level. Increased development in the town of Ceiba, especially in areas adjacent to NAPR's northern boundary, has significantly increased the surface runoff reaching NAPR, causing ponding and erosion in the Boxer Drive area. Boxer Drive, for a major portion of its length, is subject to surface water flooding, as are Hangar 200 and AIMD Hangar 379 and adjacent apron areas. This condition has been alleviated by the construction of a new highway (Route 3) immediately outside the fence and the realignment of Boxer Drive both with attendant storm water management features.

In the low-lying shore areas, seawater flooding results from storms, wind, and abnormally high tides. The tidal ranges in the NAPR area are rather small, with a maximum spring range of less than three feet. The tides are semidiurnal and have a usual range of about one-foot in the main harbor of NAPR.

Little information exists concerning the hydrogeology of NAPR. The only known potential sources of groundwater lie in lenticular beds of clay, sand and gravel, and rock fragments, which occur at a depth of less than 30 meters. No wells have been developed on site from these layers. Some wells had been developed up gradient of NAPR in Ceiba, some three kilometers from base headquarters, but were abandoned due to high levels of salinity.

The quality of surface waters is variable, reflecting the drainage area through which the water flows. Generally, surface waters have high turbidities and bio-organics (naturally occurring organics, such as decay products of vegetable and animal matter) due to the periodic heavy rains that can easily erode soils from steep slopes, exposed areas and disturbed streambeds. Water from alluvial aquifers along the coast of NAPR is of a calcium bicarbonate type, and has high concentrations of iron and manganese. The source of these minerals is unknown, but they may be derived from buried swamp or lagoon deposits.

A seawater-freshwater interface is present in the aquifers throughout the coastal areas of Puerto Rico, usually within a short distance inland of the coastline.

The NAPR potable water treatment plant receives raw water from the Rio Blanco through a 27-inch reinforced concrete pipe that replaced the old, open channel. The intake is located at the foot of the El Yunque rain forest. This buried raw water line traverses a distance of 14 miles from the intake to the NAPR boundary. A raw water reservoir is located at the water treatment plant and has a 45 million gallon capacity. Additionally, there are two fire protection storage reservoirs with a total capacity of 520,000 gallons.

NAPR has been served for over 30 years by the present treatment facility. The plant (Building 88) has a capacity of 4.0 million gallons per day (mgd). Water flows by gravity into a 45 million-gallon raw water storage basin from which the plant draws its supply at a rate of 1.3 mgd on average. Treatment consists of pre-chlorination, coagulation sedimentation, filtration, and post-chlorination.

3.3.4 Site-Specific Hydrogeology

In 2004, Baker conducted a Phase II ECP investigation involving 20 sites throughout NAPR. Some consistent stratigraphic trends were observed during the ECP. The site-specific hydrogeology can be better understood in the context of NAPR regional geology. For the sake of simplicity, the NAPR regional geology can be divided into three regions:

- Upland areas

- Near-shore flat lands
- Inland flat lands

The upland areas of NAPR includes the hills encompassing the Tow Way Fuel Farm and hospital areas, and the hills encompassing the area behind the Exchange, the former Atlantic Fleet Weapons Training Facility (AFWTF) Command, and Fort Bundy area. These upland areas are underlain by bedrock (predominately Gabbro) and exhibit varying degrees of weathering. Typically, the bedrock is overlain be a relatively thin residual soil (i.e., residuum). Residuum is unconsolidated soil, originating from weathered-in-place bedrock. This residuum generally consists of sand, silt, and clay.

The near-shore areas include the mangrove swamp areas as well as the shores of Ensenada Honda and Puerca Bay. The near-shore areas are typically underlain by marine sand layers (with coral and shell fragments), silt and clay layers, and occasional peat layers. In some near-shore areas, particularly by the harbor and Camp Moscrip in the southeastern portion of the base, fill material overlays the marine layers. The fill consists of rock fragments, debris (e.g., brick), sand, silt, and clay.

The inland flat land area generally encompasses the airfield and golf course areas. The inland flat land area is typically underlain by relatively thick residuum. The residuum generally consists predominately of clay. Fill material overlays the residuum in some areas, particularly the airfield, and generally consists of sand and gravel with lesser amounts of silt and clay.

SWMU 29 is located within the upland land area. A comparison of the boring logs from both the Phase I and Full RFI drilling programs indicates a change in underlying materials in a general line going in between 29SB05 and 29SB13. To the north of this line the underlying materials are generally silt and clay rich, while the area to the south contained mostly sand. Groundwater was observed south of this line in the sand rich materials at approximately 4 to 5 feet below ground surface. Areas to the north of this line indicated first water below 9 feet.

A geologic cross section presents the general underlying stratigraphic sequence of soil horizons at SWMU 29. A site plan map presented as Figure 3-1, shows the location of the cross section line, while Figure 3-2 presents the cross section interpretation. Overall the cross section shows a layer of sand and clay initially (which is most likely fill material) followed by a layer of sand and silt, except in the northern area of the site. In the northern area, the sand and silt layer is replaced by a zone much richer in clay. Clay was also found in the deeper zones throughout the site.

3.4 Potential Receptor Information

3.4.1 Human Receptors

NSRR underwent operational closure on March 31, 2004. On April 1, 2004, NSRR was re-designated as NAPR. The current primary mission of NAPR is to protect the physical assets remaining, comply with environmental regulations, and sustain the value of the property until final disposal of the property. It is assumed that long-term plans for the facility would be similar to those that had been in place prior to closure with land use also generally the same. Based on information available regarding the physical features, site setting, site historical activities, and current and expected land uses, five potential human receptors have been selected for evaluation. These include:

- Current On-site Adult Trespasser

- Current On-site Adolescent Trespasser (9-15 years)
- Current/Future On-site Adult Workers
- Future Construction Worker

Presently, the wastewater treatment plant is operating on a limited basis. The land use at SWMU 29 is likely to remain the same in the future. What is known of the site history and some additional background information about this site can be found in Section 2.2 of this report. The following paragraphs are a general description of potential human receptor scenarios.

In the current scenario, it is conservatively assumed that on-site trespassers and on-site workers could access the site and potentially be exposed to COPCs at the site. Potential exposure via ingestion of and dermal contact with surface soil was considered for adult and adolescent trespassers. Additionally, the inhalation pathway (fugitive dusts) is considered for soil. The potential exposure pathways evaluated for the on-site worker include ingestion and dermal contact with surface soil and subsurface soil as well as inhalation of fugitive dusts from soil. Soil at this depth could be accessible to a current on-site worker performing grounds-keeping/site maintenance activities or a future on-site worker should the site become a commercial/industrial setting, in which case shallow subsurface soil could be disturbed and brought to the surface.

Future construction workers that may perform excavation and construction at the site are also considered for ingestion and dermal contact exposures to (as appropriate) excavated surface soil and subsurface soil, as well as the inhalation of fugitive dusts emanating from soil during excavation/construction activities.

Specifically, the following potential human receptor and exposure pathway combinations are identified for SWMU 29.

Current On-Site Adult/Adolescent Trespassers

- Ingestion of Surface Soil
- Dermal Contact with Surface Soil
- Inhalation of Fugitive Dusts

Current/Future On-Site Adult Workers

- Ingestion of Surface Soil and Subsurface Soil
- Dermal Contact with Surface Soil and Subsurface Soil
- Inhalation of Fugitive Dusts

Future Construction Workers

- Ingestion of Surface Soil and Subsurface Soil
- Dermal Contact with Surface Soil and Subsurface Soil
- Inhalation of Fugitive Dusts

3.4.2 Ecological Receptors

The sections that follow provide a brief description of the habitats occurring within and contiguous to SWMU 29, as well as the biota that may be present. The description of habitats and biota relies primarily on literature-based information for Puerto Rico and NAPR.

3.4.2.1 Terrestrial Habitats

The upland habitat bounded by NAPR is classified as subtropical dry forest (Ewel and Witmore, 1973). Similar to other forested areas of Puerto Rico, this region was previously clear-cut in the early part of the century, primarily for pastureland (Geo-Marine, Inc., 1998). After acquisition by the Navy, a secondary growth of thick scrub, dominated by lead tree (*Leucaena spp*.), Christmas tree (*Randia aculeate*), sweet acacia (*Acacia famesiana*), and Australian corkwood (*Sesbania grandiflora*) grew in the previously grazed sections (Geo-Marine, Inc., 1998). Secondary growth communities (upland coastal forest communities and coastal scrub forest communities) exist today throughout NAPR's undeveloped upland. The upland vegetative community at SWMU 29 is extremely limited due to the presence of paved surfaces and structures associated with treatment plant operations. The community is limited to patches of maintained grasses of unknown species composition (likely to include *Bothriochloa ischaemum*, *Chloris barbata*, and *Digitaria* sp. based on maintained grasses identified during a habitat characterization conducted at SWMU 45 in May 2000 [(Geo-Marine, Inc., 2000]). A coastal scrub forest community is located east of SWMU 29 (see Figure 3-3). Identical to the maintained grassy areas within SWMU 29, the species composition of this community is not known. However, vegetation identified within coastal scrub forest communities elsewhere at NAPR have included lead tree, almacigo (*Bursa simaruba*), Christmas tree, oxhorn bucida (*Bucida buceras*), basket wiss (*Trichostigma octandrum*), and common guayaba (*Psidium guajava*), and *Panicum maximum* (no common name) (Geo-Marine, Inc., 2000). Many of these species are likely present with the coastal scrub forest community adjacent SWMU 29.

Cobana negra (*Stahlia monosperma*), a federally threatened tree species, is known to occur between the boundary of black mangrove communities and coastal upland forest communities. This species is also known to occur in coastal forests of southeastern Puerto Rico (Little and Wadsworth, 1964). A single individual has been reported at NAPR. Although the location of the sighting was not documented, NAPR personnel believe the tree is located within the coastal forest community behind the former Navy Exchange store, northwest of Langley Drive (approximately 2.4 miles north of SWMU 29).

3.4.2.2 Aquatic Habitats

Approximately 460 acres at NAPR are covered by palustrine habitat, which includes all freshwater wetlands. These wetlands include wet meadows and marshes, dominated by cattails (*Typha spp*.) and grasses (*Panicum spp*. and *Paspalum spp*.), as well as wet coastal scrub forests. The marine environment surrounding NAPR includes mudflats, mangroves and seagrass beds. The total area of mudflats, mangroves, and seagrass beds in the offshore environment is approximately 161 acres, 2,700 acres, and 1,900 acres, respectively (Geo-Marine, Inc., 1998). Coral reefs are also located in the offshore marine environment (see Figure 3-3). Coral reef types within the waters surrounding NAPR, as well as their associated acreage cover are provided within the table below (Department of the Navy [DoN], 2007).

Reef Habitat Type	Area (acres)
Colonized Bedrock	266
Linear reef	84
Patch Reef (Aggregated)	146
Patch reef (Individual)	175
Scattered Coral-Rock	5

Mangroves at NAPR mainly consist of red mangrove (*Rhizophora mangle*), black mangrove (*Avicenia germinans*), and white mangrove (*Laguncularia racemosa*) (Geo-Marine, Inc., 2000 and 2005). Red mangroves tolerate relatively deep water levels, grow in unstable, soft soil, and tolerate a salinity range of 10 to 55 parts per thousand (ppt). They develop large prop roots which usually extend above the water surface. Black and white mangroves generally grow in areas that are not inundated by water. Mangroves at NAPR are natural filters for upland runoff and protect the coastline from storm damage (Lewis, 1986). They also provide habitat for wildlife, fish, and benthic invertebrates. Lewis (1986) reported 112 species of birds that use the NAPR mangroves as habitat for feeding, nesting, and roosting. The red mangrove prop root habitat in Puerto Rico also is used by at least 13 species of fish (including the gray snapper [*Lutijanus griseus*], lane snapper [*Lutijanus synagris*], and gold and black tricolor [*Holocanthus tricolor*]), several crustaceans (including the flat tree oyster [*Isognomon alatus*]), gastropods (including the coffee bean snail [*Melampus coffeus*] and mangrove periwinkle [*Littorina angulifera*]), echinoids (including the long-spined sea urchin [*Diadema antillarum*] and pencil sea urchin [*Eucidaris tribuloides*]), sponges (including the fire sponge [*Tedania ignis*]), ascidians (including the black tunicate [*Acsidia nigra*]), and hydroids (including the feathered hydroid [*Halocordyle disticha*]) (Geo-Marine, Inc., 2005).

The seagrass beds in eastern Puerto Rico are typical of well developed climax meadows found throughout the tropical Atlantic and Caribbean basin, consisting primarily of dense continuous coverage of turtle grass (*Thalassia testudinum*) with lesser amounts of manatee grass (*Syringodium filiforme*) and a wide diversity of calcareous algae (Reid et al., 2001). Patchy and sparse beds of mixed species, including shoal grass (*Halodule wrightii*), manatee grass, and paddle grass (*Halophila decipiens*), occur in localized areas affected and maintained by different wave regimes, substrate type, and turbidity than what is normally found in association with the climax turtle grass meadows.

SWMU 29 is located on a peninsula, with Puerca Bay approximately 300 feet to the east and the Ensenada Honda approximately 1,000 feet to the west. A map showing the spatial relationship of SWMU 29 to these open water marine habitats is provided as Figure 3-4. The figure includes freshwater and marine wetland units identified by the Cowardin Wetland Classification System (Cowardin et al., 1979 [see Figure 3-5]). The wetlands depicted on Figure 3-4 were delineated by Geo-Marine, Inc. in December 1999 from 1993 color infrared and 1998 true color aerial photography. Twenty percent of the wetlands delineated by aerial photography were field checked to verify the accuracy of the delineations. Field verification was based on the 1987 Corps of Engineers wetland delineation manual (United States Army Corps of Engineers [USACE], 1987). There are no freshwater wetland units within or immediately contiguous to SWMU 29. However, as depicted on Figure 3-4, SWMU 29 is located approximately 400 feet west of an estuarine wetland unit classified as Estuarine, Intertidal, Scrub-Shrub, Broad-Leaved Evergreen (E2SS3) by the Cowardian Wetland Classification System.

Seagrass beds (dominated by turtle grass) are found within the open water marine environments east and west of SWMU 29 (see Figure 3-3). The seageass beds represent potential grazing areas for the West Indian manatee (*Trichechas manatus*), a federally endangered species throughout its range, and the green sea turtle (*Chelonia mydas*), a federally threatened species in Puerto Rico. In addition to sea grass habitat, coral reef habitat is located within Puerca Bay and at the mouth of the Ensenada Honda. The nearest reef habitat is located within Puerca Bay, approximately 1000 feet from the peninsula shoreline.

3.4.2.3 Biota

A description of the biota occurring within Puerto Rico and the landmass encompassed by NAPR is provided in the sections that follow. It is noted that the biota occurring at and immediately contiguous to SWMU 29 has not been documented during previous investigations.

3.4.2.3.1 Mammals

A total of 22 terrestrial mammal species are known historically from Puerto Rico; however, all mammals except bats (13 species) have been extirpated (United States Geological Survey [USGS], 1999). None of the bats found on Puerto Rico are exclusive to the island. The specific bat species known to occur on Puerto Rico are listed below:

- Fruit-eating bats: Jamaican fruit bat (*Artibeus jamaicensis*), Antillean fruit bat (*Brachyphylla cavernarum*), and red fig-eating bat (*Stenoderma rufum*)

- Nectivorous bats: brown flower bat (*Erophylla sezekoni bombifrons*) and greater Antillean long-tounged bat (*Monophyllus redmani*)

- Insectivorous bats: Antillean ghost-faced bat (*Mormoops blainvillii*), Parnell's mustached bat (*Pteronotus parnellii*), sooty mustached bat (*Pteronotus quadridens*), big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), velvety free-tailed bat (*Molossus molossus*), and Brazilian free-tailed bat (*Tadarida brasiliensis*)

- Piscivorous bats: Mexican bulldog bat (*Noctilio leporinus*)

The absence of fruit-bearing and flowering vegetation at SWMU 29 excludes potential exposures by fruit-eating species (Jamaican fruit bat, Antillean fruit bat, red fig-eating bat) and nectar-feeding species (brown flower bat and Greater Antillean long-tongued bat). It is noted that the coastal scrub forest community adjacent to SWMU 29 may provide foraging habitat for several of these species. Insectivorous bats (Antillean ghost-faced bat, Parnell's mustached bat, sooty mustached bat, big brown bat, red bat, velvety free-tailed bat, and Brazilian free-tailed bat) feed primarily on flying insects that would not be expected to have any appreciable exposure to soil contaminants At SWMU 29. Finally, the lack of any surface water body within and immediately contiguous to SWMU 29 precludes potential exposures to chemicals detected in surface and subsurface soil by fish-eating bats (Mexican bulldog bat).

Of the endangered/threatened marine mammals that may occur in Puerto Rico, only the West Indian manatee is known to occur in the marine environment surrounding NAPR (DoN, 2007). Manatee populations in Puerto Rico's coastal waters have been documented during three aerial surveys conducted from 1978 to 1979, 1984 to 1985, and in 1993 (United Nations Environmental Program [UNEP], 1995), a radio tracking study of manatee distribution and abundance (Reid and Kruer, 1998), and a year-long study of manatee distribution and abundance (Woods et al., 1984). Historical manatee sightings at NAPR are summarized on Figure 3-6. The figure (reproduced from DoN, 2007) includes information from most of the studies identified above. Feeding manatees are most often recorded within Pelican Cove and the Ensenada Honda (see Figure 3-6). They also have been encountered within Puerca Bay.

Several mammals have been introduced into Puerto Rico, including the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), and mongoose (*Herpestes javanicus*). These nonindigenous

mammals have been implicated in the decline of native bird and reptile populations (USGS, 1999 and United States Fish and Wildlife Service [USFWS], 1996a).

3.4.2.3.2 Birds

A total of 239 bird species are native to Puerto Rico (Raffaele, 1989). This total includes breeding permanent residents and non-breeding migrants. In addition, many nonindigenous bird species have been introduced to Puerto Rico, including the shiny cowbird (*Molothrus bonariensis*) and several parrot species, such as the budgerigar (*Melopsittacus undulates*), orange-fronted parrot (*Aratinga canicularis*), and monk parrot (*Myiopsitta monaqchus*). Of the 239 species native to Puerto Rico, 12 are endemic to the island (Raffaele, 1989).

Numerous native and migratory bird species have been reported at NAPR (Geo-Marine, Inc., 1998). A list of bird species reported at NAPR or having the potential to occur is provided in Table 3-1. The list, compiled from literature-based information pre-dating 1990, includes the great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), little blue heron (*Florida caerulea*), black-crowned night heron (*Nycticorax nycticorax*), belted kingfisher (*Ceryle alcyon*), spotted sandpiper (*Actitis macularia*), greater yellowlegs (*Tringa melanoleauca*), black-bellied plover (*Squatarola squatarola*), clapper rail (*Rallus longirostris*), Royal tern (*Thalasseus maximus*), sandwich tern (*Thalasseus sandvicensis*), least tern (*Stema albifrons*), yellow warbler (*Dendroica petechia*), palm warbler (*Dendroica palmarum*), prairie warbler (*Dendroica discolar*), magnolia warbler (*Dendrocia magnolia*), mourning dove (*Zenaida macroura*), red-legged thrush (*Mimocichla plumbea*), common nighthawk (*Chordeiles minor*), and red-tailed hawk (*Buteo jamaicensis*). Endemic species reported from NAPR include the Puerto Rican lizard cuckoo (*Saurothera vieilloti*), Puerto Rican flycatcher (*Myiarchus antillarum*), Puerto Rican woodpecker (*Malanerpes portoricensis*), Puerto Rican emerald (*Chlorostilbon maugaeus*), and yellow-shouldered blackbird (*Agelaius xanthomus*).

The yellow-shouldered blackbird is a federally endangered species. One of the principal reasons for the status of this species is attributed to parasitism by the nonindigenous shiny cowbird, which lays its eggs in blackbird nests and sometimes punctures the host's eggs (USFWS, 1983). Other factors contributing to the status of this species include nest predation by the introduced black rat, Norway rat, and mongoose, as well as habitat modification and destruction (USFWS, 1996a). The entire land area of NAPR was declared critical habitat for the yellow-shouldered blackbird in 1976; however, a 1980 agreement with the USFWS exempted certain areas from this categorization (Geo-Marine, Inc., 1998). SWMU 29 is not located within the critical habitat designation. A study conducted by the Naval Facilities Engineering Command (NFESC, 1996) reported that the mangrove forests surrounding NAPR should be considered the most important nesting habitats for the yellow-shouldered blackbird. A survey conducted in July 2002 by the Puerto Rico Department of Natural Resources (PRDNR, 2002) reported fifteen yellow-shouldered blackbirds (including five juveniles) at NAPR. At the time of the survey, the birds were using the structures at the NAPR airport for resting cover (the nearest airport structure is approximately 2.5 miles northeast of SWMU 29). Although nesting pairs were not observed (the survey was not conducted during the breeding season), the airport structures contained several inactive nests. The inactive nests and juvenile birds indicate that a small breeding population is present at NAPR. As discussed in Section 3.4.2.1, the vegetative community at SWMU 29 is limited to maintained grasses of unknown species composition. Because yellow-shouldered blackbirds are arboreal feeders that forage within the canopy and sub-canopy of trees (USFWS, 1996a), they are not expected to forage within the available habitat at SWMU 29. However, the adjacent coastal scrub forest community represents potential feeding habitat for this species.

Other federally listed bird species that occur or have the potential to occur at NAPR are the Caribbean brown pelican (*Pelecanus occidentalis occidentalis*), roseate tern (*Sterna dougallii dougallii*), and the piping plover (*Charadrius melodus*) (Geo-Marine, Inc., 1998). The piping plover is a rare, non-breeding winter visitor in Puerto Rico (Raffaele, 1989). This species breeds only in North America in three geographic regions (Atlantic Coast population [threatened], Great Lakes population [endangered], and Northern Great Plains population [threatened]; USFWS, 1996b). No piping plover observations were reported at NAPR during the 1990s or during sea turtle nesting surveys conducted in 2002 and 2004 (Geo-Marine, Inc., 2005). No historic evidence is available to indicate whether the roseate tern (threatened in Puerto Rico) has ever nested at NAPR and no roseate tern observations have been noted in or over coastal waters adjacent to NAPR (DoN, 2007). The nearest active roseate tern colony likely occurs on the eastern end of Vieques (more than 20 miles east of NAPR) (DoN, 2007). The Caribbean brown pelican (endangered in Puerto Rico) appears to be a seasonal resident at NAPR and in the surrounding coastal waters (Geo-Marine, Inc., 2005). Small numbers, primarily juveniles, have been seen day-roosting, feeding, and resting irregularly in onshore and near-shore habitats at NAPR; however, no brown pelican nesting colonies have been found at NAPR or on the small cays nearby (Geo-Marine, Inc., 2005). Based on the habitat preferences of these three species and observations recorded at NAPR, only the Caribbean brown pelican has the potential to use the offshore marine environments east and west of SWMU 29 as a food source.

3.4.2.3.3 Reptiles and Amphibians

A total of 23 amphibians and 47 reptiles are known from Puerto Rico and the adjacent waters (USGS, 1999). Fifteen of the amphibians and 29 of the reptiles are endemic, while four amphibian species and three reptilian species have been introduced (USGS, 1999). Puerto Rico's native amphibian species include 16 species of tiny frogs commonly called coquis. On the coastal lowlands, almost all coqui species are arboreal. The only amphibians listed under provisions of the Endangered Species Act of 1973 are the Puerto Rican ridge-headed toad (*Peltophryene lemur*) and the golden coqui (*Eleutherodactylus jasperi*). Both species are listed as threatened. Distribution of the golden coqui is restricted to areas of dense bromeliad growth. All specimens to date have been collected from a small semicircular area of a 6-mile radius south of Cayey (approximately 30 miles southwest of NAPR), generally at elevations above 700 meters (USFWS, 1984). The Puerto Rican ridge-headed toad occurs at low elevations (below 200 meters) where there is exposed limestone or porous, well drained soil offering an abundance of fissures and cavities (USFWS, 1987). A single large population is known to exist from the southwest coast in Guánica Commonwealth Forest, and a small population is believed to survive on the north coast near Quebradillas, Arecibo, Barceloneta, Vega Baja, and Bayamón (USFWS, 1987). It has also been collected on the southeastern coastal plain near Coamo (USFWS, 1987). Given the habitat preferences and locations of known occurrences, these two species are not expected to occur at NAPR.

Puerto Rico's native reptilian species include 31 lizards, 8 snakes, 1 freshwater turtle, and 5 sea turtles (USGS, 1999). Of the five sea turtles, only the green sea turtle, hawksbill sea turtle (*Eretmochelys imbricata*), and loggerhead sea turtle (*Dermochelys coriacea*) nest within Puerto Rico. These three sea turtles, as well as the leatherback sea turtle (*Caretta caretta)* are listed under the provisions of the Endangered Species Act of 1973 (hawksbill sea turtle and leatherback sea turtle are listed as endangered, while the green sea turtle [Caribbean population] and loggerhead sea turtle are listed as threatened) (USFWS, 2008). Aerial surveys of turtles were performed from March 1984 through March 1995 along the Puerto Rican Coast. This information was summarized by Geo-Marine, Inc. (2005) in the Draft NAPR Disposal Environmental Assessment (EA). Figures 3-7 and 3-8 (reproduced from Geo-Marine, Inc., 2005)

present cumulative sea turtle sightings and potential turtle nesting sites at NAPR. Significant turtle observations were made near the mouth of the Ensenada Honda, the northern shore of Pineros Island, Pelican Bay, and the Medio Mundo Passage with the frequency of turtle observations listed as green > hawksbill > loggerhead > leatherback. Based on the life history information for each turtle species (summarized in Baker, 2006b and 2006c) and the availability of forage material (in the form of sea grasses, hard bottom corals, and most likely sponges), the green, hawksbill, and loggerhead sea turtles have the potential to forage within Puerca Bay and the Ensenada Honda.

The Puerto Rican boa (*Epicrates inornatus*) is a federally endangered species. Four Puerto Rican boa sightings were reported at NAPR prior to 1999 and an additional four occurrences were reported between 2001 and 2003 (Geo-Marine, Inc., 2005). However, no boas were observed during 211 man-hours of surveys conducted within potential boa habitat in 2004 (Tolson, 2004). The Puerto Rican boa uses a variety of habitats but is most commonly found in Karst forest habitat (forested limestone hills). Based on the absence of preferred habitat, there is low probability of occurrence of this species at SWMU 29 or the adjacent upland coastal forest community.

3.4.2.3.4 Fish and Aquatic Invertebrates

A diverse fish and invertebrate community can be found in the marine environment surrounding NAPR. This can be attributed to the varied habitats that include marine and estuarine open water habitat, mud flats, sea grass beds, and mangrove forests. The fish community is represented by stingrays, herrings, groupers, needlefish, mullets, barracudas, jacks, snappers, grunts, snooks, lizardfishes, parrotfishes, gobies, filefishes, wrasses, damselfishes, and butterflyfish (Geo-Marine, Inc., 1998). The benthic invertebrate community includes sponges, corals, anemones, sea cucumbers, sea stars, urchins, and crabs. Fish and invertebrate species inhabiting the marine/estuarine habitats contiguous to SWMU 29 have not been documented in the literature or during previous investigations.

4.0 2008 RCRA FACILITY INVESTIGATION ACTIVITIES

The areas around the WWTP drying beds were investigated at SWMU 29 in November 2006 during the Phase I RFI. A Full RFI Investigation was recommended in order to delineate the Appendix IX metals site contamination above screening levels in surface soil and subsurface soil, as well as evaluate the potential for human health and ecological risk. No further study of the groundwater was warranted due to its low yield and low concentrations noted during the Phase I RFI Investigation. The following sections discuss the data collected during the Full RFI according to the 2007 Full RFI Work Plan (Baker, 2007). Section 4.1 discusses soil boring advancement. Section 4.2 discusses the soil analytical sampling program and Section 4.3 presents a discussion of the QA/QC sampling program involved with the 2008 Full RFI field work. Section 4.4 discusses how the sample locations were surveyed. The field notes from the various personnel involved with this investigation are provided in Appendix A.1. Analytical results are discussed in detail in Section 5.0.

4.1 Soil Boring Advancement

Surface and subsurface soil samples were collected using direct-push technology (DPT) through the use of a Geoprobe® Macro Core Sampler mounted to a Geoprobe® 66DT tracked rig. GeoEnviroTech of San Juan, Puerto Rico was the DPT contractor. As presented in the Final Full RFI Work Plan (Baker, 2007), a total of eight soil borings (29SB07 through 29SB014) were advanced at SWMU 29 (Figure 3-1). Each boring site was field located with a Global Positioning System (GPS) receiver. Soil boring logs have been produced and are provided in Appendix A.2.

4.2 Environmental Sampling and Analysis Program

Table 4-1 provides a summary of the soil sampling and analytical program performed for the 2008 Full RFI program at SWMU 29. In addition, this table shows information related to field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples (since these are collected concurrent with the environmental samples). Other QA/QC samples (field blanks and equipment rinsates) were collected and analyzed in accordance with Table 4-2. Also, analytical methods/descriptions, parameter lists, and Contract Required Quantitation Levels (CRQL) are presented in Table 4-3. The chain-of custodies for the sampling at SWMU 29 are provided as Appendix A.3.

4.2.1 Surface and Subsurface Soils

Surface soil samples were collected at soil borings 29SB07 through 29SB14 from a depth of 0 to 1.0-foot below ground surface (bgs). Subsurface soil samples were collected at all soil borings from two-foot intervals (e.g., 1 to 3 feet bgs, 3 to 5 feet bgs, etc) down to groundwater. Groundwater was encountered around 4 to 5 feet in borings 29SB07 through 29SB12 and at approximately 9 feet bgs at borings 29SB13 and 29SB14, and subsurface soil samples were collected to a maximum depth of 5 and 9 feet bgs, respectively.

Eight surface soil samples and nineteen subsurface soil environmental samples were submitted to Test America Laboratory in Savannah, Georgia for analysis of Appendix IX metals.

4.3 Quality Assurance/Quality Control Sampling and Analysis Program

4.3.1 Field Duplicates

The Full RFI Work Plan specifies one duplicate sample to be collected for at least every ten primary soil samples collected. Four field duplicate samples (29SB14-00D, 29SB08-01D, 29SB12-01D, and 29SB13-02D) were collected concurrently with the primary sample. One sample, 29SB14-00D, is associated with the surface soil samples and remaining samples are associated with the subsurface soil samples. All duplicate samples were analyzed for Appendix IX total metals. Duplicate samples are useful in evaluating the field sampling methodology.

4.3.2 Matrix Spike/Matrix Spike Duplicates

The Full RFI Work Plan specifies at least one MS/MSD sample be collected for every 20 primary samples collected (for each matrix). Three QA/QC soil samples, 29SB14-00MS/MSD, 29SB12-01MS/MSD, and 29SB13-02MS/MSD were collected from the surface and subsurface soil to evaluate the matrix effect upon the analytical methodology.

4.3.3 Trip Blanks

No trip blanks were collected during the Full RFI for SWMU 29 since soil samples were not analyzed for volatile organic compounds (VOCs).

4.3.4 Field Blanks

Field blank samples were collected from two different source waters encountered during this investigation. One field blank sample (FB01) was collected from lab grade deionized water used as the source water for the equipment rinsate samples. The other field blank sample (FB02) was from NAPR potable water source used for soil sample collection equipment washing. No store bought distilled water was purchased during this investigation, so a third field blank for store bought distilled water was not necessary.

Field blank samples are always analyzed for the same parameters as the related environmental samples. Therefore, both field blank samples were sent to the laboratory for analysis of Appendix IX metals. Field blank testing is useful in determining if other water sources used in the cleaning/decontamination procedures associated with the sampling event are free of contamination.

4.3.5 Equipment Rinsates

One decontaminated equipment rinsate sample was collected, submitted, and analyzed as part of the QA/QC program. ER07 is rinsate from the Macrocore® Acetate liner used for soil sampling.

Equipment rinsate samples are always analyzed for the same parameters as the related environmental samples. Therefore, the equipment rinsate sample ER07 was analyzed for Appendix IX total metals. Results from equipment rinsate samples are useful in determining if the sampling equipment was contaminant-free during the field investigation.

4.4 Surveying

In order to accurately identify the proposed sample locations in the field, a mapping grade differential (satellite DGPS corrections from Omnistar or “real-time”) GPS unit was utilized. Prior to entering the field, an electronic "shape file" (which included each proposed soil boring location) was uploaded to the GPS data collector. Once in the field, the GPS unit was used to navigate to each sample location. Each sample location was flagged and numbered accordingly.

5.0 NATURE AND EXTENT OF CONTAMINATION

This section discusses the nature of SWMU 29 contamination determined from chemical analysis of environmental samples from the February 2008 Full RFI. All of the laboratory analytical data went through a formal data validation process. Complete validated data tables for the 2008 Full RFI field effort are included in Appendix B; in addition, relevant portions of the data validation reports for the 2008 Full RFI Sample Delivery Groups (SDGs) are provided in Appendix C; a summary discussion of the necessary laboratory level data adjustments to the 2008 data is presented in Section 5.4.

As a result of the Phase I RFI, numerous metals, including arsenic, barium, cadmium, chromium, copper, lead, silver, tin, vanadium, zinc, and mercury, exceeded screening criteria and/or background levels at locations 29SB01-00 and 29SB05-00 in the surface soil. Other metals did exceed background and screening criteria at other locations, but it appears the bulk of the exceedances in the surface soils were located at 29SB01-00 and 29SB05-00, on either side of the drying beds. Arsenic and vanadium were above human health criteria at all surface soil locations and chromium and vanadium exceeded the ecological screening values at all surface soil locations.

Arsenic exceeded its human health screening levels at all locations in subsurface soil, except 29SB06-05, although concentrations were less than its background level. Vanadium exceeded its human health screening levels at all locations in subsurface soil, but were below the background levels. Chromium, cobalt, copper, vanadium, and zinc exceeded their respective ecological screening values in the shallow subsurface soil at 29SB03-01. This sample was collected from the 1 to 3 feet range, which was shallow enough to be considered ecologically significant. The metals with the exceedances noted in the surface soil at 29SB01 and 29SB05 or the shallow subsurface soil at 29SB03 do not appear to have migrated deeper to a significant extent, because no exceedances of human health screening levels were apparent in the deeper subsurface soils at these or other locations.

The Full RFI was implemented to further define potential metals contamination within the surrounding area of the sludge drying beds.

5.1 Human Health and Ecological Screening Values

Detected results for surface soil and subsurface soil are discussed in the following sections. Detected compounds for each media are compared to applicable regulatory and background criteria. These criteria, and the rationale for their usage for comparison to a specific media, are described in detail below.

5.1.1 Human Health

Applicable human health criteria for soils include USEPA Region IX Industrial Preliminary Remediation Goals (PRGs) and USEPA Region IX Residential PRGs (USEPA, 2004), and the upper limit of means background levels (inorganics only) (Baker, 2008).

The USEPA Region IX PRGs are tools for determining preliminary COPCs for human health risk assessments as part of evaluating and cleaning up contaminated sites. They are risk based concentrations derived from standardized equations (representing ingestion, dermal contact, and inhalation exposure pathways), combining exposure information assumptions and USEPA toxicity data. The PRGs contained in the Region IX PRG Table are generic; they are calculated

without site-specific information. Region IX PRGs should be viewed as Agency guidelines, not legally enforceable standards. The PRGs for potentially carcinogenic chemicals are based on a target Incremental Lifetime Cancer Risk (ILCR) of $1x10^{-6}$. The PRGs for noncarcinogens are based on a target hazard quotient of 1.0. In order to account for cumulative risk from multiple chemicals in a medium, it is necessary to derive the PRGs based on a target hazard quotient of 0.1. Noncarcinogenic PRGs based on a target hazard quotient of 0.1 and the most recent toxicological criteria available, results in a set of values that can be used as screening criteria. In order to yield a hazard index (HI) of 0.1, the noncarcinogenic PRGs were divided by a factor of ten. For potential carcinogens, the toxicity criteria applicable to the derivation of PRG values are oral and inhalation Cancer Slope Factors (CSFs); for noncarcinogens, they are chronic oral and inhalation reference doses (RfDs). These toxicity criteria are subject to change as more updated information and results from the most recent toxicological/epidemiological studies become available. The PRG table is updated periodically to reflect such changes. It should be noted that the most recent update was in October 2004 (USEPA, 2004).

5.1.2 Ecological

5.1.2.1 Soil

USEPA ecological soil screening levels (Eco-SSLs) for terrestrial plants and invertebrates (available at http://www.epa.gov/ecotox/ecossl/) were preferentially used as soil screening values. For a given metal, if an Eco-SSL has been established for both terrestrial plants and invertebrates, the lowest value was selected as the soil screening value. For those chemicals lacking an Eco-SSL, the literature-based toxicological benchmarks listed below were used as soil screening values.

- Toxicological thresholds for earthworms and microorganisms (Efroymson et al., 1997a)
- Toxicological thresholds for plants (Efroymson et al., 1997b)

When more than one screening value was available from Efroymson et al. (1997a and 1997b), the lowest value was selected as the surface soil screening value. For those chemicals lacking an Eco-SSL or a toxicological threshold from Efroymson et al. (1997a and 1997b), the following literature-based values, listed in their order of decreasing preference, were used as soil screening values:

- Toxicity reference values for plants and invertebrates listed in USEPA, 1999.
- Soil standards developed by the Ministry of Housing, Spatial Planning and Environment (MHSPE, 2000), assuming a minimum default soil organic carbon content of 2.0 percent.
- Canadian soil quality guidelines (agricultural land use) developed by the Canadian Council of Ministers of the Environment (CCME, 2006).

CCME soil quality guidelines were given the lowest preference since they are background-based values that do not represent effect concentrations.

In addition, the upper limit of means background levels (inorganics only) (Baker, 2008) were used to compare the soil concentrations to those present at NAPR in unimpacted soil. Both surface soil background levels and subsurface soil background levels for a fine sand/silt soil type (most prevalent soil type at SWMU 29) were used in screening.

As a general rule, screening of soil results for ecological purposes would include surface soil, as well as subsurface soil results from the 1 – 2 foot depth range. At SWMU 29, samples were collected at a depth of 1- 3 feet (see Table 4-1). For the sake of completeness, these samples will also undergo ecological screening.

5.2 Surface Soils

Eight surface soil samples plus one duplicate sample were collected and analyzed during the 2008 Full RFI. All eight surface soil samples were analyzed for Appendix IX metals. A detected results table for the surface soil data set is presented in Table 5-1. Results are compared to USEPA Region IX Residential Soil PRGs, Industrial Soil PRGs, ecological surface soil screening values and NAPR Basewide Background (inorganics only) criteria. For comparison, the 2006 Phase I RFI surface soil data is presented as Table 5-3.

Thirteen inorganic parameters exceeded one or more of the criteria during the February 2008 Full RFI, they are:

- Antimony
- Arsenic
- Barium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Silver
- Tin
- Vanadium
- Zinc
- Mercury

Figure 5-1 presents the locations of inorganic parameters that exceeded USEPA Region IX Soil PRGs (Residential and Industrial) and NAPR Basewide background values. Vanadium and arsenic exceeded the residential PRGs at all locations, except 29SB10 where arsenic did not. However, vanadium and arsenic did not exceed the background screening level at any of the locations sampled in 2008. Antimony, cadmium, and silver exceeded the residential PRGs in one sample, 29SB11. Antimony and cadmium exceeded the background level at this location.

Figure 5-2 presents the locations of inorganic parameters that exceeded ecological screening criteria and NAPR Basewide background values. Barium, chromium, cobalt, copper, vanadium, zinc, and mercury exceeded ecological surface soil screening values. Of these, barium, copper, zinc, and mercury also exceeded their background concentrations. With the exception of vanadium, those inorganics that exceeded screening criteria and background were primarily detected in 29SB11-00.

Lead exceeded its background concentration in 29SB11-00, and tin exceeded its background concentration in four of the sampling locations. However, lead and tin did not exceed either human health or ecological screening criteria.

Based on the exceedances of background and regulatory screening concentrations in the surface soil at 29SB11-00, it appears that inorganic contamination may have occurred in the surface soil in this area at SWMU 29 due to Navy activities.

For this Full RFI, potential human exposure to antimony, arsenic, and cadmium concentrations in surface soil at SWMU 29 were evaluated. Preliminary risk calculations were performed under a future residential exposure scenario in order to more fully evaluate potential human health risks due to exceedances of soil PRGs and background. As discussed above, antimony and cadmium exceeded their residential PRGs and background concentrations in the 2008 Full RFI. Arsenic exceeded residential and/or industrial soil PRGs in all but one location in the 2008 Full RFI but did not exceed the background concentration at any location. However, arsenic did exceed both the soil PRGs and background at two locations in the 2006 Phase I RFI. As such, arsenic was also included in the preliminary risk evaluation. Although SWMU 29 is unlikely to become a residential property in the future, future residential adult and child receptors were chosen since primarily the residential soil PRGs were exceeded (with the exception of arsenic in the 2006 Phase I RFI), and it represents the most conservative exposure scenario. To present a complete exposure scenario, antimony, arsenic, and cadmium concentrations in surface soil were evaluated together by combining surface soil analytical data from the Draft Phase I RFI Report and the Full RFI to form the surface soil data set. USEPA ProUCL Version 4.00.02 software (USEPA, 2007a and 2007b) was used to determine the distribution of the data sets and calculate the exposure point concentrations (EPC), where applicable. In the case of antimony, the maximum detected concentration was used since the data set contained less than five positive detections.

The results of the preliminary risk calculations are presented in Appendix D. The distributions and EPCs (95 percent Upper Confidence Limit of the mean) for antimony, arsenic, and cadmium are presented in Table D-1, while exposure parameters used in the preliminary risk calculations are presented in Table D-2. The results of the preliminary risk calculations are presented in Tables D-3 (future adult resident) and D-4 (future child resident). As shown on Table D-3, the carcinogenic risk for the future adult resident is 3.8×10^{-06}, and the hazard index is 0.05. As shown on Table D-4, the carcinogenic risk for the future child resident is 8.6×10^{-06}, and the hazard index is 0.45. As evidenced by Tables D-3 and D-4, there are no unacceptable carcinogenic or noncarcinogenic risks calculated from potential exposure to antimony, arsenic, and cadmium in surface soil at SWMU 29. Therefore, it is unlikely that adverse human health effects will occur from exposure to surface soil at SWMU 29.

5.3 Subsurface Soils

Nineteen (19) subsurface soil samples plus three duplicate samples were collected from eight locations and analyzed as part of the 2008 Full RFI field activities. All subsurface soil samples were analyzed for Appendix IX metals. A detected results table for the subsurface soil data set is presented in Table 5-2. Results are compared to USEPA Region IX Residential Soil PRGs, Industrial Soil PRGs, and NAPR Basewide Background (inorganics only) criteria for fine sand/silt subsurface soil. Selected sample results were also compared to the ecological surface soil screening concentrations due to the fact that the soil samples were obtained from depths of 1 to 3 feet, and anything shallower than 2 feet bgs is ecologically significant. For ease of comparison, the 2006 Phase I RFI subsurface soil data is presented in Table 5-4.

Eight inorganic parameters exceeded one or more of the criteria. They are:

- Arsenic

- Cadmium
- Chromium
- Cobalt
- Copper
- Nickel
- Vanadium
- Mercury

There were no inorganic parameters that exceeded USEPA Region IX Soil PRGs (Residential and Industrial) and NAPR Basewide background values. Arsenic exceeded the PRGs at seven out of eight locations, but did not exceed its background screening level for fine sand/silt subsurface soil at any of those locations. Vanadium exceeded the PRGs at all locations, but not its background screening level. No other exceedances of human health criteria were found in the subsurface soil.

Figure 5-3 presents the locations of inorganic parameters that exceeded ecological screening criteria and NAPR Basewide background values. Samples collected from a depth range of one to three feet were also screened for ecological exceedances. Chromium, cobalt, copper, and vanadium all exceeded the ecological surface soil screening levels. Copper was the only inorganic that also exceeded its background concentration (locations 29SB11 and 29SB13).

Cadmium, mercury, and nickel exceeded their background levels at various locations, but no other screening criteria.

As noted above, copper exceeded both the ecological screening level and background concentration at locations 29SB11 and 29SB13. These locations are on the east side of the sludge drying beds. Location 29SB11 is where the most inorganic parameters were found exceeding their screening criteria and background levels in surface soil.

5.4 2008 Laboratory Data Validation Summary

Summary data validation findings, as they relate to each Sample Delivery Group (SDG), are discussed in Sections 5.4.2 through 5.4.4 below. Data validation reports are included in Appendix C.1, C.2, and C.3. In addition, the Puerto Rican Chemist Certifications for each Test America SDG are presented in Appendix C.4.

5.4.1 Summary of Detected Compounds in Field QA/QC Samples

Field generated QA/QC samples for the 2008 field effort consisted of field blanks, equipment rinsates, and environmental duplicates. The blanks were analyzed for Appendix IX metals. Table 5-5 presents the detected compounds found in the equipment rinsates and field blanks.

Detections in the field blanks included three metals (barium, silver, and zinc) in the NAPR potable water FB02, and nothing was detected in the laboratory grade DI water FB01. Analysis of the one equipment rinsate sample ER07 reported no detections of metals.

5.4.2 Test America Savannah SDG 34322-1

This SDG (34322-1) is relevant to the analytical findings associated with the 2008 soil sampling. Laboratory analyses were performed by Test America, (Savannah, Georgia). Validation services

were provided by DataQual Environmental Services, LLC (St. Louis, Missouri). Validation conclusions are as follows:

Metals

- Laboratory blank contamination was noted and qualification was required for numerous samples. Details are provided in Appendix C.1.

- The associated serial dilution exhibited non-compliant percent differences for two analytes. Positive results for the analytes cobalt and nickel were qualified as estimated J.

- The two field duplicate pairs exhibited non-compliant reported percent differences. The reported results for zinc in the field duplicate pair of sample 29SB12-01 were qualified as estimated J and the reported results for chromium in the field duplicate pair of sample 29SB08-01 were qualified as estimated J.

Data Validation Summary for SDG 34322-1

Overall the data validity of this data package was very good. Holding times were met and the SDG was received complete and intact.

5.4.3 Test America Savannah SDG 34322-2

This SDG (34322-2) is relevant to the analytical findings associated with the 2008 soil sampling. Laboratory analyses were performed by Test America, (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC (St. Louis, Missouri). Validation conclusions are as follows:

Metals

- Laboratory blank contamination was noted and qualification was required for numerous samples in this SDG. Details are provided in Appendix C.2.

- Two of the submitted MS/MSD pairs exhibited non-compliant recoveries for the analyte antimony. Reported results in the soil samples were qualified as estimated J/UJ.

- One of the field duplicate pairs exhibited a non-compliant reported percent difference for the analytes copper and nickel. The reported results for copper and nickel in the field duplicate pair were qualified as estimated.

Data Validation Summary for SDG 34322-2

Overall the data validity of this data package was very good. Holding times were met and the SDG was received complete and intact.

5.4.4 Test America Savannah SDG 34320-2

This SDG (34320-2) is relevant to the analytical findings associated with the 2008 QA/QC sampling, specifically the field blanks FB01 and FB02. Laboratory analyses were performed by

Test America, (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC (St. Louis, Missouri). Validation conclusions are as follows:

Metals

- Blank contamination was noted and qualification was required in the samples in the SDG. Zinc was qualified as estimated in FB02; copper was qualified as non-detect up to the reporting limit in FB01 and FB02; and chromium was qualified as non-detect up to the reporting limit in FB02. Additional details are provided in Appendix C.3.

- The associated matrix duplicate exhibited non-compliant %Ds for one analyte. Positive and non-detect results for the analyte copper were qualified as estimated J in the field samples.

Data Validation Summary for SDG 34320-2

Overall the data validity of this data package was very good. Holding times were met and the SDG was received complete and intact. The changes in the results due to the application of the data validation qualifiers are not expected to significantly compromise the data quality objectives for this SDG.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The objectives of the Full RFI were to:

- Further delineate metals identified to be present from operation of the Industrial Area WWTP sludge drying beds, to the extent practical, from the completion of field activities (surface soil and subsurface soil sampling) as described in the Full RFI Work Plan;
- Screen for potential human health risks posed by the site; and
- Screen for potential ecological risks posed by the site.

It is evident from the analyses of samples obtained during the Phase I RFI and Full RFI that there has been some limited inorganic impact on the environment due to Navy activities at SWMU 29.

In surface soil, vanadium and arsenic exceeded the residential PRGs at all locations, except 29SB10 where arsenic did not. However, vanadium and arsenic did not exceed the background screening level at any of the locations sampled in 2008. Antimony, cadmium, and silver exceeded the residential PRGs in one surface soil sample, 29SB11-00, and antimony and cadmium exceeded the background level at this location.

Barium, chromium, cobalt, copper, vanadium, zinc, and mercury exceeded ecological surface soil screening values. Of these, copper, zinc, and mercury also exceeded their background surface soil screening values. With the exception of vanadium, those inorganics that exceeded screening criteria and background were detected in 29SB11-00.

Arsenic exceeded the PRGs at seven out of eight subsurface soil locations, but did not exceed its background screening level at any of those locations. Vanadium exceeded the PRGs at all locations, but not its background screening level. No other exceedances of human health criteria were found in the subsurface soil.

Subsurface soil samples collected from a depth range of one to three feet were also screened for ecological exceedances. Chromium, cobalt, copper, and vanadium all exceeded the ecological surface soil screening levels. Copper was the only inorganic that also exceeded its background concentration (locations 29SB11 and 29SB13).

Based on the exceedances of background and regulatory screening concentrations in the surface soil at 29SB11-00, it appears that inorganic contamination may have occurred in the surface soil in this area at SWMU 29 due to Navy activities. Additionally, copper exceeded both the ecological screening level and background concentration in subsurface soil at locations 29SB11 and 29SB13. These locations are on the east side of the sludge drying beds. Location 29SB11 is where the most inorganic parameters were found exceeding their screening criteria and background levels in surface soil.

Based on the results of the Phase I RFI, no significant contamination was found in the groundwater at the site.

6.2 Recommendations

Limited impact on the environment was found during the Phase I RFI and Full RFI at SWMU 29. Antimony, arsenic, and cadmium were detected in surface soil at concentrations exceeding soil PRGs and background. A preliminary human health risk evaluation was conducted to address these exceedances. This evaluation demonstrated that the concentrations of these inorganics in SWMU 29 surface soil would not cause unacceptable risks to human receptors. Therefore, no further action is recommended to address human health concerns. Additionally, no further action is recommended for groundwater at SWMU 29 since the Phase I RFI demonstrated no impacts to groundwater. However, concentrations of barium, copper, zinc, and mercury in surface soil and copper in subsurface soil indicated the presence of contamination above their ecological screening values and background concentrations. A Corrective Measures Study (CMS) is recommended to address potential risks to ecological receptors. The CMS will include an ecological risk assessment (ERA) (Steps 1, 2, and 3a of the Navy ERA process described at http://web.ead.anl.gov/ecorisk/).

It should be noted that USEPA issued new Regional Screening Levels (USEPA, 2008) on May 27, 2008. As recommended by the USEPA, these Screening Levels are to replace the Region IX PRGs. The Regional Screening Levels were developed to support the risk assessment screening process, while improving consistency across Regions and incorporating updated guidance in a timely manner. The environmental data for this Full RFI were screened using the Region IX PRGs prior to the issuance of the Regional Screening Levels, and the screening criteria have not been revised for this version of the report. However, based on a review of the PRGs versus the Regional Screening Levels, it is expected that the results of the screening would not be significantly impacted and that the conclusions and recommendations of this Full RFI would remain the same upon replacement of PRGs with the Regional Screening Levels. None the less, in keeping with current USEPA guidance, the Regional Screening Levels will be incorporated in subsequent versions of this report.

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TABLES

TABLE 3-1
LIST OF BIRDS REPORTED FROM OR HAVING THE POTENTIAL TO OCCUR AT
NAVAL ACTIVITY PUERTO RICO
SWMU 29 – INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Common Name [1]		
Pied-billed grebe	Red-billed tropicbird	Brown pelican [2]
Brown booby	Magnificent frigatebird	Great blue heron
Louisiana heron	Snowy egret	Great egret
Striated heron	Little blue heron	Cattle egret
Least bittern	Yellow-crowned night heron	Black-crowned night heron
White-cheeked pintail	Blue-winged teal	American widgeon
Red-tailed hawk	Osprey	Merlin
Clapper rail	American coot	Caribbean coot
Common gallinule	Piping plover [3][4]	Semipalmated plover
Black-bellied plover	Wilson's plover	Killdeer
Ruddy turnstone	Black-necked stilt	Whimbrel
Spotted sandpiper	Semipalmated sandpiper	Short-billed dowitcher
Greater yellowlegs	Lesser yellowlegs	Willet
Stilt sandpiper	Pectoral sandpiper	Laughing gull
Royal tern	Sandwich tern	Bridled tern
Least tern	Brown noddy	White-winged dove
Zenaida dove	White-crowned pigeon	Mourning dove
Red-necked pigeon	Common ground dove	Bridled quail dove
Ruddy quail dove	Caribbean parakeet	Smooth-billed ani
Yellow-billed cuckoo	Mangrove cockoo	Short-eared owl
Chuck-will's-widow	Common nighthawk	Antillean crested hummingbird
Green-throated carib	Antillean mango	Belted kingfisher

TABLE 3-1
LIST OF BIRDS REPORTED FROM OR HAVING THE POTENTIAL TO OCCUR AT NAVAL ACTIVITY PUERTO RICO
SWMU 29 – INDUSTRIAL WWTP SLUDGE DRUING BEDS
FULL RFI REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Common Name [1]		
Gray kingbird	Loggerhead kingbird	Stolid flycatcher
Caribbean elaenia	Purple martin	Cave swallow
Barn swallow	Northern mockingbird	Pearly-eyed thrasher
Red-legged thrush	Black-whiskered vireo	American redstart
Parula warbler	Prairie warbler	Yellow warbler
Magnolia warbler	Cape May warbler	Black-throated blue warbler
Adelaide's warbler	Palm warbler	Black and white warbler
Ovenbird	Northern water thrush	Bananaquit
Striped-headed tanager	Shiny cowbird	Black-cowled oriole
Greater Antillean grackle	Yellow-shouldered blackbird [2]	Hooded mannikin
Yellow-faced grassquit	Black-faced grassquit	Least sandpiper
Western sandpiper	Puerto Rican woodpecker	Rock dove
Puerto Rican emerald	Puerto Rican flycatcher	Pin-tailed whydah
Spice finch	Ruddy duck	Peregrine falcon
Marbled godwit	Puerto Rican lizard cuckoo	Prothonotary warbler
Green-winged teal	Orange-cheeked waxbill	Roseate tern [3][4]
Least grebe	West Indian whistling duck	Puerto Rican screech owl
Puerto Rican tody		

Notes:

[1] List of birds taken from Geo-Marine, Inc. (1998).
[2] Federally-designated endangered species.
[3] Federally-designated threatened species.
[4] Species has the potential to occur at Naval Activity Puerto Rico.

TABLE 4-1

SUMMARY OF 2008 RFI SURFACE SOIL AND SUBSURFACE SOIL SAMPLING AND ANALYSIS
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested	
Sample Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX Metals	**Comment**
Surface Soil	29SB07	29SB07-00	0.0 - 1.0	02/15/08	X	
	29SB08	29SB08-00	0.0 - 1.0	02/15/08	X	
	29SB09	29SB09-00	0.0 - 1.0	02/15/08	X	
	29SB10	29SB10-00	0.0 - 1.0	02/15/08	X	
	29SB11	29SB11-00	0.0 - 1.0	02/15/08	X	
	29SB12	29SB12-00	0.0 - 1.0	02/15/08	X	
	29SB13	29SB13-00	0.0 - 1.0	02/15/08	X	
	29SB14	29SB14-00	0.0 - 1.0	02/15/08	X	
		29SB14-00D	0.0 - 1.0	02/15/08	X	Duplicate
		29SB14-00MS/MSD	0.0 - 1.0	02/15/08	X	Matrix Spike/Matrix Spike Duplicate
Subsurface Soil	29SB07	29SB07-01	1.0-3.0	02/15/08	X	
	29SB08	29SB08-01	1.0-3.0	02/15/08	X	
		29SB08-01D	1.0-3.0	02/15/08	X	Duplicate
		29SB08-02	3.0-5.0	02/15/08	X	
	29SB09	29SB09-01	1.0-3.0	02/15/08	X	
		29SB09-02	3.0-5.0	02/15/08	X	
	29SB10	29SB10-01	1.0-3.0	02/15/08	X	
		29SB10-02	3.0-5.0	02/15/08	X	
	29SB11	29SB11-01	1.0-3.0	02/15/08	X	
		29SB11-02	3.0-5.0	02/15/08	X	
	29SB12	29SB12-01	1.0-3.0	02/15/08	X	
		29SB12-01D	1.0-3.0	02/15/08	X	Duplicate
		29SB12-01 MS/MSD	1.0-3.0	02/15/08	X	Matrix Spike/Matrix Spike Duplicate
		29SB12-02	3.0-5.0	02/15/08	X	
	29SB13	29SB13-01	1.0-3.0	02/15/08	X	
		29SB13-02	3.0-5.0	02/15/08	X	
		29SB13-02D	3.0-5.0	02/15/08	X	Duplicate
		29SB13-02 MS/MSD	3.0-5.0	02/15/08	X	Matrix Spike/Matrix Spike Duplicate
		29SB13-03	5.0-7.0	02/15/08	X	
		29SB13-04	7.0-9.0	02/15/08	X	
	29SB14	29SB14-01	1.0-3.0	02/15/08	X	
		29SB14-02	3.0-5.0	02/15/08	X	
		29SB14-03	5.0-7.0	02/15/08	X	
		29SB14-04	7.0-9.0	02/15/08	X	

Notes:
ft bgs - feet below ground surface.

TABLE 4-2

SUMMARY OF 2008 RFI QA/QC SAMPLING AND ANALYSIS
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

		Analysis Requested	
Media	**Sample Date**	App IX Metals (Total)	**Comment**
Equipment Rinsate Sample			
ER07	02/15/08	X	Macro Core Acetate Liner
Field Blank Samples			
FB01	02/16/08	X	Deionized Water
FB02	02/16/08	X	NAPR Potable Water

TABLE 4-3

PARAMETER LISTS AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Appendix IX - Metals (Total)	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (mg/kg)	
Antimony	20	2.0	6010 (Inductively Coupled Plasma)
Arsenic	10	1.0	6010 (Inductively Coupled Plasma)
Barium	10	1.0	6010 (Inductively Coupled Plasma)
Beryllium	4.0	0.4	6010 (Inductively Coupled Plasma)
Cadmium	5.0	0.5	6010 (Inductively Coupled Plasma)
Chromium	10	1.0	6010 (Inductively Coupled Plasma)
Cobalt	10	1.0	6010 (Inductively Coupled Plasma)
Copper	20	2.0	6010 (Inductively Coupled Plasma)
Lead	5.0	0.5	6010 (Inductively Coupled Plasma)
Mercury	0.2	0.02	7470/7471 (Cold Vapor AA)
Nickel	40	4.0	6010 (Inductively Coupled Plasma)
Selenium	10	1.0	6010 (Inductively Coupled Plasma)
Silver	10	1.0	6010 (Inductively Coupled Plasma)
Thallium	10	1.0	6010 (Inductively Coupled Plasma)
Tin	10	5.0	6010 (Inductively Coupled Plasma)
Vanadium	10	1.0	6010 (Inductively Coupled Plasma)
Cyanide	0.010	1.0	9012 (Colorimetric)
Sulfide	1.0	25	9030 (Titrimetric, Iodine)
Zinc	20	2.0	6010 (Inductively Coupled Plasma)

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

µg/L - micrograms per liter
µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
NA - Not Applicable

TABLE 5-1

SUMMARY OF DETECTED RESULTS - 2008 SURFACE SOIL
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID **Sample ID** **Sample Depth (ft bgs)** **Sampling Date**	**USEPA** **Region IX** **Residential** **Soil PRGs**	*USEPA* *Region IX* *Industrial* *Soil PRGs*	Selected Ecological Soil Screening Values	NAPR [1] Basewide Background	**29SB07** **29SB07-00** **0.0 - 1.0** **02/15/08**	**29SB08** **29SB08-00** **0.0 - 1.0** **02/15/08**	**29SB09** **29SB09-00** **0.0 - 1.0** **02/15/08**	**29SB10** **29SB10-00** **0.0 - 1.0** **02/15/08**	**29SB11** **29SB11-00** **0.0 - 1.0** **02/15/08**
Metals (mg/kg)									
Antimony	3.1 [2]	41 [2]	78 [8]	3.17	1.1 U	0.21 U	0.57 J	0.6 U	**4.5**
Arsenic	0.39	1.59	18 [4]	2.65	***1.8***	**0.68** J	**0.57** J	0.33 U	***2.4***
Barium	537 [2]	6658 [2]	330 [5]	199	96	220	53	88	350
Beryllium	15.44 [2]	1941 [3]	40 [5]	0.59	0.23 J	0.19 J	0.13 J	0.13 J	0.19 J
Cadmium	3.7 [2]	45.14 [2]	32 [4]	1.02	1.2	0.27 J	0.84	0.39 J	**5.4**
Chromium	211	448	0.4 [6]	49.8	19	12	14	19	26
Cobalt	903	1921	13 [4]	46.2	15	8.7	14	14	12
Copper	313 [2]	4088 [2]	70 [4]	168	98 J	43 J	180 J	110 J	230 J
Lead	400 [3]	800 [3]	120 [4]	22	11	2.5	1.5	0.79	45
Nickel	156 [2]	2043 [2]	38 [4]	20.7	13	4.8	8.4	10	17
Silver	39 [2]	510 [2]	560 [8]	NE	9.3	0.27 U	0.62 U	0.08 U	**61**
Tin	4700 [2]	10,000	50 [7]	3.76	7 J	3.9 U	4.3 U	4 U	42
Vanadium	7.82 [2]	102 [2]	2 [7]	259	***110***	**63**	***180***	***110***	**98**
Zinc	2346 [2]	100,000	120 [5]	115	100 J	42 J	62 J	63 J	250
Mercury	2.35 [2]	30.7 [2]	0.1 [6]	0.109	0.31	0.014 J	0.026	0.0053 J	1.8

TABLE 5-1

SUMMARY OF DETECTED RESULTS - 2008 SURFACE SOIL
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID **Sample ID** **Sample Depth (ft bgs)** **Sampling Date**	**USEPA** **Region IX** **Residential** **Soil PRGs**	*USEPA* *Region IX* *Industrial* *Soil PRGs*	Selected Ecological Soil Screening Values	NAPR [1] Basewide Background	**29SB12** **29SB12-00** **0.0 - 1.0** **02/15/08**	**29SB13** **29SB13-00** **0.0 - 1.0** **02/15/08**	**29SB14** **29SB14-00** **0.0 - 1.0** **02/15/08**	**29SB14** **29SB14-00D** **0.0 - 1.0** **02/15/08**
Metals (mg/kg)								
Antimony	3.1 [2]	41 [2]	78 [8]	3.17	0.79 U	0.77 U	0.73 UJ	0.33 UJ
Arsenic	0.39	1.59	18 [4]	2.65	**1.2**	**0.62** J	**1.5**	***1.9***
Barium	537 [2]	6658 [2]	330 [5]	199	80	73	130	130
Beryllium	15.44 [2]	1941 [3]	40 [5]	0.59	0.18 J	0.21 J	0.23 J	0.2 J
Cadmium	3.7 [2]	45.14 [2]	32 [4]	1.02	1.8	1.3	1.7	1.4
Chromium	211	448	0.4 [6]	49.8	22	32	26	26
Cobalt	903	1921	13 [4]	46.2	18	20	17	16
Copper	313 [2]	4088 [2]	70 [4]	168	180 J	160 J	160	140
Lead	400 [3]	800 [3]	120 [4]	22	7.2	3.3	8.8	8.6
Nickel	156 [2]	2043 [2]	38 [4]	20.7	14	13	13	13
Silver	39 [2]	510 [2]	560 [8]	NE	7	1.3	5.5	5.3
Tin	4700 [2]	10,000	50 [7]	3.76	7.1 J	4 U	5.5 J	4.7 J
Vanadium	7.82 [2]	102 [2]	2 [7]	259	***120***	***170***	***130***	***120***
Zinc	2346 [2]	100,000	120 [5]	115	88 J	66 J	100 J	89 J
Mercury	2.35 [2]	30.7 [2]	0.1 [6]	0.109	0.43	0.034	0.16	0.17

TABLE 5-1

SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
SWMU 29 - INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes/Qualifiers:
J: Estimated: The analyte was positively identified; the quantitation is an estimation
U: Undetected at the Limit of Detection.
UJ: Reported quantitation limit is qualified as estimated
ft bgs - feet below ground surface
mg/kg miligrams per kilogram
NE: Not Established
PRG - Preliminary Remedial Goal
NAPR - Naval Activity Puerto Rico
USEPA - United States Environmental Protection Agency

(1) NAPR basewide background surface soil screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2008)
(2) Noncarcinogenic PRGs based on a target hazard quotient of 0.1 for conservative screening purposes
(3) Noncancer PRG < 10X Cancer PRG
(3) USEPA Action Level for lead in soils
(4) Plant-based ecological soil screening level (USEPA,, 2005a [arsenic]; USEPA, 2005b [cadmium]; USEPA, 2005c [cobalt]; USEPA, 2005d [lead]; USEPA, 2007a [copper]; USEPA, 2007b [nickel]; USEPA, 2007c [selenium])
(5) Invertebrate-based ecological soil screening level (USEPA, 2005e [antimony]; USEPA, 2005f [barium]; USEPA, 2005g [beryllium]; USEPA, 2007e [zinc])
(6) Toxicological threshold for earthworms (Efroymson et al., 1997a)
(7) Toxicogical threshold for plants (Efroymson et al., 1997b)
(8) Ecological soil screening level (http://www.epa.gov/ecotox/ecossl/)

TABLE 5-1

SUMMARY OF DETECTED RESULTS - 2008 SURFACE SOIL
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Table References:

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USEPA. 2005f. Ecological Soil Screening Levels for Barium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

USEPA. 2005g. Ecological Soil Screening Levels for Beryllium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

TABLE 5-2

SUMMARY OF DETECTED RESULTS - 2008 SUBSURFACE SOIL
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID	**USEPA**	*USEPA*	Selected		**29SB07**	**29SB08**	**29SB08**	**29SB08**	**29SB09**	**29SB09**	**29SB10**
Sample ID	**Region IX**	*Region IX*	Ecological	NAPR (1)	**29SB07-01**	**29SB08-01**	**29SB08-01D**	**29SB08-02**	**29SB09-01**	**29SB09-02**	**29SB10-01**
Sample Depth (ft bgs)	**Residential**	*Industrial*	Surface Soil	Basewide	**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**	**3.0 - 5.0**	**1.0 - 3.0**	**3.0 - 5.0**	**1.0 - 3.0**
Sampling Date	**Soil PRGs**	*Soil PRGs*	Screening Values	Background	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**
Metals (mg/kg)											
Antimony	3.1 (2)	41 (2)	78 (8)	7.44	0.31 U	0.31 J	0.38 J	0.63 U	0.38 U	0.64 U	0.62 U
Arsenic	0.39	1.59	18 (4)	6.66	***3.2***	**0.44** J	0.35 U	***2.7***	0.32 U	0.36 U	**1.4**
Barium	537 (2)	6658 (2)	330 (5)	207	49	67	58	14	70	75	55
Beryllium	15.44 (2)	1941	40 (5)	0.933	0.087 J	0.16 J	0.15 J	0.075 U	0.14 J	0.19 J	0.2 J
Cadmium	3.7	45.14 (2)	32 (4)	0.57	0.14 J	0.88	0.76	0.056 U	0.28 J	0.6	1.1
Chromium	211	448	0.4 (6)	47.9	14	13 J	24 J	4.4	11	13	19
Cobalt	903	1921	13 (4)	63.1	4.7	16	15	0.95 J	12	23	16
Copper	313 (2)	4088 (2)	70 (4)	120	31 J	92 J	88 J	8.2 J	62 J	100 J	100 J
Lead	400 (3)	800 (3)	120 (4)	6.2	3.7	2.2	0.65	0.67 U	1.1	1	2.5
Nickel	156 (2)	2043 (2)	38 (4)	26.5	5.2	8.1	9	1.8 U	4.6	8.1	8.4
Selenium	39 (2)	511 (2)	0.52 (4)	1.19	0.23 U	0.22 U	0.21 U	0.29 U	0.19 U	0.22 U	0.28 J
Silver	39 (2)	510 (2)	560 (8)	NE	0.11 U	0.086 U	0.092 U	0.055 U	0.14 U	0.17 U	0.1 U
Vanadium	7.82 (2)	102 (2)	2 (7)	256	**48**	***200***	***180***	**11**	**99**	***210***	***180***
Zinc	2346 (2)	100,000	120 (5)	92	12 R	55 J	49 J	3.8 R	64 J	56 J	57 J
Mercury	2.35 (2)	30.7 (2)	0.1 (6)	0.067	0.024 J	0.008 J	0.0041 U	0.006 J	0.005 J	0.013 J	0.013 J

TABLE 5-2

SUMMARY OF DETECTED RESULTS - 2008 SUBSURFACE SOIL
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID **Sample ID** **Sample Depth (ft bgs)** **Sampling Date**	**USEPA Region IX Residential Soil PRGs**	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR (1) Basewide Background	**29SB10** **29SB10-02** **3.0 - 5.0** **02/15/08**	**29SB11** **29SB11-01** **1.0 - 3.0** **02/15/08**	**29SB11** **29SB11-02** **3.0 - 5.0** **02/15/08**	**29SB12** **29SB12-01** **1.0 - 3.0** **02/15/08**	**29SB12** **29SB12-01D** **1.0 - 3.0** **02/15/08**	**29SB12** **29SB12-02** **3.0 - 5.0** **02/15/08**	**29SB13** **29SB13-01** **1.0 - 3.0** **02/15/08**
Metals (mg/kg)											
Antimony	3.1 (2)	41 (2)	78 (8)	7.44	0.21 U	0.9 U	0.68 U	0.22 U	1 U	0.49 U	0.59 UJ
Arsenic	0.39	1.59	18 (4)	6.66	0.33 U	**0.57** J	***3.8***	***2.7***	***2.6***	***1.9***	0.33 U
Barium	537 (2)	6658 (2)	330 (5)	207	69	61	13	44	40	55	70
Beryllium	15.44 (2)	1941	40 (5)	0.933	0.12 J	0.19 J	0.066 U	0.16 J	0.22 J	0.16 J	0.22 J
Cadmium	3.7	45.14 (2)	32 (4)	0.57	0.54	0.8	0.065 J	0.68	0.88	1.4	0.85
Chromium	211	448	0.4 (6)	47.9	4	19	3.8	13	17	19	25
Cobalt	903	1921	13 (4)	63.1	6.8	19	0.81 J	8.6	11	14	25
Copper	313 (2)	4088 (2)	70 (4)	120	57 J	230 J	7.3 J	110 J	120 J	150 J	200
Lead	400 (3)	800 (3)	120 (4)	6.2	1.2	1.6	0.71	1.4	1.1	3.9	3.9
Nickel	156 (2)	2043 (2)	38 (4)	26.5	2.4 J	15	1.5 J	6.6	10	11	12
Selenium	39 (2)	511 (2)	0.52 (4)	1.19	0.2 U	0.22 U	0.24 U	0.21 U	0.22 U	0.22 U	0.2 U
Silver	39 (2)	510 (2)	560 (8)	NE	0.19 U	0.19 U	0.048 U	0.055 J	0.083 U	2.7	0.13 U
Vanadium	7.82 (2)	102 (2)	2 (7)	256	**58**	***140***	**9.5**	**80**	***110***	***110***	***130***
Zinc	2346 (2)	100,000	120 (5)	92	55 J	62 J	3.5 R	26 J	45 J	68 J	50 J
Mercury	2.35 (2)	30.7 (2)	0.1 (6)	0.067	0.0074 J	0.013 J	0.0054 J	0.012 J	0.0082 J	0.11	0.0094 J

TABLE 5-2

SUMMARY OF DETECTED RESULTS - 2008 SUBSURFACE SOIL
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID	**USEPA**	*USEPA*	Selected		**29SB13**	**29SB13**	**29SB13**	**29SB13**	**29SB14**	**29SB14**	**29SB14**	**29SB14**
Sample ID	**Region IX**	*Region IX*	Ecological	NAPR (1)	**29SB13-02**	**29SB13-02D**	**29SB13-03**	**29SB13-04**	**29SB14-01**	**29SB14-02**	**29SB14-03**	**29SB14-04**
Sample Depth (ft bgs)	**Residential**	*Industrial*	Surface Soil	Basewide	**3.0 - 5.0**	**3.0 - 5.0**	**5.0 - 7.0**	**7.0 - 9.0**	**1.0 - 3.0**	**3.0 - 5.0**	**5.0 - 7.0**	**7.0 - 9.0**
Sampling Date	**Soil PRGs**	*Soil PRGs*	Screening Values	Background	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**
Metals (mg/kg)												
Antimony	3.1 (2)	41 (2)	78 (8)	7.44	0.87 UJ	0.75 UJ	0.48 UJ	0.78 UJ	0.35 UJ	0.67 UJ	0.8 UJ	0.5 UJ
Arsenic	0.39	1.59	18 (4)	6.66	**1.1** J	**1.1** J	**0.5** J	**0.84** J	***2.8***	**0.53** J	**0.41** J	0.34 U
Barium	537 (2)	6658 (2)	330 (5)	207	68	86	92	70	36	110	51	49
Beryllium	15.44 (2)	1941	40 (5)	0.933	0.26 J	0.26 J	0.24 J	0.25 J	0.13 J	0.3 J	0.65	0.19 J
Cadmium	3.7	45.14 (2)	32 (4)	0.57	1.3	0.95	0.8	1.3	0.59	1.1	0.6 J	0.48 J
Chromium	211	448	0.4 (6)	47.9	120	150	140	130	12	39	6.5	15
Cobalt	903	1921	13 (4)	63.1	39	52	53	27	7	20	6.6	6.1
Copper	313 (2)	4088 (2)	70 (4)	120	110 J	190 J	130	150	84	130	21	31
Lead	400 (3)	800 (3)	120 (4)	6.2	1.2	0.87	1.1	1.1	1.4	0.99	0.5 U	2.2
Nickel	156 (2)	2043 (2)	38 (4)	26.5	34 J	51 J	53	36	6.1	19	13	7.7
Selenium	39 (2)	511 (2)	0.52 (4)	1.19	0.56 U	0.91 U	0.55 U	0.55 U	0.2 U	0.25 U	0.24 U	0.21 U
Silver	39 (2)	510 (2)	560 (8)	NE	0.12 U	0.098 U	0.12 U	0.077 U	0.21 U	0.051 U	0.048 U	0.31 U
Vanadium	7.82 (2)	102 (2)	2 (7)	256	***220***	***230***	***220***	***210***	**62**	***130***	***130***	**54**
Zinc	2346 (2)	100,000	120 (5)	92	65 J	92 J	77 J	83 J	29 J	76 J	47 J	57 J
Mercury	2.35 (2)	30.7 (2)	0.1 (6)	0.067	0.046	0.027	0.025	0.026	0.021 J	0.0049 U	0.01 J	0.0085 J

TABLE 5-2

SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 29 - INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes/Qualifiers:

J: Estimated: The analyte was positively identified; the quantitation is an estimation
U: Undetected at the Limit of Detection.
UJ: Reported quantitation limit is qualified as estimated
R: Data is rejected and ot usable
ft bgs - feet below ground surface
mg/kg - miligrams per kilogram
NE: Not Established
PRG - Preliminary Remedial Goal
NAPR - Naval Activity Puerto Rico
USEPA - United States Environmental Protection Agency

(1) NAPR basewide background surface soil screening value (upper limit of the means concentration [mean plus two standard deviations]) for fine sand/silt, Table 3-7 (Baker, 2008)

(2) Noncarcinogenic PRGs based on a target hazard quotient of 0.1 for conservative screening purposes

(3) USEPA Action Level for lead in soils

(4) Plant-based ecological soil screening level (USEPA,, 2005a [arsenic]; USEPA, 2005b [cadmium]; USEPA, 2005c [cobalt]; USEPA, 2005d [lead]; USEPA, 2007a [copper]; USEPA, 2007b [nickel]; USEPA, 2007c [selenium])

(5) Invertebrate-based ecological soil screening level (USEPA, 2005e [antimony]; USEPA, 2005f [barium]; USEPA, 2005g [beryllium]; USEPA, 2007e [zinc])

(6) Toxicological threshold for earthworms (Efroymson et al., 1997a)

(7) Toxicogical threshold for plants (Efroymson et al., 1997b)

(8) Ecological soil screening level (http://www.epa.gov/ecotox/ecossl/)

TABLE 5-2

SUMMARY OF DETECTED RESULTS - 2008 SUBSURFACE SOIL
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Table References:

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USEPA. 2007b. Ecological Soil Screening Levels for Nickel (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-76.

USEPA. 2007c. Ecological Soil Screening Levels for Selenium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-72.

USEPA. 2007e. Ecological Soil Screening Levels for Zinc (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-72.

USEPA. 2005a. Ecological Soil Screening Levels for Arsenic (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA. 2005b. Ecological Soil Screening Levels for Cadmium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-62.

USEPA. 2005c. Ecological Soil Screening Levels for Cobalt (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-67

USEPA. 2005d. Ecological Soil Screening Levels for Lead (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-70.

USEPA. 2005f. Ecological Soil Screening Levels for Barium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

USEPA. 2005g. Ecological Soil Screening Levels for Beryllium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

TABLE 5-3

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	USEPA Region IX Residential Soil PRGs	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [1] Basewide Background	29SS01 0.0 - 1.0 11/15/06	29SS02 0.0 - 1.0 11/15/06	29SS02D 0.0 - 1.0 11/15/06	29SB01-00 0.0 - 1.0 11/16/06	29SB02-00 0.0 - 1.0 11/16/06
Volatiles (ug/kg)									
Acetone	1,412,657	5,432,098	NE	NE	85	220 J	290	120	150 J
Carbon disulfide	35,534	720,000	NE	NE	1.6 J	4.2 J	3.2 J	5.2 U	7.2 U
Isobutanol	1,251,390	40,000,000	NE	NE	700 J	1100 J	230 J	210 R	290 R
Methyl Ethyl Ketone	2,231,120	11,326,440	NE	NE	27	43 J	34	31	21 J
methyl isobutyl ketone	528,090	4,700,140	NE	NE	7.1 J	42 U	10 J	26 U	36 U
Methyl methacrylate	218,740	2,700,000	NE	NE	4.9 U	3.2 J	5.7 U	5.2 U	7.2 UJ
Styrene	1,700,000	1,700,000	10,010	NE	4.9 U	8.3 UJ	5.7 U	1.2 J	7.2 U
Semivolatiles (ug/kg)									
4-Chloroaniline	24,440	246,240	NE	NE	760 U	940 U	760 U	45 J	820 U
Acetophenone	NE	NE	NE	NE	380 U	470 U	380 U	45 J	410 U
Bis(2-ethylhexyl) phthalate	34,741	123,121	6,010	NE	380 U	470 U	44 J	97 J	410 U
PAHs (ug/kg)									
Anthracene	2,189,610	100,000,000	1,200	NE	38 U	48 U	39 U	43 U	2.1 J
Benzo[a]anthracene	621	2,110	1,200	NE	14 J	48 U	39 U	43 U	9.3
Benzo[a]pyrene	60	210	1,200	NE	38 U	48 U	39 U	43 U	11
Benzo[b]fluoranthene	620	2,110	1,200	NE	38 U	48 U	39 U	43 U	15
Benzo[ghi]perylene	NE	NE	1,200	NE	38 U	48 U	39 U	43 U	7.9 J
Benzo[k]fluoranthene	6,210	21,100	1,200	NE	38 U	48 U	39 U	43 U	13
Chrysene	62,146	210,962	1,200	NE	15 J	48 U	39 U	43 U	11
Indeno[123-cd]pyrene	620	2,110	1,200	NE	38 UJ	48 UJ	39 UJ	43 U	8.0 J
Phenanthrene	NE	NE	1,200	NE	8.0 J	48 U	39 U	43 U	6.2 J
Pyrene	231,595	2,912,620	1,200	NE	17 J	48 U	39 U	43 U	13
PCBs (ug/kg)									
Aroclor 1260	220	740	2,510	NE	38 UJ	47 UJ	38 UJ	65 J	41 UJ

TABLE 5-3

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	**USEPA Region IX Residential Soil PRGs**	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [1] Basewide Background	**29SB03-00 0.0 - 1.0 11/16/06**	**29SB04-00 0.0 - 1.0 11/15/06**	**29SB05-00 0.0 - 1.0 11/15/06**	**29SB06-00 0.0 - 1.0 11/16/06**
Volatiles (ug/kg)								
Acetone	1,412,657	5,432,098	NE	NE	210 J	63	14 J	52 J
Carbon disulfide	35,534	720,000	NE	NE	4.9 U	4.5 U	5.6 U	5.5 U
Isobutanol	1,251,390	40,000,000	NE	NE	220 J	180 R	220 R	220 R
Methyl Ethyl Ketone	2,231,120	11,326,440	NE	NE	20 J	8.1 J	6.6 J	6.7 J
methyl isobutyl ketone	528,090	4,700,140	NE	NE	24 U	23 U	28 U	27 U
Methyl methacrylate	218,740	2,700,000	NE	NE	4.9 UJ	4.5 U	5.6 U	5.5 UJ
Styrene	1,700,000	1,700,000	10,010	NE	4.9 U	4.5 U	5.6 U	5.5 U
Semivolatiles (ug/kg)								
4-Chloroaniline	24,440	246,240	NE	NE	720 U	790 U	740 U	790 U
Acetophenone	NE	NE	NE	NE	360 U	390 U	370 U	390 U
Bis(2-ethylhexyl) phthalate	34,741	123,121	6,010	NE	360 U	390 U	73 J	390 U
PAHs (ug/kg)								
Anthracene	2,189,610	100,000,000	1,200	NE	7.3 U	8.0 J	37 U	8.0 U
Benzo[a]anthracene	621	2,110	1,200	NE	7.3 U	31 J	37 U	8.0 J
Benzo[a]pyrene	60	210	1,200	NE	7.3 U	21 J	37 U	6.9 J
Benzo[b]fluoranthene	620	2,110	1,200	NE	7.3 U	22 J	37 UJ	8.0 J
Benzo[ghi]perylene	NE	NE	1,200	NE	7.3 U	18 J	37 UJ	4.8 J
Benzo[k]fluoranthene	6,210	21,100	1,200	NE	7.3 U	21 J	37 UJ	6.3 J
Chrysene	62,146	210,962	1,200	NE	7.3 U	28 J	37 U	8.4
Indeno[123-cd]pyrene	620	2,110	1,200	NE	7.3 U	16 J	37 U	4.8 J
Phenanthrene	NE	NE	1,200	NE	7.3 U	31 J	37 U	6.1 J
Pyrene	231,595	2,912,620	1,200	NE	7.3 U	47	37 U	13
PCBs (ug/kg)								
Aroclor 1260	220	740	2,510	NE	36 UJ	39 UJ	8.9 J	39 U

TABLE 5-3

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	USEPA Region IX Residential Soil PRGs	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [1] Basewide Background	29SS01 0.0 - 1.0 11/15/06	29SS02 0.0 - 1.0 11/15/06	29SS02D 0.0 - 1.0 11/15/06	29SB01-00 0.0 - 1.0 11/16/06	29SB02-00 0.0 - 1.0 11/16/06
TPH (mg/kg)									
Diesel Range Organics	NE	NE	NE	NE	0.17 J	0.21 J	0.14 J	0.33 U	0.31 U
Gasoline Range Organics	NE	NE	NE	NE	7.3 U	17	16	23	7.1 U
Inorganics (mg/kg)									
Antimony	3	40.88	78	3.17	4.3 U	5.1 U	4.2 U	2.3 J	4.8 U
Arsenic	0.39	1.59	18	2.65	**1.2 J**	**1.0 J**	**0.94 J**	***11***	**0.71 J**
Barium	537	6,658	330	199	250 J	190 J	190 J	310	120
Beryllium	15.44	1,941	40	0.590	0.51 J	0.43 J	0.40 J	0.13 J	0.10 J
Cadmium	3.70	45.14	32	1.02	0.37 J	0.46 J	0.39 J	**3.8 J**	0.50 J
Chromium	211	448	0.4	49.8	10 J	18 J	9.9 J	42	8.3
Cobalt	903	1,921	13	46.2	9.3 J	9.9 J	7.8 J	13	11
Copper	313	4,088	70	168	40 J	59 J	37 J	230 J	55 J
Lead	400[2]	800[2]	120	22.0	3.4 J	5.4 J	4.4 J	58	7.1
Nickel	156	2,044	30	20.7	6.4 J	7.5 J	6.0 J	20	9.2 J
Selenium	39	511	1	1.48	0.22 J	2.5 U	2.1 U	0.88 J	2.4 U
Silver	39	511	560	NE	2.4 J	2.6 J	2.3 J	**51 J**	2.0 J
Tin	4,692	100,000	50	3.76	11 UJ	13 UJ	11 UJ	40 J	12 UJ
Vanadium	7.82	102.20	2	287	**47 J**	**41 J**	**46 J**	**85**	**67**
Zinc	2,346	100,000	50	115	48	55	47	280 J	80 J
Mercury - 7471A	2.35	30.66	0.1	0.109	0.091 J	0.13 J	0.11 J	1.5 J	0.19 J
Cyanide Total - 9012A	1.08	3.54	0.9	NE	0.57 U	0.70 U	0.56 U	0.31 J	0.62 U
Sulfide - 9034	NE	NE	NE	NE	30	36 U	29 U	32 U	31 U

TABLE 5-3

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	USEPA Region IX Residential Soil PRGs	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [1] Basewide Background	29SB03-00 0.0 - 1.0 11/16/06	29SB04-00 0.0 - 1.0 11/15/06	29SB05-00 0.0 - 1.0 11/15/06	29SB06-00 0.0 - 1.0 11/16/06
TPH (mg/kg)								
Diesel Range Organics	NE	NE	NE	NE	0.39 U	0.30 U	0.35 U	0.28 U
Gasoline Range Organics	NE	NE	NE	NE	3.6 U	4.7 U	6.8 U	21
Inorganics (mg/kg)								
Antimony	3	40.88	78	3.17	4.0 U	4.3 U	4.0 U	4.4 U
Arsenic	0.39	1.59	18	2.65	**0.43 J**	**1.4 J**	***4.5***	***1.9 J***
Barium	537	6,658	330	199	42	99	230	73
Beryllium	15.44	1,941	40	0.590	0.099 J	0.15 J	0.44 J	0.19 J
Cadmium	3.70	45.14	32	1.02	1.0 U	0.24 J	0.26 J	0.30 J
Chromium	211	448	0.4	49.8	3.0	6.3	29	45
Cobalt	903	1,921	13	46.2	6.0	8.8	10	20
Copper	313	4,088	70	168	30 J	75 J	46 J	190 J
Lead	400 [2]	800 [2]	120	22.0	1.0 U	4.5	7.8	28
Nickel	156	2,044	30	20.7	2.0 J	5.0 J	12	17
Selenium	39	511	1	1.48	2.0 U	2.2 U	0.20 J	0.47 J
Silver	39	511	560	NE	2.0 U	2.5 J	2.5 J	1.4 J
Tin	4,692	100,000	50	3.76	10 UJ	11 UJ	10 UJ	11 UJ
Vanadium	7.82	102.20	2	287	**47**	**76**	**64**	***160***
Zinc	2,346	100,000	50	115	47 J	64 J	51 J	82 J
Mercury - 7471A	2.35	30.66	0.1	0.109	0.020 UJ	0.039 J	0.12 J	0.042 J
Cyanide Total - 9012A	1.08	3.54	0.9	NE	0.53 U	0.59 U	0.56 U	0.58 U
Sulfide - 9034	NE	NE	NE	NE	27 U	30 U	32	30 U

TABLE 5-3

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes:

(1) NAPR Basewide Surface Soil Background - Upper Limit of Means (Mean + 2 standard deviations) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, PR, Baker, February 29, 2008

(2) USEPA action level for lead in soils

UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
U - Not detected
NA - Not Analyzed
ND - Not Detected
NE - Not Established
PRG - Preliminary Remedial Goal
NAPR - Naval Activity Puerto Rico
ft bgs - feet below ground surface

TABLE 5-4

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SUBSURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	**USEPA Region IX Residential Soil PRGs**	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [2] Basewide Background	**29SB01-02 (3.0 - 5.0) 11/16/06**	**29SB02-02 (3.0 - 5.0) 11/16/06**	**29SB03-01 (1.0 - 3.0) 11/16/06**	**29SB04-02 (3.0 - 5.0) 11/15/06**
Volatiles (ug/kg)								
Acetone	1,412,657	5,432,098	NE	NE	60	170 J	170 J	18 J
Iodomethane	NE	NE	NE	NE	4.2 U	1.6 J	6.5 U	6.4 U
Isobutanol	1,251,390	40,000,000	NE	NE	170 R	190 R	310 J	260 R
Methyl Ethyl Ketone	2,231,120	11,326,440	NE	NE	12 J	29	17 J	32 U
Semivolatiles (ug/kg)								
Bis(2-ethylhexyl) phthalate	34,741	123,121	6,010	NE	60 J	400 U	370 U	56 J
PAHs (ug/kg)								
Benzo[a]anthracene	621	2,110	1,200	NE	7.9 U	4.0 J	7.5 U	50 J
Benzo[a]pyrene	60	210	1,200	NE	7.9 U	3.3 J	7.5 U	79 U
Benzo[b]fluoranthene	620	2,110	1,200	NE	7.9 U	4.3 J	7.5 U	79 U
Benzo[k]fluoranthene	6,210	21,100	1,200	NE	7.9 U	4.0 J	7.5 U	79 U
Chrysene	62,146	210,962	1,200	NE	7.9 U	5.8 J	7.5 U	56 J
Phenanthrene	NE	NE	1,200	NE	7.9 U	8.1 U	7.5 U	79
Pyrene	231,595	2,912,620	1,200	NE	7.9 U	2.8 J	7.5 U	78 J
PCBs (ug/kg)								
Aroclor 1260	220	740	2,510	NE	10 J	40 UJ	37 UJ	39 UJ
TPH (mg/kg)								
Diesel Range Organics	NE	NE	NE	NE	35	4.0 U	3.7 U	3.9 U

TABLE 5-4

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SUBSURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	USEPA Region IX Residential Soil PRGs	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [2] Basewide Background	29SB05-02 (3.0 - 5.0) 11/15/06	29SB06-02 (3.0 - 5.0) 11/16/06	29SB06-05 (9.0 - 11.0) 11/16/06	29SB06-05D (9.0 - 11.0) 11/16/06
Volatiles (ug/kg)								
Acetone	1,412,657	5,432,098	NE	NE	23 J	37 J	33 J	22 J
Iodomethane	NE	NE	NE	NE	5.0 U	1.2 J	6.0 U	4.5 U
Isobutanol	1,251,390	40,000,000	NE	NE	200 R	190 R	240 R	180 R
Methyl Ethyl Ketone	2,231,120	11,326,440	NE	NE	25 U	7.6 J	7.2 J	5.4 J
Semivolatiles (ug/kg)								
Bis(2-ethylhexyl) phthalate	34,741	123,121	6,010	NE	420 U	380 U	370 U	370 U
PAHs (ug/kg)								
Benzo[a]anthracene	621	2,110	1,200	NE	4.4 J	7.8 U	7.5 U	7.6 U
Benzo[a]pyrene	60	210	1,200	NE	8.5 U	7.8 UJ	7.5 UJ	7.6 UJ
Benzo[b]fluoranthene	620	2,110	1,200	NE	8.5 U	7.8 U	7.5 U	7.6 U
Benzo[k]fluoranthene	6,210	21,100	1,200	NE	8.5 U	7.8 U	7.5 U	7.6 U
Chrysene	62,146	210,962	1,200	NE	4.6 J	7.8 U	7.5 U	7.6 U
Phenanthrene	NE	NE	1,200	NE	8.5 U	7.8 U	7.5 U	7.6 U
Pyrene	231,595	2,912,620	1,200	NE	4.2 J	7.8 U	7.5 U	7.6 U
PCBs (ug/kg)								
Aroclor 1260	220	740	2,510	NE	42 UJ	38 U	37 U	37 U
TPH (mg/kg)								
Diesel Range Organics	NE	NE	NE	NE	4.2 U	3.8 U	3.7 U	3.7 U

TABLE 5-4

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SUBSURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	USEPA Region IX Residential Soil PRGs	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [2] Basewide Background	29SB01-02 (3.0 - 5.0) 11/16/06	29SB02-02 (3.0 - 5.0) 11/16/06	29SB03-01 (1.0 - 3.0) 11/16/06	29SB04-02 (3.0 - 5.0) 11/15/06
Inorganics (mg/kg)								
Antimony	3	40.88	78	6.29	0.71 J	4.6 U	4.2 U	4.1 U
Arsenic	0.39	1.59	18	4.28	***2.0 J***	**0.95 J**	**0.68 J**	***1.6 J***
Barium	537	6,658	330	207	210	60	82	57
Beryllium	15.44	1,941	40	0.933	0.26 J	0.25 J	0.18 J	0.16 J
Cadmium	3.70	45	32	0.70	1.1 J	0.11 J	0.11 J	0.078 J
Chromium	211	448	0.4	47.9	48	28	19	17
Cobalt	903	1,921	13	63.1	31	18	17	24
Copper	313	4,088	70	120	280 J	96 J	120 J	90 J
Lead	400[2]	800[2]	120	6.2	17	1.6	1.3	2.5
Nickel	156	2,044	30	26.5	21	14	11	13
Selenium	39	511	1	1.72	0.72 J	2.3 U	0.26 J	2.1 U
Silver	39	511	560	NE	18 J	0.25 J	2.1 U	2.1 U
Tin	4,692	100,000	50	3.47	16 J	11 UJ	10 UJ	10 UJ
Vanadium	7.82	102.20	2	256	***170***	***200***	***180***	***170***
Zinc	2,346	100,000	50	92	130 J	67 J	69 J	64 J
Mercury - 7471A	2.35	30.66	0.1	0.095	0.26 J	0.020 UJ	0.022 UJ	0.020 UJ
Sulfide -9034	NE	NE	NE	NE	29 U	30	28 U	29 U

Notes:

[1] Surface Soil Screening values compared to 29SB03-01 only, since it was from 1 to 3 feet bgs, and anything above 2 feet is ecologically significant

[2] NAPR Basewide Subsurface Soil Background - FINE SAND - Upper Limit of Means, Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, PR, Baker, February 29, 2008

[2] USEPA action level for lead in soils

UJ - Reported quantitation limit is qualified as estimated

J - Analyte present - Reported value is estimated

U - Not detected

R - Validator rejected analytical result

PRG - Preliminary Remedial Goal

NAPR - Naval Activity Puerto Rico

NE - Not Established

ft bgs - feet below ground surface

TABLE 5-4

SUMMARY OF DETECTED RESULTS - 2006 PHASE I RFI SUBSURFACE SOIL
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Depth (ft bgs) Sampling Date	USEPA Region IX Residential Soil PRGs	*USEPA Region IX Industrial Soil PRGs*	Selected Ecological Surface Soil Screening Values	NAPR [2] Basewide Background	29SB05-02 (3.0 - 5.0) 11/15/06	29SB06-02 (3.0 - 5.0) 11/16/06	29SB06-05 (9.0 - 11.0) 11/16/06	29SB06-05D (9.0 - 11.0) 11/16/06
Inorganics (mg/kg)								
Antimony	3	40.88	78	6.29	4.7 U	4.2 U	4.2 U	4.1 U
Arsenic	0.39	1.59	18	4.28	***2.3 J***	***3.0***	0.32 J	0.37 J
Barium	537	6,658	330	207	66	110	33 J	74 J
Beryllium	15.44	1,941	40	0.933	0.21 J	0.13 J	0.088 J	0.089 J
Cadmium	3.70	45	32	0.70	0.079 J	0.083 J	0.045 J	0.11 J
Chromium	211	448	0.4	47.9	20	66	150	150
Cobalt	903	1,921	13	63.1	17	19	17 J	26 J
Copper	313	4,088	70	120	140 J	65 J	79	90 J
Lead	400[2]	800[2]	120	6.2	2.6	1.4	1.05 U	1.05 U
Nickel	156	2,044	30	26.5	17	19	35	44
Selenium	39	511	1	1.72	0.54 J	2.1 U	2.1 U	2.1 U
Silver	39	511	560	NE	0.19 J	2.1 U	2.1 U	2.1 U
Tin	4,692	100,000	50	3.47	12 UJ	10 UJ	10 UJ	10 UJ
Vanadium	7.82	102.20	2	256	***140***	***87***	***130***	***160***
Zinc	2,346	100,000	50	92	41 J	52 J	33 J	33 J
Mercury - 7471A	2.35	30.66	0.1	0.095	0.055 J	0.022 UJ	0.021 UJ	0.022 UJ
Sulfide -9034	NE	NE	NE	NE	32 U	29 U	28 U	48

Notes:

[1] Surface Soil Screening values compared to 29SB03-01 only, since it was from 1 to 3 feet bgs, and anything above 2 feet is ecologically significant

[2] NAPR Basewide Subsurface Soil Background - FINE SAND - Upper Limit of Means, Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, PR, Baker, February 29, 2008

[2] USEPA action level for lead in soils

UJ - Reported quantitation limit is qualified as estimated

J - Analyte present - Reported value is estimated

U - Not detected

R - Validator rejected analytical result

PRG - Preliminary Remedial Goal

NAPR - Naval Activity Puerto Rico

NE - Not Established

ft bgs - feet below ground surface

TABLE 5-5

SUMMARY OF DETECTED RESULTS - QUALITY ASSURANCE / QUALITY CONTROL (2008)
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	**FB01**	**FB02**	**ER07**
Sampling Date	**02/16/08**	**02/16/08**	**02/15/08**
Metals (ug/L)			
Barium	2 U	2.3 J	2 U
Silver	0.51 U	0.77 J	0.51 U
Zinc	8.4 U	160	8.4 U

Notes:
ug/L - micrograms per liter
mg/L - miligrams per liter
U - Undetected at the Limit of Detection.
J - Estimated: The analyte was positively identified; the quantitation is an estimation

FIGURES

K:_SOUTHNAVFAC\111626 DO2\Task 9 – Phase II RFIs\SWMU 29 Full RFI Report\CAD\111626_29FUL-03

4 0 2 4 8

1 inch = 4 miles

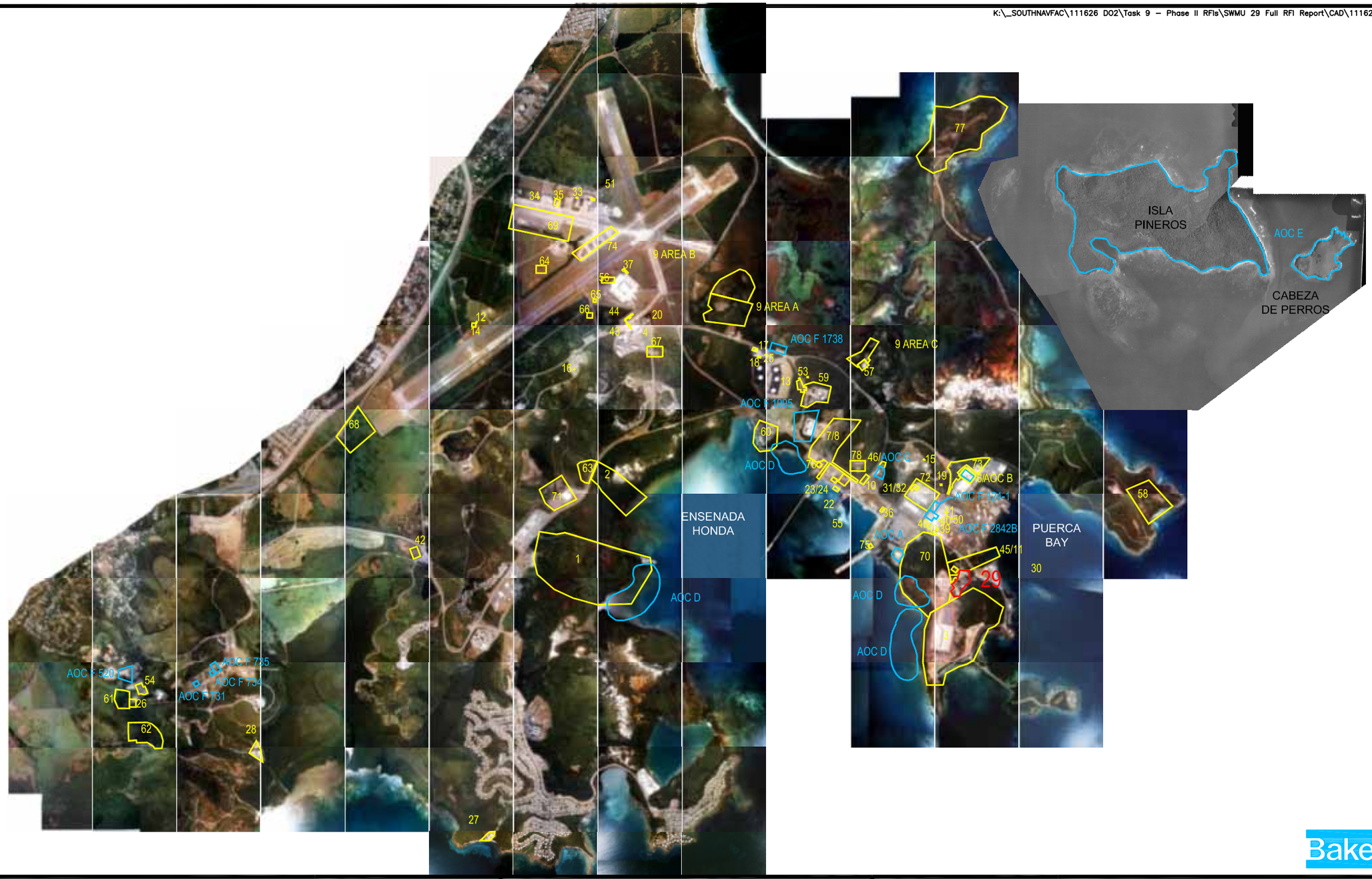
Baker

FIGURE 2-1
REGIONAL LOCATION MAP
SWMU 29-INDUSTRIAL AREA WWTP
SLUDGE DRYING BEDS
FULL RFI

SOURCE: METRODATA, INC., 1999.

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\111626 DO2\Task 9 – Phase II RFIs\SWMU 29 Full RFI Report\CAD\111626_29FUL–02



Baker

LEGEND

1 – SWMUs

AOC D – AOCs

– AREA TO WHICH THIS INVESTIGATION PERTAINS

SOURCE: GEO–MARINE, INC., SEPTEMBER 6, 2000.

3000 0 1500 3000

1 inch = 3000 ft.

FIGURE 2–2
SWMU/AOC LOCATION MAP
SWMU 29–INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI

NAVAL ACTIVITY PUERTO RICO

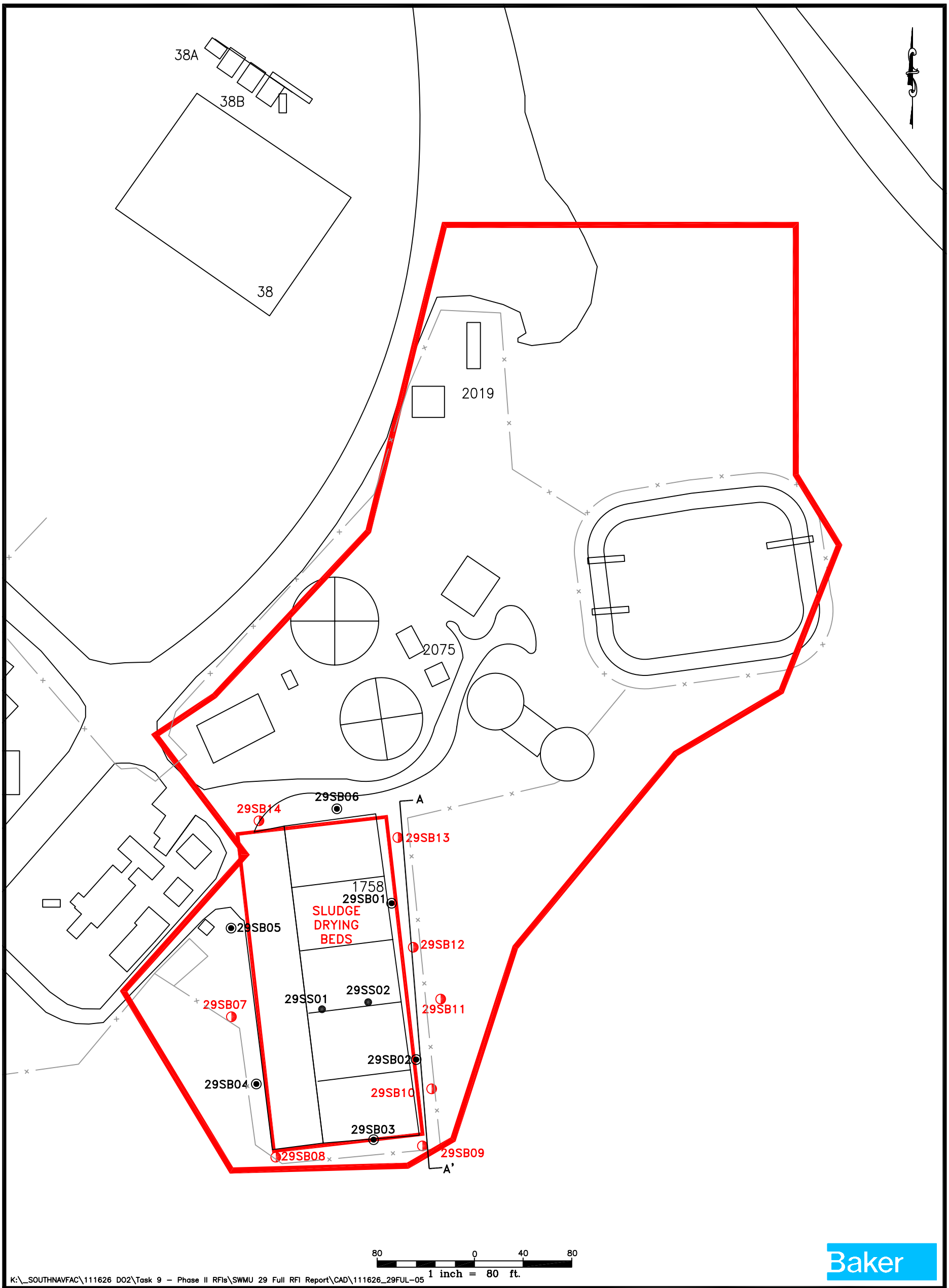
LEGEND

– SWMU BOUNDARY

FIGURE 2–3
SWMU 29 LOCATION MAP

SWMU 29–INDUSTRIAL AREA WWTP
SLUDGE DRYING BEDS
FULL RFI

NAVAL ACTIVITY PUERTO RICO



LEGEND

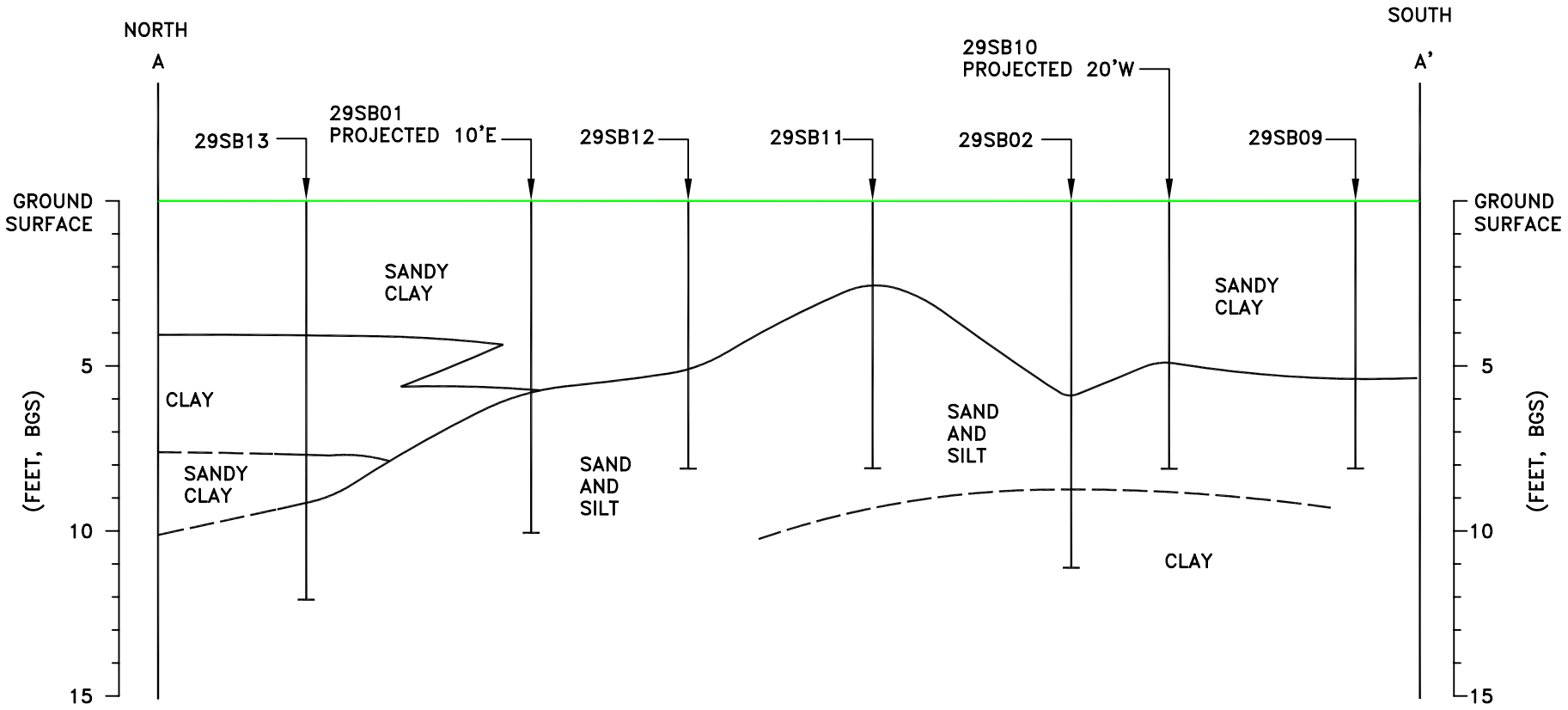
- SWMU BOUNDARY
- EXISTING SURFACE, SUBSURFACE AND GROUNDWATER SOIL SAMPLE LOCATION (NOVEMBER 2006)
- EXISTING SURFACE SOIL SAMPLE LOCATION (NOVEMBER 2006)
- SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS (MARCH 2008)
- A A' CROSS SECTION

FIGURE 3-1
SITE PLAN AND CROSS-SECTION LOCATION MAP

SWMU 29-INDUSTRIAL AREA WWTP
SLUDGE DRYING BEDS
FULL RFI

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\111626 DO2\Task 9 – Phase II RFIs\SWMU 29 Full RFI Report\CAD\111626_29FUL-08.DWG



GEOLOGIC CROSS-SECTION A-A'
LOOKING EAST

5 0 2.5 5
1 inch = 5 ft.
VERTICAL SCALE
EXACGERATION 8x

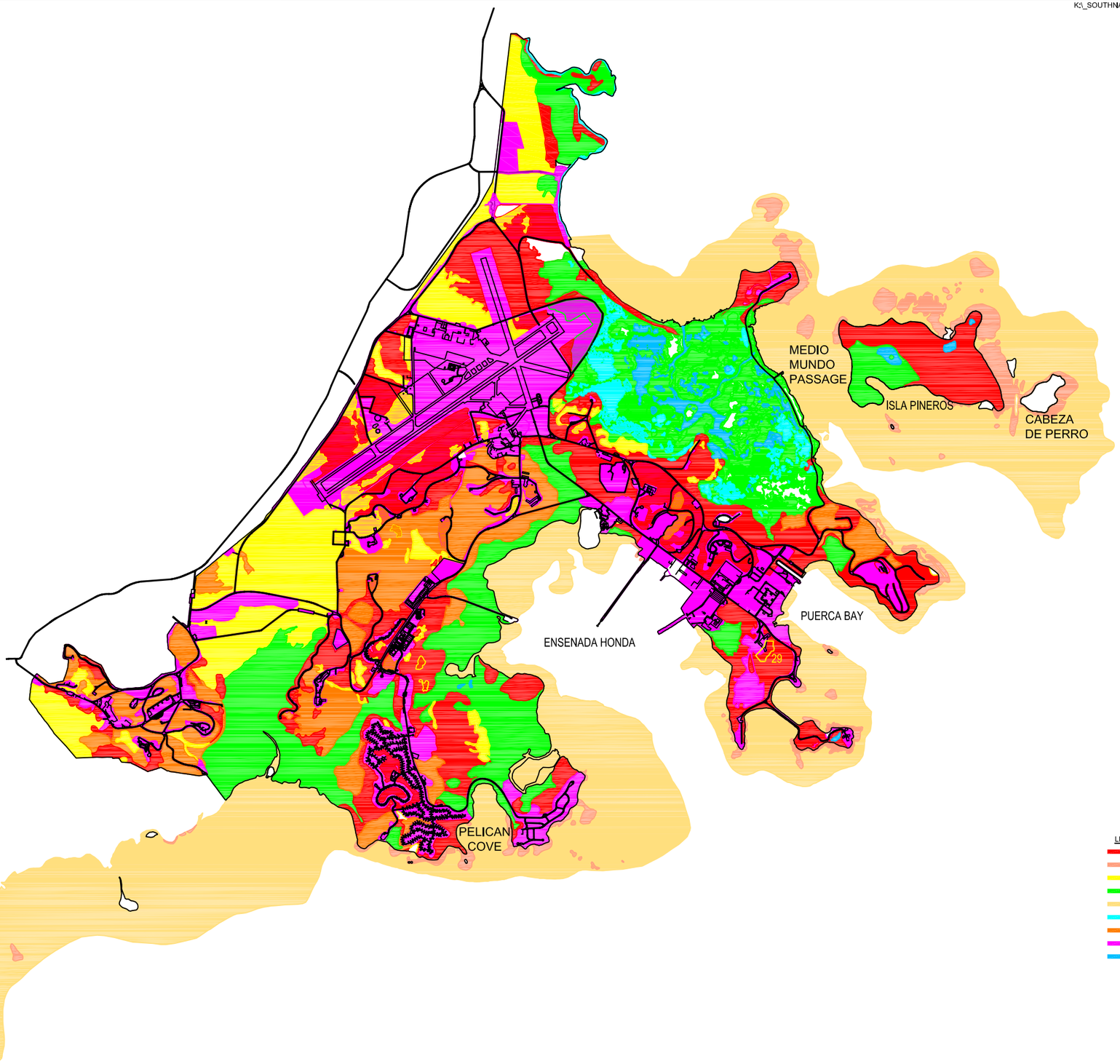
40 0 20 40
1 inch = 40 ft.
HORIZONTAL SCALE

Baker

LEGEND

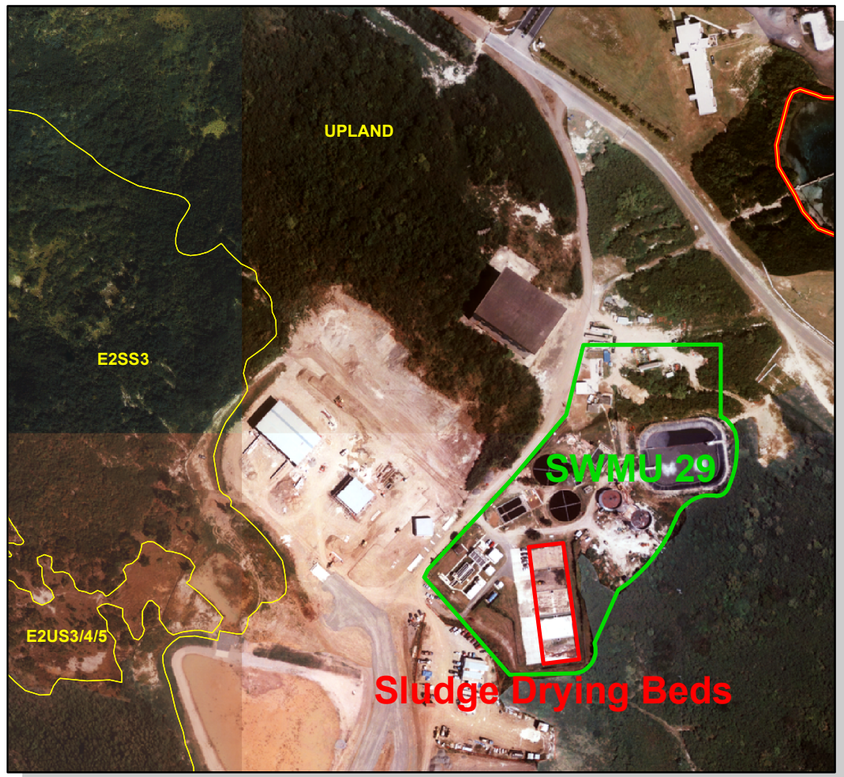
BGS – BELOW GROUND SURFACE
~~~ – ESTIMATED CONTACT
– – – – PROJECTED CONTACT
⊥ – SOIL BORING

THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

FIGURE 3-2
GEOLOGIC CROSS-SECTION A-A'
SWMU 29-INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO
~~~

K:_SOUTHNAVFAC\111626 DO2\Task 9 - Phase II RFIs\SWMU 29 Full RFI Report\CAD\111626_29FUL-09



SOURCE: GEO-MARINE, INC, 1998

REVISIONS		NORTH		SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS NAVAL ACTIVITY PUERTO RICO	Baker	"TERRESTRIAL AND AQUATIC HABITAT OCCURRING AT NAVAL ACTIVITY PUERTO RICO" FULL RCRA FACILITY INVESTIGATION	FIGURE
	DRAWN RRR REVIEWED MEK S.O.# 111626 CADD# 111626_29FUL-09.dwg			BAKER ENVIRONMENTAL, Inc. Coraopolis, Pennsylvania		SCALE FULLSIZE 1" = 600' DATE JUNE 2008	3-3



0 250 500 1,000 Feet

0 50 100 200 Meters

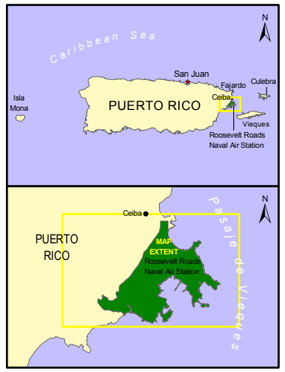


Figure 3-4
Naval Activity Puerto Rico Wetlands Delineation North and East Sections

This certifies that this plat identifies potential waters and wetlands regulated persuant to Section 404 of the Clean Water Act. Wetlands were delineated in December, 1999 from 1993 color infrared and 1998 true color aerial photography.

Data form locations
Roosevelt Roads base boundary
Wetland boundaries
SWMU's

N

Source: Geo-Marine, Inc., September 6, 2000

0 1,500 3,000 6,000 Feet

0 750 1,500 3,000 Meters

FIGURE 3-5
THE COWARDIN WETLAND CLASSIFICATION SYSTEM
SWMU 29-INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RCRA FACILITY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

M - MARINE

SUBSYSTEM	1 - SUBTIDAL					2 - INTERTIDAL			
CLASS	RB - Rock Bottom	UB - Uncon-solidated Bottom	AB - Aquatic Bed	RF - Reef	OW - Open Water (unknown bottom)	AB - Aquatic Bed	RF - Reef	RS - Rocky Shore	US - Uncon-solidated Shore
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vasc 5 Unknown	1 Coral 3 Worm		1 Algal 3 Rooted Vasc 5 Unknown	1 Coral 3 Worm	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic

E - ESTUARINE

SUBSYSTEM	1 - SUBTIDAL			2 - INTERTIDAL							
CLASS	RB - Rock Bottom	UB - Uncon-solidated Bottom	AB - Aquatic Bed	RF - Reef	OW - Open Water (unknown bottom)	AB - Aquatic Bed	RF - Reef	SB - Streambed	RS - Rocky Shore	US - Uncon-solidated Shore	EM - Emergent	SS - Scrub-Shrub	FO - Forested
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	2 Mollusk 3 Worm		1 Algal 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	2 Mollusk 3 Worm	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Dead	1 Persistent 2 Nonpersistent	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*

R - RIVERINE

SUBSYSTEM	1 - TIDAL	2 - LOWER PERENNIAL		3 - UPPER PERENNIAL		4 INTERMITTENT		5 - UNKNOWN PERENNIAL
CLASS	RB - Rock	UB - Uncon-solidated Bottom	SB - Streambed	AB - Aquatic Bed	RS - Rocky Shore	US - Uncon-solidated Shore	OW - Open Water (unknown bottom)	**EM - Emergent
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble 3 Cobble - Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic		2 Nonpersistent

L - LACUSTRINE

SUBSYSTEM	1 - LIMNETIC			2 - LITTORAL					
CLASS	RB - Rock Bottom	UB - Uncon-solidated Bottom	AB - Aquatic Bed	OW - Open Water (unknown bottom)	RS - Rocky Shore	UB - Uncon-solidated Bottom	AB - Aquatic Bed	US - Uncon-solidated Shore	EM - Emergent	OW - Open Water (unknown bottom)
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*		1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent	

P - PALUSTRINE

SYSTEM	P - PALUSTRINE							
CLASS	RB - Rock Bottom	UB - Uncon-solidated Bottom	AB - Aquatic Bed	US - Uncon-solidated Shore	ML - Moss-Lichen	EM - Emergent	SS - Scrub-Shrub	FO - Forested	OW - Open Water (unknown bottom)
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	

MODIFIERS

WATER REGIME				WATER CHEMISTRY			SOIL	SPECIAL
	Non-Tidal		**Tidal**	**Coastal Halinity**	**Inland Salinity**	**pH (fresh water)**		
A Temp. Flooded	H Permanently Flooded	K Artificially Flooded	*S Temporary-Tidal	1 Hyperhaline	7 Hypersaline	a Acid	g Organic	b Beaver
B Saturated	J Intermittently Flooded	L Subtidal	*R Seasonal-Tidal	2 Euhaline	8 Eusaline	t circumneutral	n Mineral	d partially drained/ditched
C Seasonally Flooded	K Artificially Flooded	M Irregularly Flooded	*T Semipermanent- Tidal	3 Mixohaline	9 Mixosaline	i Alkaline		f Farmed
D Seasonally Flooded/ Well Drained	W Intermittently Flooded/ Temporary	N Regularly Flooded	*V Permanent-Tidal	4 Polyhaline	0 Fresh			h Diked/Impounded
E Seasonally Flooded/ Saturated	Y Saturated/Semipermanent/ Seasonal	P Irregularly Flooded	U Unknown	5 Mesohaline				r Artificial Substrate
F Semipermanently Flooded	Z Intermittently Exposed	* These water regimes are only used in tidally influenced, freshwater systems.		6 Oligohaline				s Spoil
G Intermittently Exposed	Permanent			0 Fresh				x Excavated
	U Unknown							

SOURCE: UNITED STATES, FISH AND WILDLIFE SERVICE. CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES, 1985

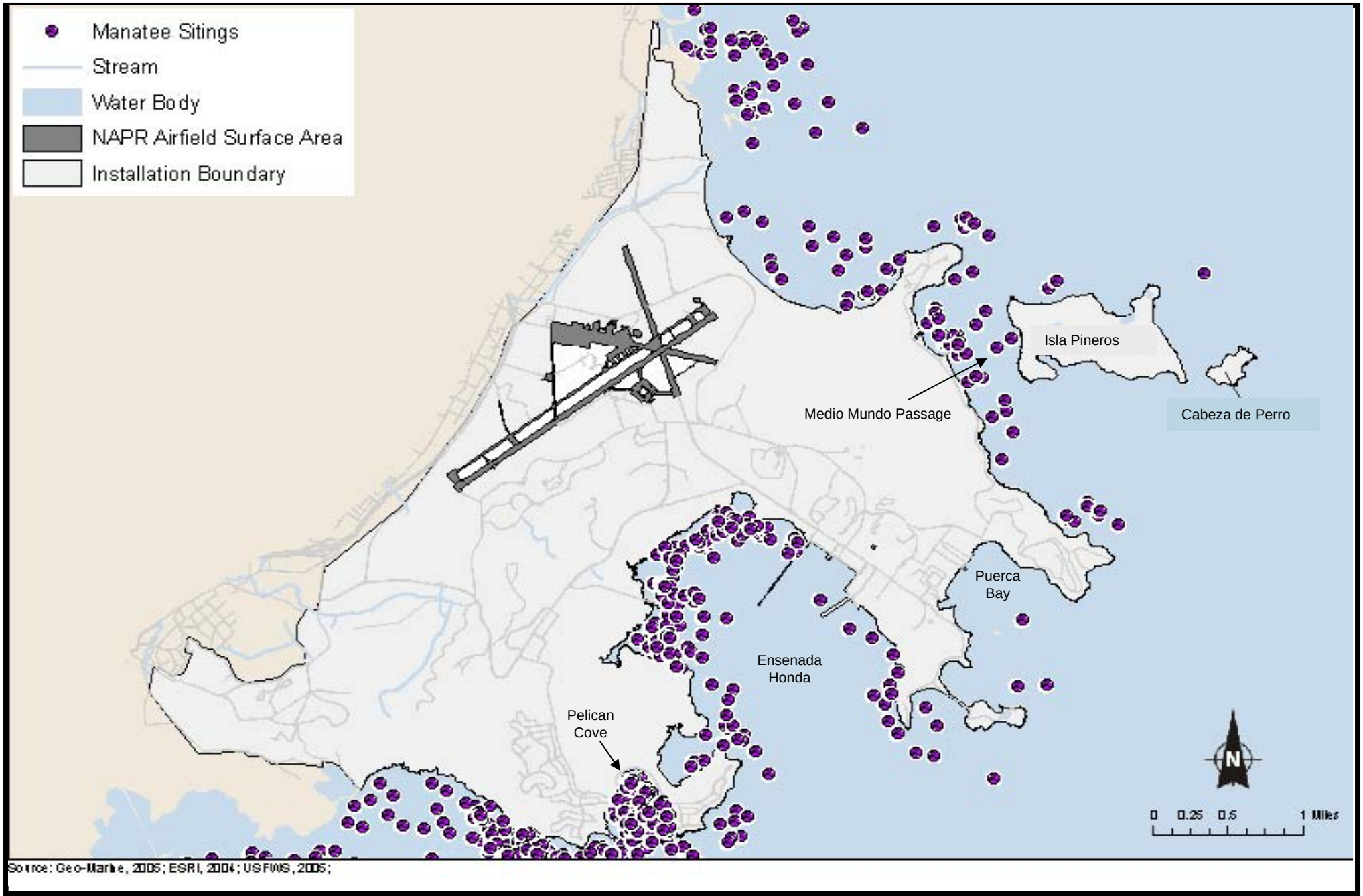
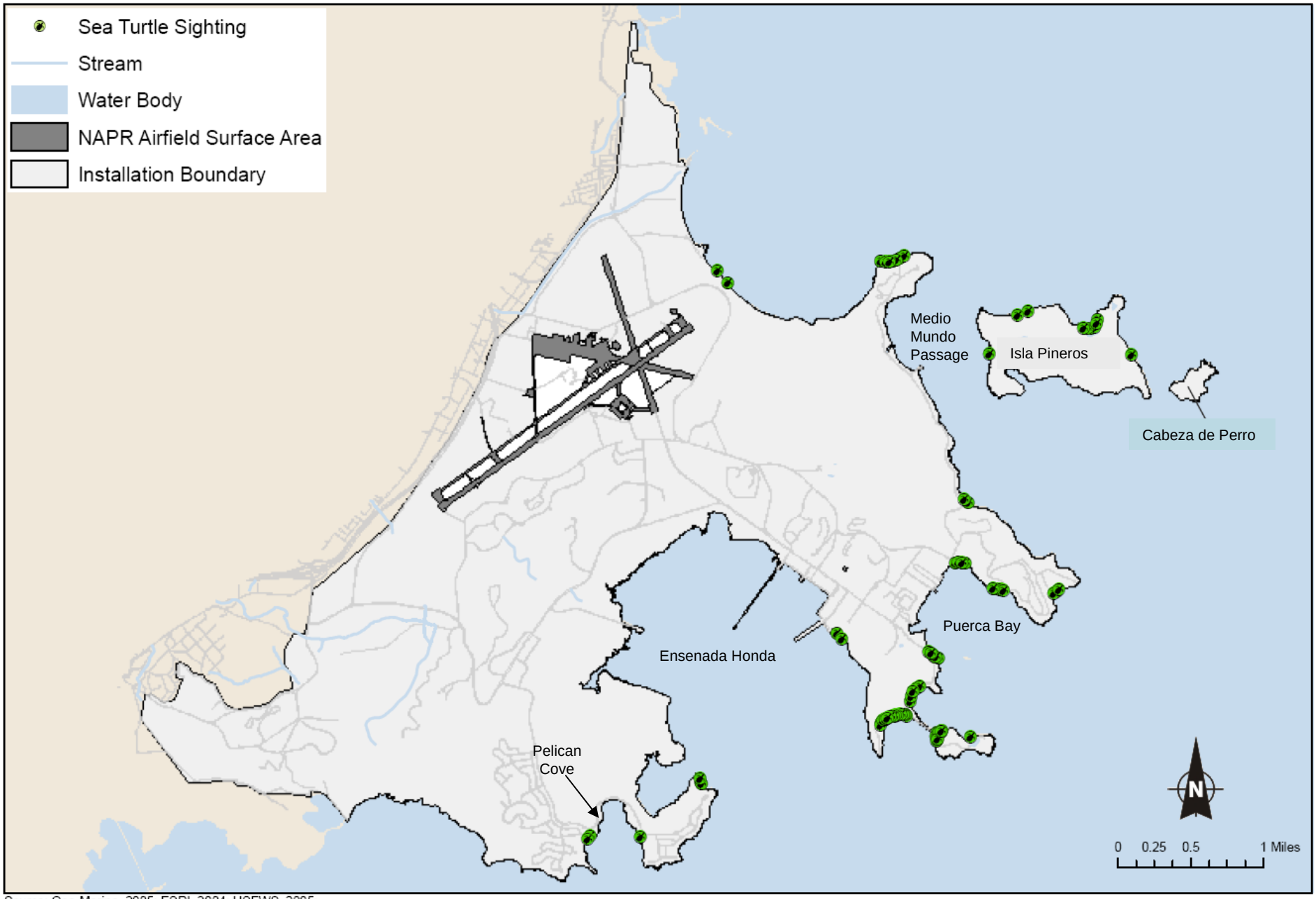


Figure from: Department of the Navy (DoN). 2007. *Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads).* April 2007.

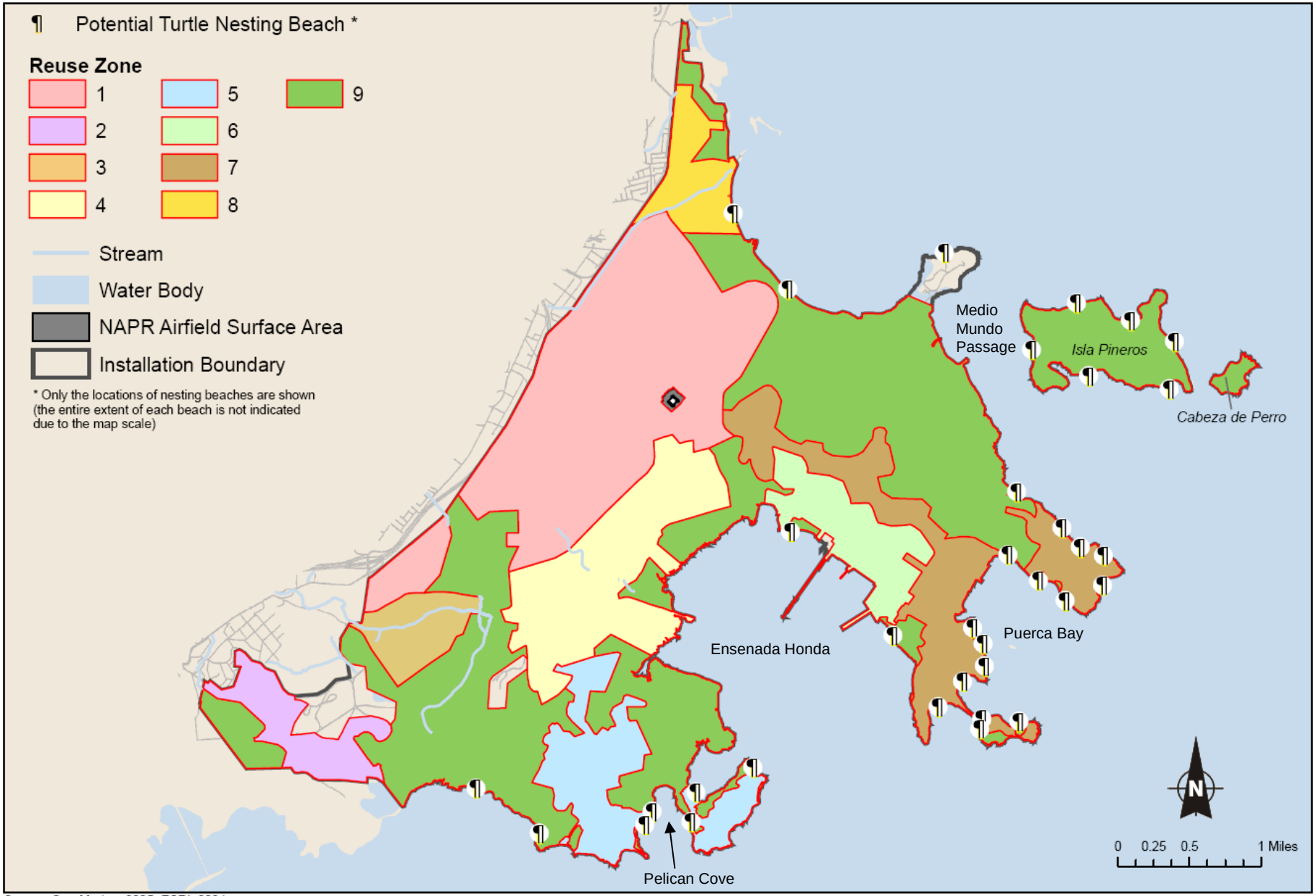
FIGURE 3-6
HISTORICAL MANATEE SIGHTINGS IN EASTERN PUERTO RICO
SWMU 29 – INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Cumulative sea turtle sightings from March 1984 through March 1995 obtained from weekly aerial surveys of the Former Naval station Roosevelt Roads.

Figure from: Department of the Navy (DoN). 2007. *Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads).* April 2007.

FIGURE 3-7
SEA TURTLE SIGHTINGS AT NAVAL ACTIVITY PUERTO RICO
SWMU 29 – INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Source: Geo-Marine, 2005; ESRI, 2004;

Figure from: Department of Navy (DoN). 2007. *Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads).* April 2007

FIGURE 3-8
POTENTIAL TURTLE NESTING SITES
SWMU 29 – INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

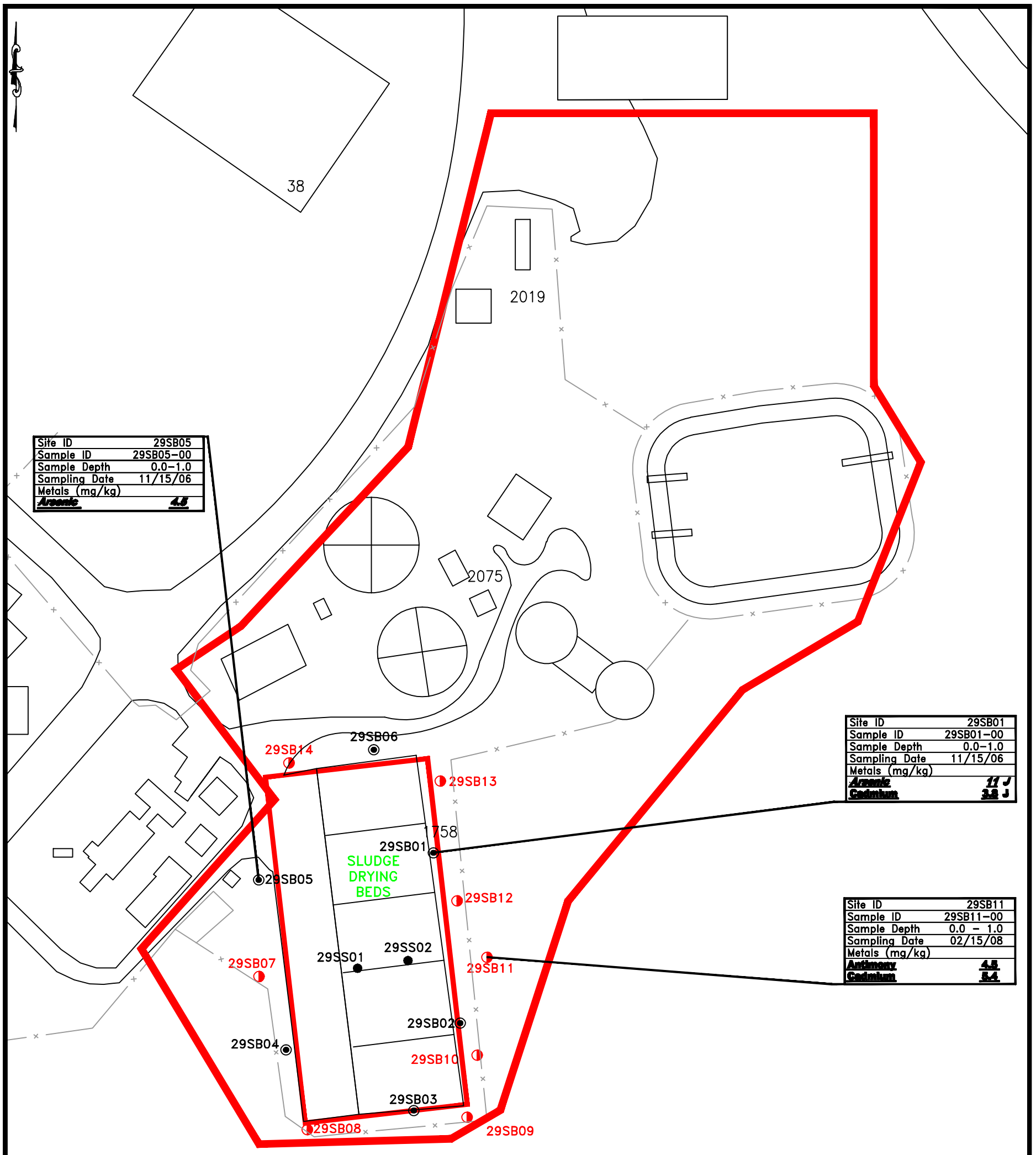
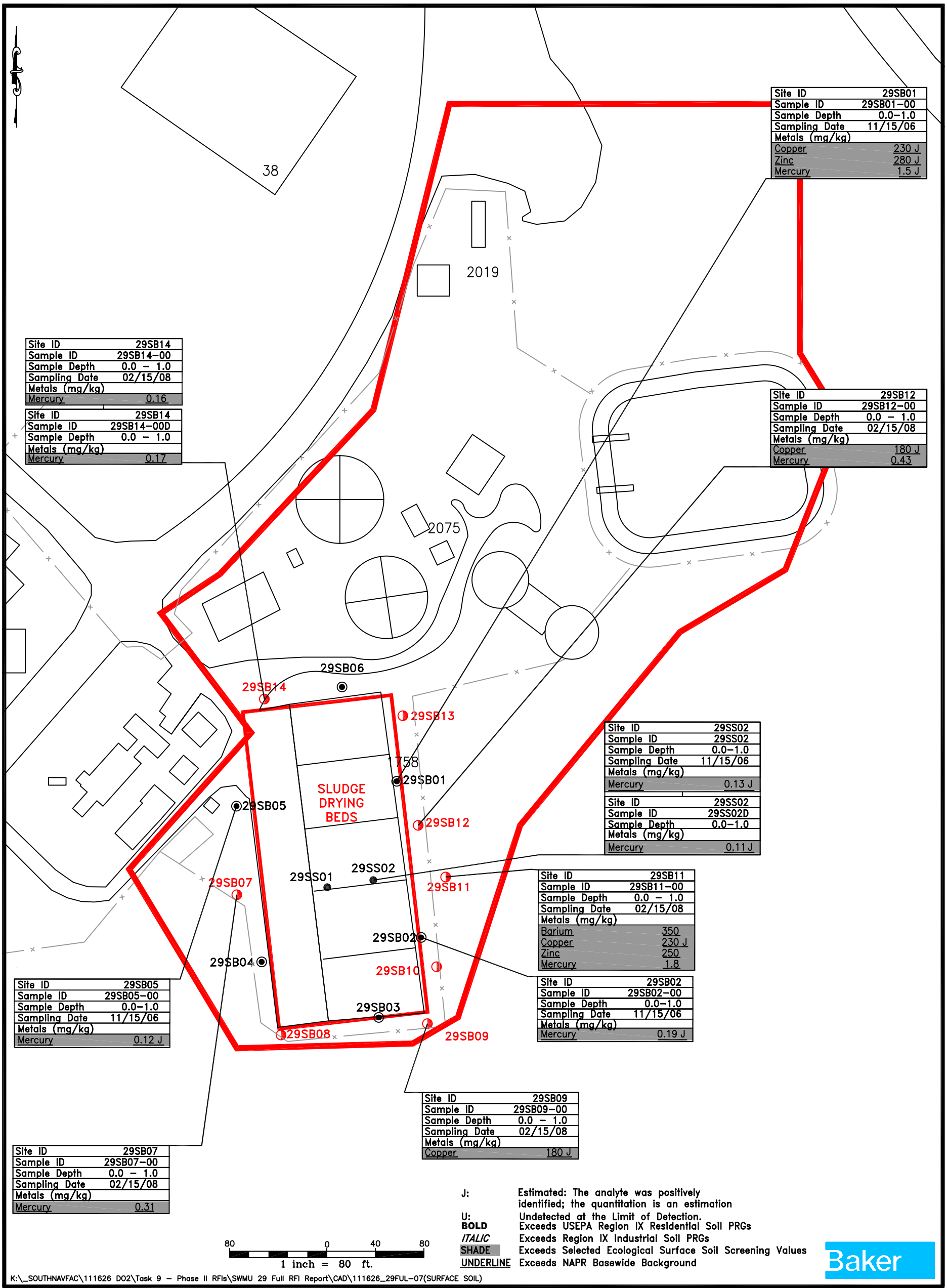


FIGURE 5-1
EXCEEDANCES OF HUMAN HEALTH SCREENING CRITERIA AND BACKGROUND FOR SURFACE SOIL

SWMU 29-INDUSTRIAL AREA WWTP
SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO



Site ID	29SB01
Sample ID	29SB01-00
Sample Depth	0.0-1.0
Sampling Date	11/15/06
Metals (mg/kg)	
Copper	230 J
Zinc	280 J
Mercury	1.5 J

Site ID	29SB14
Sample ID	29SB14-00
Sample Depth	0.0 - 1.0
Sampling Date	02/15/08
Metals (mg/kg)	
Mercury	0.16

Site ID	29SB14
Sample ID	29SB14-00D
Sample Depth	0.0 - 1.0
Metals (mg/kg)	
Mercury	0.17

Site ID	29SB12
Sample ID	29SB12-00
Sample Depth	0.0 - 1.0
Sampling Date	02/15/08
Metals (mg/kg)	
Copper	180 J
Mercury	0.43

Site ID	29SS02
Sample ID	29SS02
Sample Depth	0.0-1.0
Sampling Date	11/15/06
Metals (mg/kg)	
Mercury	0.13 J

Site ID	29SS02
Sample ID	29SS02D
Sample Depth	0.0-1.0
Metals (mg/kg)	
Mercury	0.11 J

Site ID	29SB11
Sample ID	29SB11-00
Sample Depth	0.0 - 1.0
Sampling Date	02/15/08
Metals (mg/kg)	
Barium	350
Copper	230 J
Zinc	250
Mercury	1.8

Site ID	29SB02
Sample ID	29SB02-00
Sample Depth	0.0-1.0
Sampling Date	11/15/06
Metals (mg/kg)	
Mercury	0.19 J

Site ID	29SB05
Sample ID	29SB05-00
Sample Depth	0.0-1.0
Sampling Date	11/15/06
Metals (mg/kg)	
Mercury	0.12 J

Site ID	29SB09
Sample ID	29SB09-00
Sample Depth	0.0 - 1.0
Sampling Date	02/15/08
Metals (mg/kg)	
Copper	180 J

Site ID	29SB07
Sample ID	29SB07-00
Sample Depth	0.0 - 1.0
Sampling Date	02/15/08
Metals (mg/kg)	
Mercury	0.31

J: Estimated: The analyte was positively identified; the quantitation is an estimation

U: Undetected at the Limit of Detection.

BOLD Exceeds USEPA Region IX Residential Soil PRGs

ITALIC Exceeds Region IX Industrial Soil PRGs

SHADE Exceeds Selected Ecological Surface Soil Screening Values

UNDERLINE Exceeds NAPR Basewide Background

K:_SOUTHNAVFAC\111626 DO2\Task 9 - Phase II RFIs\SWMU 29 Full RFI Report\CAD\111626_29FUL-07(SURFACE SOIL)

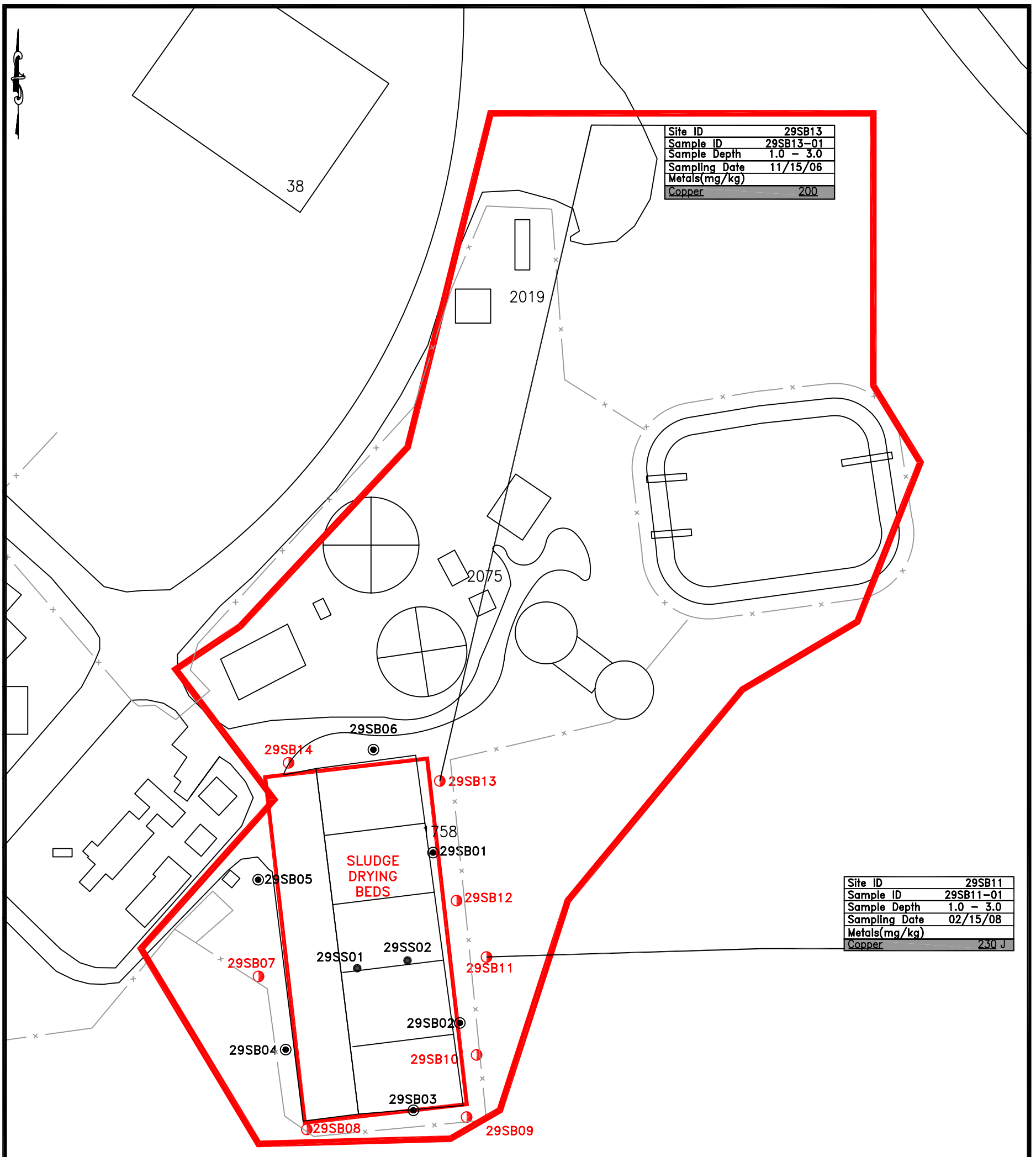
Baker

LEGEND

- SWMU BOUNDARY
- EXISTING SURFACE, SUBSURFACE AND GROUNDWATER SOIL SAMPLE LOCATION (NOVEMBER 2006)
- EXISTING SURFACE SOIL SAMPLE LOCATION (NOVEMBER 2006)
- SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS (MARCH 2008)

FIGURE 5-2
EXCEEDANCES OF ECOLOGICAL SCREENING CRITERIA AND BACKGROUND FOR SURFACE SOIL

SWMU 29-INDUSTRIAL
AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO



LEGEND

- SWMU BOUNDARY
- EXISTING SURFACE, SUBSURFACE AND GROUNDWATER SOIL SAMPLE LOCATION (NOVEMBER 2006)
- EXISTING SURFACE SOIL SAMPLE LOCATION (NOVEMBER 2006)
- SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS (MARCH 2008)

FIGURE 5-3
EXCEEDANCES OF ECOLOGICAL SCREENING CRITERIA AND BACKGROUND FOR SUBSURFACE SOIL

SWMU 29-INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS FULL RFI

NAVAL ACTIVITY PUERTO RICO

APPENDIX A
2008 FIELD ACTIVITIES

APPENDIX A.1
SWMU 29 FIELD LOG BOOK NOTES

295B07

0-4'
2.9' Rec.

0.8' Top soil, med brown mod soft, sandy loam

Light gray silt and sand some gravel, moist to wet at 3'

4-8'
3' Rec.

Light gray and beige silty sand, well sorted no gravel saturated.

End boring @ 8.0'

Collect sample 295B07

295B07-00
295B07-01

295B08

0-4'
2.6' Rec.

Top six inches topsoil
sandy gravel, med brown, damp
then mixed sandy clay and
gravel, med brown, damp
mod loose,
becomes lighter brown gray sand
at 2.5' some clay and silt
damp, soft

4-8'
3.8' Rec.

Become tight then silt and sand
very soft saturated at 5'
some shell frags throughout
zones of more silt then
sand and vise versa, no gravel

End Boring @ 8.0'

Collect Samples 295B08

295B08-00	Surface Soil
295B08-01	1-3'
295B08-01D	Dup of 1-3'
295B08-02	3-5'

metals only

29 SB09

0-4' Topsoil, sandy clay loam, med brown to 6" some gravel,

3.5' Ree. Sandy clay at 0.5', mod stiff some gravel, damp, occassional sandy zone, med to dark brown

4-8' same as above

3.6' cobble at 5.5' then light tan sand and silt, well sorted, no gravel wet

End Boring @ 8.0'

Samples Collected

29SB09-00	Surface
29SB09-01	1-3'
29SB09-02	3-5'

295B10

0-4'
2.3' Rec

Top soil first 8"
Sandy clay loam, med brown
soft, damp
@ 0.75' clayey sand, dark
brown, med grained sand
soft, some silt damp to dry

4-8'
2.8' Rec.

cobble @ 4.2' hard, gray
then dark brown, sandy clay
5.0' light beige sand and silt
fine grained sand, well sorted
no gravel
saturated @ 5.5'

Samples Collected 295B10

295B10-00	Surface 0-1'
295B10-01	1-3'
295B10-02	3-5'

29SB11

0-4'
2.8' Rec

Top soil 0,9'
Sandy loam, dark brown, soft, dry, some pebbles
@ 0.9 Sandy clay and gravel light gray brown, mod stiff damp

@ 2.5' Light tan, sand and silt loose, soft, no gravel, shell frags, damp, fine-to-med. grained sand

4-8'
3.2' Rec.

Sand and silt become saturated at approx 5' Bgs
light gray and tan fine to med grained sand

end boring @ 8.0'

Samples Collected 29SB11

29SB11-00	Surface
29SB11-01	1-3'
29SB11-02	3-5'

2-15-08

295B12

0-4'
3.5' Rec

Topsoil, med brown, sandy loam soft, dry some gravel then 0.6' sandy clay and gravel, brownish gray, mod soft, damp, med grained sand

4-8'
3.2' Rec

@ 5.1' becomes light tan sand and silt, very soft well sorted, becomes wet and saturated @ 5.8'

Samples Collected 295B12

295B12-00	Surface
295B12-01	1-3'
295B12-01D	1-3' Dup
295B12-01MS/MSD	1-3' MSpike
295B12-02	3-5'

295B13

0-4' Sandy clay @ surface
2.5 Rec. dry, mod hard, gray gravel @ 0.7'
@ 0.7' Sandy clay and gravel, cobble and rock @ 2.5'

4-8' Med brown clay, very stiff
4.0' Rec. hard, damp 4.2 to 7.5'
lean, no gravel.
@ 7.5' Sandy clay olive brown
mod soft, damp
med grained sand

8-12' @ 9' Clayey sand, soft, wet
grayish brown to 10.5' then
blue/gray weathered rock and
clay, damp to moist, hard

End of Bore @ 12'

Samples Collected @ 2BSB13

295B13-00	Surface
295B13-01	1-3'
295B13-02	3-5'
295B13-02D	3-5' Dup
295B13-02MS/MSD	3-5' Spike
295B13-03	5-7'
295B13-04	7-9'

295B14

0-4'
3.4' Rec.

Sandy clay at surface, hard with gravel, gray/green, dry to 0.7'
0.7' Sandy clay and sand coral frags (fill material) hard, damp to dry, med grained sand,

4-8'
4' Rec.

Becomes lean clay, stiff white and light gray green, some sand and silt, damp to dry

Becomes more sandy clay at 7.5' med. grained sand, gold/brown damp

8-12'

Samples Collected 295B14

295B14-00	Surface 0-1'
295B14-00D	Surface Dup
295B14-00MS/MSD	surface spike
295B14-01	1-3'
295B14-02	3-5'
295B14-03	5-7'
295B14-04	7-9'

Equipment rinsate ER07
Geoprobe Sleeve

APPENDIX A.2
SOIL BORING LOGS

Baker
Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB07
COORDINATES: EAST: 797594.9 NORTH: 942088.1
ELEVATION: SURFACE:

Rig:	Tracked Geoprobe 66DT				Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	Macro Sampler	Casing	Augers	Core Barrel				
Size (ID)	2.5"				2/15/2008	0.0 - 8.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	(Ft. BGS)
1					29SB07 -00 (0-12")		TOP SOIL, med. brown, mod. soft	
2		GP-1	2.9 73%		29SB07 -01 (1-3')	<1		
3							3.0	3.00
4	4.0						SILT and SAND, some GRAVEL, light gray, moist to wet 4.0	4.00
5							SILTY SAND, no gravel, well sorted, light gray, saturated	
6		GP-2	3.0 75%			<1		
7								
8	8.0						8.0	8.00
9							End of Boring at 8.0'	
10								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB07 SHEET 1 OF 1

Baker
Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB08
COORDINATES: EAST: 797479.5 NORTH: 942124.5
ELEVATION: SURFACE:

Rig:	Geoprobe 66DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"				2/15/2008	0.0 - 8.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	(Ft. BGS)
1		GP-1	2.6 65%		29SB08-00 (0-12")	<1	TOP SOIL, med. brown, SANDY CLAY and GRAVEL, med. brown, mod. loose, damp	
2					29SB08-01 (1-3')			
3							SAND, some CLAY and SILT, light brown-gray, soft, damp	
4	4.0				29SB08-02 (3-5')			4.00
5		GP-2	3.8 95%			<1	SILT and SAND, light tan, some shell frags throughout, very soft, zones of greater SILT vs. SAND, saturated at 5'	
6								
7								
8	8.0							8.00
9							End of Boring at 8'	
10								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB08 SHEET 1 OF 1

Baker
Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB09
COORDINATES: EAST: 797488.8 NORTH: 942245.1
ELEVATION: SURFACE:

Rig:	Geoprobe 66DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"				2/15/2008	0.0 - 8.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	(Ft. BGS)
1		GP-1	3.5 88%		29SB09-00 (0-12")	<1	TOP SOIL, med. brown	0.5 0.50
2							SANDY CLAY, some GRAVEL, occasional SAND zone, med. to dark brown, mod. stiff, damp	
3					29SB09-01 (1-3')			
4	4.0				29SB09-02			4.0 4.00
5		GP-2	3.6 90%		(3-5')	<1		5.5 5.50
6							cobble at 5.5', SAND and SILT, well sorted, light tan wet	
7								
8	8.0							8.0 8.00
9							End of Boring at 8'	
10								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB09 SHEET 1 OF 1

Baker
Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB10
COORDINATES: EAST: 797535.6 NORTH: 942252.7
ELEVATION: SURFACE:

Rig:	Geoprobe 66DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"				2/15/2008	0.0 - 8.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	(Ft. BGS)
1					29SB10-00 (0-12")		TOP SOIL	
							0.8	0.75
2		GP-1	2.3 58%		29SB10-01 (1-3')	<1	CLAYEY SAND, some SILT, med. grained, dark brown, soft, damp to dry	
3								
4	4.0				29SB10-02 (3-5')			
5							SANDY CLAY, gray then dark brown, cobble at 4.2	
							5.0	5.00
6		GP-2	2.8 70%			<1	SAND and SILT, fine grained, well sorted, light beige, saturated at 5.5'	
7								
8	8.0						8.0	8.00
9							End of Boring at 8'	
10								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB10 SHEET 1 OF 1

Baker
Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB11
COORDINATES: EAST: 797609.5 NORTH: 942260.1
ELEVATION: SURFACE:

Rig:	Geoprobe 66DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"				2/15/2008	0.0 - 8.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	(Ft. BGS)
1					29SB11-00 (0-12")		TOPSOIL	
							0.9	0.90
2		GP-1	2.8 70%		29sb11-01 (1-3')	<1	SANDY CLAY, GRAVEL, light gray-brown, mod. stiff, damp	
							2.5	2.50
3					29sb11-02		SAND and SILT, fine-med. grained, shell frags, light tan, loose, soft, damp	
4	4.0						4.0	4.00
5					(3-5')		light gray and tan, saturated at 5'	
6		GP-2	3.2 80%			<1		
7								
8	8.0						8.0	8.00
9							End of Boring at 8'	
10								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB11 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB012
COORDINATES: EAST: 797652.0 NORTH: 942237.5
ELEVATION: SURFACE:

Rig:	Geoprobe 66DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"				2/15/2008	0.0 - 8.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description		(Ft. BGS)
1					29SB12-00 (0-12")		TOPSOIL	0.6	0.60
2		GP-1	3.5 88%		29SB12-01 (1-3')	<1	SANDY CLAY, GRAVEL, med. grained, brownish-gray, mod. soft, damp		
3									
4	4.0				29SB12-02 (3-5')				
5								5.1	5.10
6		GP-2	3.2 80%			<1	SAND and SILT, well sorted, light tan, very soft, saturated at 5.8'		
7									
8	8.0							8.0	8.00
9							End of Boring at 8'		
10									

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB012 SHEET 1 OF 1

Baker
Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB13
COORDINATES: EAST: 797742.3 NORTH: 942224.9
ELEVATION: SURFACE:

Rig:	Geoprobe 66DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"				2/15/2008	0.0 - 12.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	(Ft. BGS)
1		GP-1	2.5 63%		29SB13-00 (0-12") 29SB13-01 (1-3') 29SB13-02 (3-5') 29SB13-03 (5-7') 29SB13-04 (7-9')	<1	SANDY CLAY, mod. hard, dry	0.70
2							with GRAVEL, COBBLES,	
3							ROCK at 2.5'	
4	4.0							4.00
5		GP-2	4.0 100%				CLAY, very stiff, med. brown, hard, damp, lean	
6								
7								
							7.5	7.50
8	8.0						SANDY CLAY, med. grained, olive brown, mod. soft, damp	
9		GP-3	2.8 70%			<1	9.0	9.00
10							CLAYEY SAND, grayish-brown, soft, wet	
							10.5	10.50

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB13 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29

SO NO.: 111626 BORING NO.: 29SB13

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	(Ft. BGS)
11		GP-3	2.8 70%			<1	Continued from Sheet 1 - weathered ROCK and CLAY, blue-gray, hard, damp to moist	
12	12.0						12.0	12.00
							End of Boring at 12.0'	
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa

DRILLER: Abraham BORING NO.: 29SB13 SHEET 2 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29
PROJ. NO.: 111626 BORING NO.: 29SB14
COORDINATES: EAST: 797756.0 NORTH: 942110.8
ELEVATION: SURFACE:

Rig:	Geoprobe 66DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"				2/15/2008	0.0 - 12.0	Sunny 85	
Length	4'							
Type								
Hammer Wt.								
Fall								

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	(Ft. BGS)
1		GP-1	3.4 85%		29SB14-00 (0-12") 29SB14-01 (1-3') 29SB14-02	<1	SANDY CLAY, GRAVEL, gray/green, dry 0.7	0.70
2							with SAND, med. grained, coral frags, fill material, hard, damp to dry	
3								
4	4.0						4.0	4.00
5		GP-2	4.0 100%		(3-5') 29SB14-03 (5-7') 29SB14-04 (7-9')	<1	CLAY, lean, some SAND and SILT, whight and light gray/green, stiff, damp to dry	
6								
7							7.5	7.50
8	8.0						SANDY CLAY, med. grained, gold/brown, damp	
9		GP-3	3.5 88%			<1		
10								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa
DRILLER: Abraham BORING NO.: 29SB14 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Roosevelt Roads Puerto Rico, SWMU 29

SO NO.: 111626 BORING NO.: 29SB14

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	(Ft. BGS)
11		GP-3	3.5 88%			<1	Continued from Sheet 1 SANDY CLAY continued	
12	12.0						End of Boring at 12.0'	
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING COMPANY: GeoEnviroTech, Inc. BAKER REP.: Joe Burawa

DRILLER: Abraham BORING NO.: 29SB14 SHEET 2 OF 2

APPENDIX A.3
CHAIN-OF-CUSTODY FORMS

Serial Number 96806

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT **STL**

● STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.stl-inc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

○ Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)	MATRIX TYPE	REQUIRED ANALYSIS	PAGE	OF
NAPR Summ 29	111626 9.4	PR			1	3

STL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO
Kathy Smith		

CLIENT (SITE) PM	CLIENT PHONE	CLIENT FAX
Mark Kimes	412-337-7465	

CLIENT NAME	CLIENT E-MAIL
Michael Baker Jr., Inc	mkimes@mbakercorp.com

CLIENT ADDRESS
100 Airside Drive, Moon Twp., PA 15108

COMPANY CONTRACTING THIS WORK (if applicable)

STANDARD REPORT DELIVERY ●

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ○

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	Appendix IX Metals	REMARKS
2-15-08		295B07-00			X			1	
		295B07-01			X			1	
		295B08-00			X			1	
		295B08-01			X			1	
		295B08-01D			X			1	Duplicate
		295B08-02			X			1	
		295B09-00			X			1	
		295B09-01			X			1	
		295B09-02			X			1	
		295B10-00			X			1	
		295B10-01			X			1	
		295B10-02			X			1	

5.9

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
	2-18-08	1700						
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	STL SAVANNAH LOG NO.	LABORATORY REMARKS
	021908	0920	YES ○ NO ○		080-34322	

030

STL 8240-80 (12/02)

Serial Number 96802

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT STL

● STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.stlinc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

○ Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: NAAR SWMU 29	PROJECT NO.: 111626 9.4	PROJECT LOCATION (STATE): PR	
STL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER:	CONTRACT NO.:	
CLIENT (SITE) PM: Mark Kimes	CLIENT PHONE: 412-337-7465	CLIENT FAX:	
CLIENT NAME: Michael Baker Jr., Inc.	CLIENT E-MAIL: mkimes@mbakercorp.com		
CLIENT ADDRESS: 100 Airside Drive, Moon Twp., PA 15108			
COMPANY CONTRACTING THIS WORK (if applicable):			

MATRIX TYPE: COMPOSITE (C) OR GRAB (G) INDICATE | AQUEOUS (WATER) | SOLID OR SEMISOLID | AIR | NONAQUEOUS LIQUID (OIL, SOLVENT,...)

REQUIRED ANALYSIS: Appendix IX Metals

PAGE 2 OF 3

STANDARD REPORT DELIVERY ●

DATE DUE:

EXPEDITED REPORT DELIVERY (SURCHARGE) ○

DATE DUE:

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	SOLID OR SEMISOLID	NUMBER OF CONTAINERS SUBMITTED	REMARKS
2-15-08		29SB11-00	X	1	
		29SB11-01	X	1	
		29SB11-02	X	1	
		29SB12-00	X	1	
		29SB12-01	X	1	
		29SB12-01D	X	1	Duplicate
		29SB12-01 MS/MSD	X	1	Matrix Spike/MS Dup
		29SB12-02	X	1	
		29SB13-00	X	1	
		29SB13-01	X	1	
		29SB13-02	X	1	
		29SB13-02D	X	1	Duplicate

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
	2-18-08	1700						
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	STL SAVANNAH LOG NO.	LABORATORY REMARKS
	02/19/08	0920	YES ○ NO ○		680-31322	

STL 8240-680 (12/02)

031

Serial Number 96803

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT **STL**

● STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.stl-inc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

○ Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: NAPR Sumu 29	PROJECT NO.: 111626 9.4	PROJECT LOCATION (STATE): PR	MATRIX TYPE	REQUIRED ANALYSIS
STL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER:	CONTRACT NO.:		
CLIENT (SITE) PM: Mark Kimes	CLIENT PHONE: 412-337-7465	CLIENT FAX:		
CLIENT NAME: Michael Baker Jr., Inc.	CLIENT E-MAIL: mkimes@mbakercorp.com			
CLIENT ADDRESS: 100 Airside Drive, Moon Twp., PA 15108				
COMPANY CONTRACTING THIS WORK (if applicable):				

PAGE 3 OF 3

STANDARD REPORT DELIVERY ●
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ○
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT,...)	NUMBER OF CONTAINERS SUBMITTED: Appendix IX Metals	REMARKS
2-15-08		295B13-02 MS/MSD			X			1	Matrix Spike/MS DP
		295B13-03			X			1	
		295B13-04			X			1	
		295B14-00			X			1	
		295B14-00D			X			1	Duplicate
		295B14-00 MS/MSD			X			1	Matrix Spike/MS DP
		295B14-01			X			1	
		295B14-02			X			1	
		295B14-03			X			1	
		295B14-04			X			1	
↓		ER07		X				1	Rinsate Sleeve

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
	2-18-08	1700						
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT YES ○ NO ○	CUSTODY SEAL NO.	STL SAVANNAH LOG NO.	LABORATORY REMARKS
	021908	0920			680-31322	

STL-8240-680-(12/02)

032

APPENDIX B
LABORATORY ANALYTICAL RESULTS

APPENDIX B.1
SURFACE SOIL

APPENDIX B

SURFACE SOIL ANALYTICAL RESULTS
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID	**29SB07**	**29SB08**	**29SB09**	**29SB10**	**29SB11**
Sample ID	**29SB07-00**	**29SB08-00**	**29SB09-00**	**29SB10-00**	**29SB11-00**
Sample Depth (ft bgs)	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Sampling Date	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**
Metals (mg/kg)					
Antimony	1.1 U	0.21 U	0.57 J	0.6 U	4.5
Arsenic	1.8	0.68 J	0.57 J	0.33 U	2.4
Barium	96	220	53	88	350
Beryllium	0.23 J	0.19 J	0.13 J	0.13 J	0.19 J
Cadmium	1.2	0.27 J	0.84	0.39 J	5.4
Chromium	19	12	14	19	26
Cobalt	15	8.7	14	14	12
Copper	98 J	43 J	180 J	110 J	230 J
Lead	11	2.5	1.5	0.79	45
Nickel	13	4.8	8.4	10	17
Selenium	0.22 U	0.2 U	0.21 U	0.39 U	0.56 U
Silver	9.3	0.27 U	0.62 U	0.08 U	61
Thallium	0.51 U	0.46 U	0.5 U	0.47 U	0.53 U
Tin	7 J	3.9 U	4.3 U	4 U	42
Vanadium	110	63	180	110	98
Zinc	100 J	42 J	62 J	63 J	250
Mercury	0.31	0.014 J	0.026	0.0053 J	1.8

APPENDIX B

SURFACE SOIL ANALYTICAL RESULTS
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID	**29SB12**	**29SB13**	**29SB14**	**29SB14**
Sample ID	**29SB12-00**	**29SB13-00**	**29SB14-00**	**29SB14-00D**
Sample Depth (ft bgs)	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Sampling Date	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**
Metals (mg/kg)				
Antimony	0.79 U	0.77 U	0.73 UJ	0.33 UJ
Arsenic	1.2	0.62 J	1.5	1.9
Barium	80	73	130	130
Beryllium	0.18 J	0.21 J	0.23 J	0.2 J
Cadmium	1.8	1.3	1.7	1.4
Chromium	22	32	26	26
Cobalt	18	20	17	16
Copper	180 J	160 J	160	140
Lead	7.2	3.3	8.8	8.6
Nickel	14	13	13	13
Selenium	0.2 U	0.2 U	0.2 U	0.2 U
Silver	7	1.3	5.5	5.3
Thallium	0.48 U	0.47 U	0.48 U	0.47 U
Tin	7.1 J	4 U	5.5 J	4.7 J
Vanadium	120	170	130	120
Zinc	88 J	66 J	100 J	89 J
Mercury	0.43	0.034	0.16	0.17

APPENDIX B.2
SUBSURFACE SOIL

APPENDIX B

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID	**29SB07**	**29SB08**	**29SB08**	**29SB08**	**29SB09**	**29SB09**	**29SB10**	**29SB10**
Sample ID	**29SB07-01**	**29SB08-01**	**29SB08-01D**	**29SB08-02**	**29SB09-01**	**29SB09-02**	**29SB10-01**	**29SB10-02**
Sample Depth (ft bgs)	**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**	**3.0 - 5.0**	**1.0 - 3.0**	**3.0 - 5.0**	**1.0 - 3.0**	**3.0 - 5.0**
Sampling Date	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**
Metals (mg/kg)								
Antimony	0.31 U	0.31 J	0.38 J	0.63 U	0.38 U	0.64 U	0.62 U	0.21 U
Arsenic	3.2	0.44 J	0.35 U	2.7	0.32 U	0.36 U	1.4	0.33 U
Barium	49	67	58	14	70	75	55	69
Beryllium	0.087 J	0.16 J	0.15 J	0.075 U	0.14 J	0.19 J	0.2 J	0.12 J
Cadmium	0.14 J	0.88	0.76	0.056 U	0.28 J	0.6	1.1	0.54
Chromium	14	13 J	24 J	4.4	11	13	19	4
Cobalt	4.7	16	15	0.95 J	12	23	16	6.8
Copper	31 J	92 J	88 J	8.2 J	62 J	100 J	100 J	57 J
Lead	3.7	2.2	0.65	0.67 U	1.1	1	2.5	1.2
Nickel	5.2	8.1	9	1.8 U	4.6	8.1	8.4	2.4 J
Selenium	0.23 U	0.22 U	0.21 U	0.29 U	0.19 U	0.22 U	0.28 J	0.2 U
Silver	0.11 U	0.086 U	0.092 U	0.055 U	0.14 U	0.17 U	0.1 U	0.19 U
Thallium	0.54 U	0.51 U	0.5 U	0.64 U	0.46 U	0.51 U	0.5 U	0.47 U
Tin	4.6 U	4.3 U	4.2 U	5.5 U	3.9 U	4.3 U	4.2 U	4 U
Vanadium	48	200	180	11	99	210	180	58
Zinc	12 R	55 J	49 J	3.8 R	64 J	56 J	57 J	55 J
Mercury	0.024 J	0.008 J	0.0041 U	0.006 J	0.005 J	0.013 J	0.013 J	0.0074 J

APPENDIX B

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID	**29SB11**	**29SB11**	**29SB12**	**29SB12**	**29SB12**	**29SB13**	**29SB13**	**29SB13**
Sample ID	**29SB11-01**	**29SB11-02**	**29SB12-01**	**29SB12-01D**	**29SB12-02**	**29SB13-01**	**29SB13-02**	**29SB13-02D**
Sample Depth (ft bgs)	**1.0 - 3.0**	**3.0 - 5.0**	**1.0 - 3.0**	**1.0 - 3.0**	**3.0 - 5.0**	**1.0 - 3.0**	**3.0 - 5.0**	**3.0 - 5.0**
Sampling Date	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**
Metals (mg/kg)								
Antimony	0.9 U	0.68 U	0.22 U	1 U	0.49 U	0.59 UJ	0.87 UJ	0.75 UJ
Arsenic	0.57 J	3.8	2.7	2.6	1.9	0.33 U	1.1 J	1.1 J
Barium	61	13	44	40	55	70	68	86
Beryllium	0.19 J	0.066 U	0.16 J	0.22 J	0.16 J	0.22 J	0.26 J	0.26 J
Cadmium	0.8	0.065 J	0.68	0.88	1.4	0.85	1.3	0.95
Chromium	19	3.8	13	17	19	25	120	150
Cobalt	19	0.81 J	8.6	11	14	25	39	52
Copper	230 J	7.3 J	110 J	120 J	150 J	200	110 J	190 J
Lead	1.6	0.71	1.4	1.1	3.9	3.9	1.2	0.87
Nickel	15	1.5 J	6.6	10	11	12	34 J	51 J
Selenium	0.22 U	0.24 U	0.21 U	0.22 U	0.22 U	0.2 U	0.56 U	0.91 U
Silver	0.19 U	0.048 U	0.055 J	0.083 U	2.7	0.13 U	0.12 U	0.098 U
Thallium	0.51 U	0.57 U	0.49 U	0.51 U	0.51 U	0.47 U	0.55 U	0.53 U
Tin	4.4 U	4.8 U	4.2 U	4.4 U	4.3 U	4 U	4.7 U	4.5 U
Vanadium	140	9.5	80	110	110	130	220	230
Zinc	62 J	3.5 R	26 J	45 J	68 J	50 J	65 J	92 J
Mercury	0.013 J	0.0054 J	0.012 J	0.0082 J	0.11	0.0094 J	0.046	0.027

APPENDIX B

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 29-INDUSTRIAL WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Site ID	**29SB13**	**29SB13**	**29SB14**	**29SB14**	**29SB14**	**29SB14**
Sample ID	**29SB13-03**	**29SB13-04**	**29SB14-01**	**29SB14-02**	**29SB14-03**	**29SB14-04**
Sample Depth (ft bgs)	**5.0 - 7.0**	**7.0 - 9.0**	**1.0 - 3.0**	**3.0 - 5.0**	**5.0 - 7.0**	**7.0 - 9.0**
Sampling Date	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**	**02/15/08**
Metals (mg/kg)						
Antimony	0.48 UJ	0.78 UJ	0.35 UJ	0.67 UJ	0.8 UJ	0.5 UJ
Arsenic	0.5 J	0.84 J	2.8	0.53 J	0.41 J	0.34 U
Barium	92	70	36	110	51	49
Beryllium	0.24 J	0.25 J	0.13 J	0.3 J	0.65	0.19 J
Cadmium	0.8	1.3	0.59	1.1	0.6 J	0.48 J
Chromium	140	130	12	39	6.5	15
Cobalt	53	27	7	20	6.6	6.1
Copper	130	150	84	130	21	31
Lead	1.1	1.1	1.4	0.99	0.5 U	2.2
Nickel	53	36	6.1	19	13	7.7
Selenium	0.55 U	0.55 U	0.2 U	0.25 U	0.24 U	0.21 U
Silver	0.12 U	0.077 U	0.21 U	0.051 U	0.048 U	0.31 U
Thallium	0.54 U	0.53 U	0.47 U	0.6 U	0.56 U	0.49 U
Tin	4.6 U	4.5 U	4 U	5.1 U	4.8 U	4.2 U
Vanadium	220	210	62	130	130	54
Zinc	77 J	83 J	29 J	76 J	47 J	57 J
Mercury	0.025	0.026	0.021 J	0.0049 U	0.01 J	0.0085 J

APPENDIX B.3
QUALITY ASSURANCE / QUALITY CONTROL

APPENDIX B

QA/QC ANALYTICAL RESULTS
SWMU 29 - INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PR

Sample ID	**ER07**	**FB01**	**FB02**
Sampling Date	**02/15/08**	**02/16/08**	**02/16/08**
Metals (ug/L)			
Antimony	3.7 U	3.7 U	3.7 U
Arsenic	5.9 U	5.9 U	5.9 U
Barium	2 U	2 U	2.3 J
Beryllium	0.2 U	0.2 U	0.2 U
Cadmium	0.53 U	0.53 U	0.53 U
Chromium	1.3 U	1.3 U	1.7 U
Cobalt	1.2 U	1.2 U	1.2 U
Copper	2.2 U	2.8 U	9.2 U
Lead	2.3 U	2.3 U	2.3 U
Nickel	1.6 U	1.6 U	1.6 U
Selenium	3.6 U	3.6 U	3.6 U
Silver	0.51 U	0.51 U	0.77 J
Thallium	4.6 U	4.6 U	4.6 U
Tin	3.2 U	3.2 U	3.2 U
Vanadium	1.8 U	1.8 U	1.8 U
Zinc	8.4 U	8.4 U	160
Mercury	0.08 U	0.08 U	0.08 U

APPENDIX C
2008 RFI DATA VALIDATION SUMMARIES

APPENDIX C.1
TEST AMERICA SAVANNAH SDG 34322-1

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

April 9, 2008
SDG# SWMU34322-1, Test America-Savannah
NAPR SWMU 29, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU34322-1. The data validation was performed in accordance with the SW-846 meth ɔds utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the samples in this SDG (SW-846 methods 6010B & 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	Metals
29SB01-00	680-34322-1	soil	X
29SB07-01	680-34322-2	soil	X
29SB08-00	680-34322-3	soil	X
29SB08-01	680-34322-4	soil	X
29SB08-01D	680-34322-5	soil	X
29SB08-02	680-34322-6	soil	X
29SB09-00	680-34322-7	soil	X
29SB09-01	680-34322-8	soil	X
29SB09-02	680-34322-9	soil	X
29SB10-00	680-34322-10	soil	X
29SB10-01	680-34322-11	soil	X
29SB10-02	680-34322-12	soil	X
29SB11-00	680-34322-13	soil	X
29SB11-01	680-34322-14	soil	X
29SB11-02	680-34322-15	soil	X
29SB12-00	680-34322-16	soil	X
29SB12-01	680-34322-17	soil	X
29SB12-01MS	680-34322-17MS	soil	X
29SB12-01MSD	680-34322-17MSD	soil	X
29SB12-01D	680-34322-18	soil	X
29SB12-02	680-34322-19	soil	X
29SB13-00	680-34322-20	soil	X

The following quality control samples were provided with this SDG: sample 29SB08-01D-field duplicate of sample 29SB08-01; sample 29SB12-01D-field duplicate of sample 29SB12-01.

The samples were evaluated based ɔn the following criteria:

- Data Completeness *
- Technical Holding Times *
- Initial/Continuing Calibrations *
- CRDL Standards *
- ICSA/ICSAB Standards *
- Blanks
- Laboratory Control Samples *
- Matrix Spike Recoveries *
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated serial dilution exhibited non-compliant %Ds for two analytes. Positive results for the analytes cobalt and nickel were qualified as estimated J.

The two field duplicate pairs exhibited non-compliant RPDs. The reported results for zinc in the field duplicate pair of sample 29SB12-01 were qualified as estimated J and the reported results for chromium in the field duplicate pair of sample 29SB08-01 were qualified as estimated J..

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. No resubmissions were required.

Technical Holding Times

According to chain of custody records, sampling was performed on 2/15/08 and samples were received at the laboratory 2/19/08. Sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration.

Blank ID	Analyte	Concentration	Action Level	Q Flag
PBlk 1- soils	lead	0.388J mg/Kg	RL	U at reported value
CCB – (1-10, 13, 14)	antimony	3.166J ug/L – 0.3166 mg/Kg	RL	U at reported value
	nickel	2.438J ug/L – 0.2438 mg/Kg	RL	U at reported value
	selenium	3.452J ug/L – 0.3452 mg/Kg	RL	U at reported value
	silver	0.824J ug/L – 0.0842 mg/Kg	RL	U at reported value
PBLK 2 – soils	silver	0.040J mg/Kg	RL	U at reported value
CCB (11-12)	antimony	4.257J ug/L – 0.4257 mg/Kg	RL	U at reported value
CCB (15-20)	antimony	2.448J ug/L – 0.2448 mg/Kg	RL	U at reported value
FB02	silver	0.77J ug/L – 0.077mg/Kg	RL	U at reported value
	zinc	160 ug/L – 16 mg/Kg	10X Blank Level	J

Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
29SB08-02	lead	U up to action level
29SB08-02	nickel	
29SB07-00, 29SB08-02, 29SB10-00, 29SB11-00	selenium	
all samples	antimony	
all samples	silver	
all except 29SB07-01, 29SB08-02 and 29SB11-02	zinc	J
29SB07-01, 29SB08-02, 29SB11-02	zinc	R

Serial Dilutions

Metals

The serial dilution of sample 29SB08-02 exhibited non-compliant %Ds for cobalt and nickel that required qualification in the field samples. A summary of this non-compliance and affected samples are noted in the following table.

SD	Analytes	Samples	%D	Q Flag
29SB08-02	cobalt	all soil samples	11.4%	J+
	nickel		11.8%	

Field Duplicates

Metals

The field duplicate pair of samples 29SB12-01 and 29SB12-01D exhibited non-compliant reproducibility for zinc (RPD > 35%). Therefore, the reported positive results for zinc in the field sample and field duplicate were qualified as estimated J. The field duplicate pair of samples 29SB08-01 and 29SB08-01D exhibited non-compliant reproducibility for chromium (RPD > 35%). Therefore, the reported positive results for chromium in the field sample and field duplicate were qualified as estimated J.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

Metals

Sample ID	Analyte	Results	Q flag
29SB08-02	lead	+J up to CRDL	U at reported value
29SB08-02	nickel		
29SB07-00, 29SB08-02, 29SB10-00, 29SB11-00	selenium		
all samples	antimony		
all samples	silver		
29SB07-01, 29SB08-02, 29SB11-02	zinc	+ >MDL < blank level	R
all soil samples	zinc	+ >blank level up to 10X blank level	J
29SB12-01 and 29SB12-01D	zinc	+	J
29SB08-01 and 29SB08-01D	chromium	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
-	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U	The sample result for the blank contaminant is greater than the sample RL and is less than 5X (10X for common laboratory contaminants) the blank value.
CRQL	The sample result for the blank contaminant is less than the sample RL and is less than 5X (10X for common laboratory contaminants) the blank value.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Glossary of Qualification Flags and Abbreviations

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.
Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action - The sample result is greater than the RL and greater than ten times (10X) the blank value.

U - The sample result is greater than or equal to the MDL but less than or equal to the RL when the field blank result is greater than the RL - result is reported as non-detect at the reported concentration.

R - Sample result is greater than the RL and less than the field blank value when the field blank result is greater than the RL.

J - Sample result is greater than the field blank value but less than 10X the field blank value when field blank result is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

APPENDIX C.2
TEST AMERICA SAVANNAH SDG 34322-2

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

April 9, 2008
SDG# SWMU34322-2, Test America-Savannah
NAPR SWMU 29, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU34322-2. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the samples in this SDG (SW-846 methods 6010B & 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	Metals
ER07	680-34322-32	water	X
29SB13-01	680-34322-21	soil	X
29SB13-02	680-34322-22	soil	X
29SB13-02MS	680-34322-22MS	soil	X
29SB13-02MSD	680-34322-22MSD	soil	X
29SB13-02D	680-34322-23	soil	X
29SB13-03	680-34322-24	soil	X
29SB13-04	680-34322-25	soil	X
29SB14-00	680-34322-26	soil	X
29SB14-00MS	680-34322-26MS	soil	X
29SB14-00MSD	680-34322-26MSD	soil	X
29SB14-00D	680-34322-27	soil	X
29SB14-01	680-34322-28	soil	X
29SB14-02	680-34322-29	soil	X
29SB14-03	680-34322-30	soil	X
29SB14-04	680-34322-31	soil	X

The following quality control samples were provided with this SDG: sample ER07-equipment blank; sample 29SB13-02D-field duplicate of sample 29SB13-02; sample 29SB14-00D-field duplicate of sample 29SB14-00.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- Initial/Continuing Calibrations *
- CRDL Standards *

- ICSA/ICSAB Standards *
- Blanks
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals

Blank contamination was noted and qualification was required in the samples in this SDG.

Two of the submitted MS/MSD pairs exhibited non-compliant recoveries for the analyte antimony. Reported results in the soil samples were qualified as estimated J/UJ.

One of the field duplicate pairs exhibited a non-compliant RPD for the analytes copper and nickel. The reported results for copper and nickel in the field duplicate pair were qualified as estimated.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. No resubmissions were required.

Technical Holding Times

According to chain of custody records, sampling was performed on 2/15/08 and samples were received at the laboratory 2/19/08. Sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration.

Blank ID	Analyte	Concentration	Action Level	Q Flag
PBlk – soils	lead	0.320J mg/Kg	RL	U at reported value
ICB – soils	selenium	4.335J ug/L – 0.4335 mg/Kg	RL	U at reported value
	silver	0.783J ug/L – 0.0783 mg/Kg	RL	U at reported value
CCB – soils	antimony	4.257J ug/L – 0.4257 mg/Kg	RL	U at reported value
FB02	zinc	160 ug/L – 16 mg/Kg	10X Blank Level	J

Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
all soil samples	selenium	U up to action level
29SB13-01, 29SB13-02, 29SB13-02D, 29SB13-03, 29SB13-04, 29SB14-01, 29SB14-04	silver	
29SB14-03	lead	
all soil samples	antimony	
all soil samples	zinc	J

Matrix Spike

Metals

The matrix spikes of samples 29SB13-02 and 29SB14-00 exhibited non-compliant recoveries for antimony that required qualification in the field samples. A summary of this non-compliances and affected samples are noted in the following table.

MS/SD	Analytes	Samples	%R	Q Flag
29SB13-02	antimony	all soil samples	66%/74%	J/UJ
29SB14-00	antimony		73%/70%	

Field Duplicates

Metals

The field duplicate pair of samples 29SB13-02 and 29SB13-02D exhibited non-compliant reproducibility for copper and nickel (RPD > 35%). Therefore, the reported positive results for copper and nickel in the field sample and field duplicate were qualified as estimated J.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

Metals

Sample ID	Analyte	Results	Q flag
all soil samples	selenium	+J up to action level	U at reported value
29SB13-01, 29SB13-02, 29SB13-02D, 29SB13-03, 29SB13-04, 29SB14-01, 29SB14-04	silver		
29SB14-03	lead		
all soil samples	antimony		
all soil samples	zinc	+ up to 10X blank level	J
all soil samples	antimony	+/-	J/UJ
29SB13-02, 29SB13-02D	copper nickel	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
-	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U	The sample result for the blank contaminant is greater than the sample RL and is less than 5X (10X for common laboratory contaminants) the blank value.
CRQL	The sample result for the blank contaminant is less than the sample RL and is less than 5X (10X for common laboratory contaminants) the blank value.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Glossary of Qualification Flags and Abbreviations

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.
Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action - The sample result is greater than the RL and greater than ten times (10X) the blank value.

U - The sample result is greater than or equal to the MDL but less than or equal to the RL when the field blank result is greater than the RL - result is reported as non-detect at the reported concentration.

R - Sample result is greater than the RL and less than the field blank value when the field blank result is greater than the RL.

J - Sample result is greater than the field blank value but less than 10X the field blank value when field blank result is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

APPENDIX C.3
TEST AMERICA SAVANNAH SDG 34320-2

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

April 9, 2008
SDG# SWMU34320-2, Test America-Savannah
NAPR SWMU 14, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU34320-2. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (for 8260B: Rev 2, October 2006-SOP #HW-24 and for 8270D-Rev 3, October 2006-SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganics methods in this SDG (SW-846 methods 6010B, 7471A, 9045C & 9060). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	LL-PAH	Metals	PCB	TOC	pH
FB01	680-34320-28	water	X	X	X	X		
FB02	680-34320-29	water	X	X	X	X		
14D-SB10-00	680-34320-21	soil		X	X		X	X
14D-SB10-01	680-34320-22	soil		X	X			
14D-SB11-00	680-34320-23	soil		X	X		X	X
14D-SB11-00D	680-34320-24	soil		X	X			
14D-SB11-01	680-34320-35	soil		X	X			
ER08	680-34320-26	water		X	X			
ER09	680-34320-27	water		X	X			

The following quality control samples were provided with this SDG: Samples FB01 and FB02-field blanks; Samples ER08 and ER09-equipment blanks; Sample 14D-SB11-00D-field duplicate of sample 14D-SB11-00.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- GC/MS Tuning *
- GC Performance *
- Initial/Continuing Calibrations
- Blanks
- Internal Standards *

- Surrogate Recoveries *
- Laboratory Control Samples *
- Matrix Spike Recoveries *
- Matrix Duplicate RPDs
- Field Duplicates
- Identification/Quantitation
- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria.

VOA

The continuing calibration exhibited compounds with high %D and low RRF values that resulted in qualifications to the data.

Positive results were exhibited in one of the field blanks, the laboratory re-analyzed the sample to confirm the results. The results were confirmed; the results were used from the initial analysis.

SVOA

No qualifications were required to be added to the data.

Metals

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix duplicate exhibited non-compliant %Ds for one analyte. Positive and non-detect results for the analyte copper were qualified as estimated J in the field samples.

The field duplicate pair exhibited non-compliant RPDs. The reported results for chromium and cobalt were qualified as estimated J in the field duplicate pair of sample 14D-SB11-00.

Wet Chemistry

No qualifications were required.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 02/16/08 and samples were received at the laboratory 02/19/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Initial/Continuing Calibration

VOA

Calibration standards exhibited %Ds and RRFs that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 02/25/08	iodomethane	26.5%	FB01, FB02	J/UJ
	isobutyl alcohol	0.01715		J/R

Blanks

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration.

Blank ID	Analyte	Concentration	Action Level	Q Flag
CCB – soils	antimony	5.444J mg/Kg	RL	U at reported value
	silver	0.406J mg/Kg	RL	U at reported value
CCB-waters	copper	2.360J ug/L	RL	U at reported value
	chromium	1.728J ug/L	RL	U at reported value
FB02	zinc	160 ug/L – 16 mg/Kg	10X Blank Level	J
ER08	cadmium	0.99 ug/L – 0.099 mg/Kg	RL	U at reported value

Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
14D-SB10-00, 14D-SB10-01, 14DSB11-00, 14D-SB11-00D, 14D-SB11-01	antimony	U up to action level
14D-SB10-01, 14DSB11-00, 14D-SB11-00D, 14D-SB11-01	silver	
ER08, ER09, FB01, FB02	copper	
ER09, FB02	chromium	
14D-SB10-00, 14D-SB10-01, 14DSB11-00, 14D-SB11-00D, 14D-SB11-01	cadmium	
all field samples	zinc	J

Matrix Duplicates

Metals

The matrix duplicate of sample 14D-SB11-01 exhibited a non-compliant %D for copper that required qualification in the field samples. A summary of this non-compliance and affected samples are noted in the following table.

MD	Analytes	Samples	RPD	Q Flag
14D-SB11-01	copper	all soil samples	47.5%	J/UJ

Field Duplicates

Metals

The field duplicate pair of samples 14D-SB11-00 and 14D-SB11-00D exhibited non-compliant reproducibility for chromium and cobalt (RPD > 35%). Therefore, the reported positive results for these analytes were qualified as estimated J in both the field sample and the field duplicate.

Identification/Quantitation

VOA

Sample FB02 was reanalyzed to confirm positive results that were detected in the initial analysis. The results were confirmed; therefore the reanalysis was rejected and the initial analysis was used.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q-Flag
FB01, FB02	iodomethane	+/-	J/UJ
FB01, FB02	isobutyl alcohol	+/-	J/R
FB02RE	all results	+/-	R

SVOA

Sample ID	Compound	Results	Q flag
No qualifications required.			

Metals

Sample ID	Analyte	Results	Q flag
14D-SB10-00, 14D-SB10-01, 14DSB11-00, 14D-SB11-00D, 14D-SB11-01	antimony	+J up to CRDL	U at reported value
14D-SB10-01, 14DSB11-00, 14D-SB11-00D, 14D-SB11-01	silver		
ER08, ER09, FB01, FB02	copper		
ER09, FB02	chromium		
14D-SB10-00, 14D-SB10-01, 14DSB11-00, 14D-SB11-00D, 14D-SB11-01	cadmium		
all soil samples	zinc	+ >blank level up to 10X blank level	J
all soil samples	copper	+/-	J/UJ
14D-SB11-00 and 14D-SB11-00D	chromium cobalt	+	J

Wet Chemistry

Sample ID	Parameter	Results	Q flag
No qualifications required.			

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
-	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U	The sample result for the blank contaminant is greater than the sample RL and is less than 5X (10X for common laboratory contaminants) the blank value.
CRQL	The sample result for the blank contaminant is less than the sample RL and is less than 5X (10X for common laboratory contaminants) the blank value.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Glossary of Qualification Flags and Abbreviations

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.
Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action - The sample result is greater than the RL and greater than ten times (10X) the blank value.

U - The sample result is greater than or equal to the MDL but less than or equal to the RL when the field blank result is greater than the RL - result is reported as non-detect at the reported concentration.

R - Sample result is greater than the RL and less than the field blank value when the field blank result is greater than the RL.

J - Sample result is greater than the field blank value but less than 10X the field blank value when field blank result is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

APPENDIX C.4
PUERTO RICAN CHEMIST CERTIFICATIONS

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-34320-2,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-34322-1,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-34322-2,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

APPENDIX D
PRELIMINARY HUMAN HEALTH RISK CALCULATIONS

TABLE D-1
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 29 (INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS)
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL)
Surface Soil									
	Antimony	mg/kg	1.56	ND	4.5	4.50	mg/kg	Max	Less than 5 positive detections
	Arsenic	mg/kg	1.97	4.84 (NP)	11	4.84	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
	Cadmium	mg/kg	1.21	2.79 (NP)	5.4	2.79	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL

EPC = Exposure Point Concentration
UCL = Upper Confidence Level
ND = Not determined

(1) Distribution and 95% UCL were calculated by ProUCL 4.00.02 and are indicated as follows:
(NP) - Non-parametric distribution and 95% UCL
(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL).

TABLE D-2

SUMMARY OF EXPOSURE PARAMETERS
SWMU 29 (INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS)
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Parameter	Units	Future Adult Residents RME	Future Young Child Residents RME
Soil			
Ingestion Rate of Soil (IR-S)	mg/day	100 USEPA, 1991	200 USEPA, 1991
Fraction Ingested from Source (Fi)	NA	1 Prof Judge	1 Prof Judge
Exposure Frequency (EF)	days/year	350 USEPA, 1991	350 USEPA, 1991
Exposure Duration (ED)	years	24 USEPA, 1997	6 USEPA, 1997
Exposure Time (ET)	hours/day	24 Prof Judge	24 Prof Judge
Surface Area Available for Contact (SA)	cm2/day	5,700 USEPA, 2004	2,800 USEPA, 2004
Respiration Rate (RR)	m3/hour	1.27 USEPA, 1997	0.69 USEPA, 1997
Conversion Factor (CF)	kg/mg	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989
Averaging Time (Non-Cancer) (AT-N)	days	8,760 USEPA, 1989	2,190 USEPA, 1989
Other Parameters			
Body Weight (BW)	kg	70 USEPA, 1997	15 USEPA, 1997
Soil to Skin Adherence Factor (AF)	mg/cm2	0.07 USEPA, 1997	0.2 USEPA, 1997
Particulate Emission Factor (PEF)	m3/kg	1.32E+09 Cowherd, et al., 1995	1.32E+09 Cowherd, et al., 1995
Averaging Time (Cancer) (AT-C)	days	25,550 USEPA, 1989	25,550 USEPA, 1989

Notes:

RME - Reasonalble Maximum Exposure
CT - Central Tendency

ABS - Absorption Factors
USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual
(Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.
The following USEPA Region III default absorbance factors will be applied in the absence of reference values from
USEPA, 2001 to estimate dermal intake of COPCs in soil and sediment (USEPA, 1995):
0.05% and 3.0% - VOAs (chemical specific)
1.0% - Inorganics
3.0% - Dioxins / Furans

Prof Judge - Professional Judgment

Cowherd, et al., 1995: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/002.
USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A) Interim Final
USEPA, 1991. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual Supplemental Gudiance "Standard Default Exposure Factors
USEPA, 1997. Exposure Factors Handbook. Vol. 1: General Factors ORD. EPA/600/P-95/002Fa.

TABLE D-3
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 29 (INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS)
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Antimony	--	--	--	--	--	Whole Body, CVS	0.02	--	<0.01	0.02
			Arsenic	3.4E-06	--	4.1E-07	--	3.8E-06	Skin / CVS	0.02	--	<0.01	0.02
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Chemical Total	3.4E-06	--	4.1E-07	--	3.8E-06		0.05	--	<0.01	0.05
		Exposure Point Total						3.8E-06					0.05
	Exposure Medium Total							3.8E-06					0.05
	Air	Fugative Dust	Antimony	--	--	--	--	--	NA	--	--	--	--
			Arsenic	--	7.9E-09	--	--	7.9E-09	NA	--	--	--	--
			Cadmium	--	1.9E-09	--	--	1.9E-09	Kidney	--	--	--	--
			Chemical Total	--	9.8E-09	--	--	9.8E-09		--	--	--	--
		Exposure Point Total						9.8E-09					--
	Exposure Medium Total							9.8E-09					--
Surface Soil Total								**3.83E-06**					**0.05**
Adult Residents Total								**3.83E-06**					**0.05**

Total Risk Across Surface Soil	3.8E-06	Total Hazard Index Across Surface Soil	0.05
Total Risk Across All Media and All Exposure Routes	3.8E-06	Total Hazard Index Across All Media and All Exposure Routes	0.05

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System

All Exposure Routes:		**Oral and Dermal Exposure Routes:**	
Total Whole Body HI =	0.02	Oral / Dermal Whole Body HI =	0.02
Total Cardiovascular System HI =	0.04	Oral / Dermal Cardiovascular System HI =	0.04
Total Skin HI =	0.02	Oral / Dermal Skin HI =	0.02
Total Kidney HI =	<0.01	Oral / Dermal Kidney HI =	<0.01

Ingestion Pathway Intake:
CDI (mg/kg-day) = C x IR x CF x Fi x EF x ED x 1/BW x 1/AT

Dermal Pathway Intake:
CDI (mg/kg-day) = C x CF x SA x AF x ABS x EF x ED x 1/BW x1/AT

Carcinogenic Risk =
ILCR = ∑CDI*CSF

Noncarcinogenic Risk =
HQ = ∑CDI/RfD

TABLE D-4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 29 (INDUSTRIAL AREA WWTP SLUDGE DRYING BEDS)
FULL RFI
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Antimony	--	--	--	--	--	Whole Body, CVS	0.14	--	<0.01	0.15
			Arsenic	8.0E-06	--	6.7E-07	--	8.6E-06	Skin / CVS	0.21	--	0.02	0.22
			Cadmium	--	--	--	--	--	Kidney	0.07	--	<0.01	0.08
			Chemical Total	8.0E-06	--	6.7E-07	--	8.6E-06		0.42	--	0.02	0.45
		Exposure Point Total						8.6E-06					0.45
	Exposure Medium Total							8.6E-06					0.45
	Air	Fugative Dust	Antimony	--	--	--	--	--	NA	--	--	--	--
			Arsenic	--	5.0E-09	--	--	5.0E-09	NA	--	--	--	--
			Cadmium	--	1.2E-09	--	--	1.2E-09	Kidney	--	--	--	--
			Chemical Total	--	6.2E-09	--	--	6.2E-09		--	--	--	--
		Exposure Point Total						6.2E-09					--
	Exposure Medium Total							6.2E-09					--
Surface Soil Total								**8.63E-06**					**0.45**
Young Child Residents Total								**8.63E-06**					**0.45**

Total Risk Across Surface Soil	8.6E-06	Total Hazard Index Across Surface Soil	0.45
Total Risk Across All Media and All Exposure Routes	8.6E-06	Total Hazard Index Across All Media and All Exposure Routes	0.45

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System

All Exposure Routes:		**Oral and Dermal Exposure Routes:**	
Total Whole Body HI =	0.1	Oral / Dermal Whole Body HI =	0.1
Total Cardiovascular System HI =	0.4	Oral / Dermal Cardiovascular System HI =	0.4
Total Skin HI =	0.2	Oral / Dermal Skin HI =	0.2
Total Kidney HI =	0.1	Oral / Dermal Kidney HI =	0.1

Ingestion Pathway Intake:
CDI (mg/kg-day) = C x IR x CF x Fi x EF x ED x 1/BW x 1/AT

Dermal Pathway Intake:
CDI (mg/kg-day) = C x CF x SA x AF x ABS x EF x ED x 1/BW x1/AT

Carcinogenic Risk =
ILCR = ∑CDI*CSF

Noncarcinogenic Risk =
HQ = ∑CDI/RfD