Final

RCRA Facility Investigation Work Plan

SWMU 68

Naval Activity Puerto Rico
RCRA/HSWA Permit No. PR2170027203
Ceiba, Puerto Rico

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Norfolk, Virginia

Contract No. N62470-02-D-3052
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FINAL

RCRA FACILITY INVESTIGATION WORK PLAN
SWMU 68

NAVAL ACTIVITY PUERTO RICO
RCRA/HSWA PERMIT NO. PR2170027203
CEIBA, PUERTO RICO

CONTRACT TASK ORDER 0121

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Prepared for:

DEPARTMENT OF THE NAVY
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ATLANTIC DIVISION
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TABLE OF CONTENTS

Page

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

APA	Arial Photo Analysis
Baker	Baker Environmental, Inc.
bgs	below ground surface
BRAC	Base Realignment and Closure
CLEAN	Comprehensive Long-Term Environmental Action Navy
CRQL	Contract Required Quantitation Limit
CTO	Contract Task Order
ECP	Environmental Condition of Property
DRO	Diesel Range Organics
FID	flame ionization detector
FMTUD	Facility Management Transportation and Utility Division
GIS	Geographic Information System
GPS	Global Positioning System
GRO	Gasoline Range Organics
IDW	Investigation Derived Waste
LANTDIV	Naval Facilities Engineering Command Atlantic Division
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MCL	Maximum Contaminant Level
Mg/kg	milligrams per kilogram
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPR	Naval Activity Puerto Rico
NTR	Navy Technical Representative
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PI	Photo Identified
PID	Photoionization Detector
PMO	Project Management Office
PRG	Preliminary Remediation Goal
PVC	polyvinyl chloride
PWD	Public Works Department
QA/QC	Quality Assurance/Quality Control

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SE	Southeast
SVOC	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This document presents the activities required for the performance of a Phase I Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) at Solid Waste Management Unit (SWMU) 68 – Former Southern Fire Training Area located at Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico (Figure 1-1).

This document was prepared by Baker Environmental, Inc. (Baker), for the Naval Facilities Engineering Command Atlantic Division (LANTDIV). This work plan is being developed under Contract Task Order (CTO) 121 under the LANTDIV Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Number N62470-02-D-3052.

1.1 Site History

This site [also known as Environmental Condition of Property (ECP) Site 14] is located at the southwest end of the Ofstie Airfield within a flat lying open area surrounded by secondary growth vegetation as shown on Figure 1-2. The Aerial Photography Analysis (APA) identified this area as photo identified (PI) Site 19, due to the observation of a circular, graded area with an aircraft fuselage and two stained areas consistent with a fire training area from 1961-1964 (see Figure 1-3). The records review did not identify a fire training area at this location. Interviews confirmed former use as a fire training area; dates of usage and fuel used unknown but were suspected to be in the 1950s and 1960s. The physical site inspection conducted during the ECP observed a disturbed circular area consistent with that of a fire training area, but no stressed vegetation or stained soils.

1.2 Objectives

The purpose of this work plan is to make a determination of whether or not the environment has been impacted due to past operations at SWMU 68. A Phase I RFI is required as outlined in the NAPR RCRA 7003 Order being issued by the United States Environmental Protection Agency (USEPA) Region II. Therefore, this RCRA Order provides for the performance of a records review of available information describing the activities and operations of these sites along with the development of a work plan, field investigation, and reporting on the findings of the investigation with recommendations of follow-on actions necessary to ensure protection of human health and the environment.

The investigation area at SWMU 68 is shown on Figure 1-2. The objectives of the investigation to be performed at SWMU 68 are outlined below.

An investigation consisting of the collection of soil and groundwater samples will be performed at SWMU 68 to further determine whether the past operations of this SWMU have impacted the environment.

1.3 Organization of the Work Plan

This work plan is organized into seven sections. Section 1.0 of this document includes the site history and objectives of this RFI. Section 2.0 provides a description of the current conditions and usage of the site, as well as a summary of previous investigations. Section 3.0 provides a description of the scope of investigations that will be utilized during the upcoming fieldwork. The proposed scope of investigations include soil sampling and analysis program, temporary monitor well installation program, groundwater sampling and analysis program, and quality assurance/quality control (QA/QC) samples, as well as other investigation considerations. The reporting activities that will be conducted following the completion of the field investigation are described in Section 4.0.

Section 5.0 discusses the proposed project schedule that will be followed for this data collection investigation. The site management structure that will be utilized during this investigation, including project team responsibilities and field reporting requirements, is presented in Section 6.0, while Section 7.0 presents the report references.

2.0 CURRENT CONDITIONS

The following sections provide a discussion of the current conditions that exist at SWMU 68 along with any previous investigations that may have been conducted.

2.1 Current Site Conditions/Usage

The former southern fire training area is currently not utilized, the operational closure of Naval Station Roosevelt Roads occurred on March 31, 2004. The area consists of a limited vegetation circular area formerly bisected by a road running generally east to west. Many depressed areas can be found at the site containing differing vegetation.

2.2 Previous Investigations

The Phase I/II Environmental Condition of Property (ECP) investigation performed in 2004 noted several depressed areas at this site containing different types of vegetation then the remaining portions of the site (NAVFAC Atlantic, 2005). The depressed areas contained vegetation that appeared in vines, rather then the remaining areas that contained mostly dense tall grass. Also noted within the area were trees around the perimeter of the site.

Three soil borings were advanced at SWMU 68 during the ECP investigation to profile surface and subsurface conditions. Three surface soil and three subsurface soil samples were collected and analyzed for Appendix IX VOCs, SVOCs, metals, and TPH GRO and DRO. Groundwater samples were not collected at SWMU 68 during the ECP investigation.

Results indicated SWMU 68 has locations with higher than background metals concentrations, consistent with a fire training area and a small amount of DRO.

3.0 SCOPE OF INVESTIGATION

Sampling locations presented in this section were identified due to the historical aerial photograph from 1961. Consideration was given to site topography, site features, historical operational features of the facility, and anticipated groundwater flow direction when selecting the sampling locations.

Sample matrices for this investigation are provided as Table 3-1. The sampling locations for SWMU 68 are shown on Figure 3-1. The various investigation elements are described in detail in the subsections that follow.

- Ten surface soil samples will be collected from ten boring locations
- Twenty subsurface soil samples will be collected from the ten boring locations. A minimum of two samples will be collected from different depths at each boring location. One sample will be collected from any area of suspected contamination and the other will be obtained just above the groundwater interface. If suspected contamination stretches across multiple samples than additional samples will be obtained from the boring location.
- Ten groundwater samples will be collected from ten temporary monitor wells installed at each of the ten boring locations.

3.1 <u>Soil Sampling and Analysis Program</u>

Surface and subsurface soil samples will be collected from SWMU 68. The following outlines the specific sampling protocol.

As shown on Figure 3-1, three soil borings will be advanced from the north side of the former roadway and seven soil borings will be advanced south of the former roadway. One surface soil sample (0 to 1 foot bgs) and a minimum of two subsurface soil samples [based on flame ionization detector (FID)/ photo ionization detector (PID) screening and just above the water table] will be collected from each boring location. All the surface and subsurface samples will be analyzed for Appendix IX volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals; Low-level polynuclear aromatic hydrocarbons (PAHs); and total petroleum hydrocarbons (TPH) gasoline range organics (GRO)/ diesel range organics (DRO) as presented in Table 3-1.

The soil sample designations will be as follows. For example, one of the soil borings will be designated 68SB01. Extensions to the sample identification will reflect the depth at which the sample was obtained. For the purposes of this work plan, two-foot discrete depths will be used except for surface soil. Sample identification extensions will follow the pattern shown below.

> 68SB01-00 - 0 to 12 inches below ground surface (bgs) (surface soil)
> 68SB01-01 - 1 to 3 feet bgs
> 68SB01-02 - 3 to 5 feet bgs, etc.

The actual sample depth will be determined in the field.

Samples will be packed in ice and shipped next day air to the "fixed base" laboratory. Because of previously encountered delays associated with sample shipments from Puerto Rico to the United States, additional insurance to cover re-sampling costs should be claimed on the bill of laden. At least one member of the field team will remain on the island until verification by the laboratory of receipt of all shipments. This will minimize any potential re-sampling costs associated with mobilization. Tracking numbers for each shipment will be forwarded to the project manager for assisting in verification of receipt.

All analysis at the laboratory will be performed using current methodologies as presented in Table 3-2. The specific laboratory and third party validator, as well as a certified licensed chemist from Puerto Rico, will be determined at a later date.

3.2 Monitor Well Installation Program

A total of ten temporary monitor wells will be installed within the soil borings at SWMU 68. The locations of these monitoring wells are presented on Figure 3-1.

All temporary monitor wells will be advanced using the 66DT Geoprobe rig capable of direct push and augering. All completed temporary monitor wells will consist of a 1- inch diameter, schedule 40 polyvinyl chloride (PVC), riser with a five-foot screen. Each temporary well will be sealed with plastic sheeting at the surface to prevent inflow of surface water or accidental introduction of foreign material into the hole. A groundwater sample will be obtained from each temporary well after allowing the groundwater to enter the screen overnight. The temporary wells will not be developed.

Each well boring will be sampled and logged as described in Section 3.1.

3.3 Groundwater Sampling and Analysis Program

The groundwater sampling will be used to aid in characterization of the groundwater potentially effected by activities associated with SWMU 68. All groundwater samples will be submitted to the laboratory for analyses including the following:

Ten groundwater samples from the ten boring locations will be analyzed for Appendix IX VOCs, SVOCs, PCBs, and total and dissolved metals; Low-level PAHs; and TPH GRO/DRO (See Table 3-1).

The groundwater will be sampled using a low flow sampling technique. Appendix A includes a detailed description of low flow sampling technique. Field parameters of pH, temperature, turbidity, conductivity, and oxidation-reduction potential will be obtained with appropriate instrumentation during sampling if enough volume of groundwater is present.

Samples will be packed in ice and shipped next day air to the “fixed base” laboratory. Because of previously encountered delays associated with sample shipments from Puerto Rico to the United States, additional insurance to cover re-sampling costs should be claimed on the bill of laden. At least one member of the field team will remain on the island until verification by the laboratory of receipt of all shipments. This will minimize any potential re-sampling costs associated with mobilization. Tracking numbers for each shipment will be forwarded to the project manager for assisting in verification of receipt.

All analyses at the laboratory will be performed using current methodologies as presented in Table 3-1. The specific laboratory and validator, as well as a certified licensed chemist from Puerto Rico, will be determined at a later date.

3.4 Quality Assurance/Quality Control Samples

QA/QC requirements for the investigations are as follows and are identified in sample matrix presented in Table 3-3.

3.4.1 Trip Blanks

Trip blank samples will be required to accompany the samples to the laboratory because there are volatile organic and/or TPH GRO constituent samples scheduled for collection. One trip blank sample will accompany each cooler containing samples requiring the Appendix IX VOC and/or TPH GRO analysis.

3.4.2 Equipment Rinsates

Equipment rinsate samples are collected from analyte-free water rinse of decontaminated equipment. Equipment rinsate blanks will be collected and submitted to a fixed-base analytical laboratory for analysis. The results from the blanks will be used to determine if the sampling equipment was free of contamination. The equipment rinsate samples are analyzed for the same parameters as the related samples.

It is anticipated that a minimum of three equipment rinsates will be collected. The proposed rate of equipment rinsate blank collection will be dependent on the number of field days, the sample count, and the various media collected as defined in EPA guidance. This guidance defines frequency as one sample per day per media or one sample per 20 individual media samples collected, whichever is more frequent. These samples will be associated with the surface soil, subsurface soil, and groundwater sampling equipment. The samples will be obtained from a stainless steel spoon for collection of soil, a split spoon sampler or macro core liner for collection of subsurface soil, and the polyethylene and silicon tubing used during the collection of groundwater. These samples will be analyzed for the analytes presented in Table 3-3.

3.4.3 Field Blanks

Field blank samples consist of the source water used in equipment decontamination procedures. At a minimum, one field blank for each source of water must be collected and analyzed for the same parameters as the related samples. It is anticipated that three different sources of water (i.e., NAPR potable water source, store-bought distilled water, and laboratory-grade de-ionized water) will be utilized for this investigation as shown in Table 3-3.

3.4.4 Field Duplicates

Field duplicate samples of the surface soil, subsurface soil, and groundwater will be collected during the same time the corresponding environmental sample is collected. One duplicate sample will be collected for every 10 environmental samples collected per media.

3.4.5 Matrix Spike/Matrix Spike Duplicates

Matrix Spike/Matrix Spike Duplicates (MS/MSDs) are laboratory derived and are collected to evaluate the matrix effect of the sample upon the analytical methodology. One MS/MSD will be collected for every 20 samples collected of a similar matrix. The sample matrices in the preceding paragraphs specified the collection and analysis of these samples.

3.5 Other Investigation Considerations

3.5.1 Utility Clearance

Fifteen days prior to the initiation of the proposed fieldwork, a digging permit request will be submitted by Baker to the Facility Management Transportation and Utility Division (FMTUD) of the Public Works Department at NAPR. Although utilities are not identified on the Geographic

Information System (GIS) utility layer, all proposed soil borings and temporary monitor well locations will be cleared by the base utility department.

3.5.2 Investigation Derived Wastes (IDW)

The generation of IDW associated with soil sampling and temporary monitor well installation, including soil cuttings and decontamination fluids, will be collected and stored temporarily in 55-gallon drums. However, the soil cuttings from the subsurface soil sampling, as well as from the temporary monitor wells, will be placed back into the boring from which they came, unless contamination is present. As much as possible, soils last out of the hole will be returned first, thereby, approximating original stratigraphy.

Two IDW samples will be collected during this investigation. One composite aqueous sample will be collected from all drums containing decontamination fluid (from sampling equipment and drill rig), and one composite soil sample will be collected from all drums containing drill cuttings. The samples will be analyzed for parameters as shown in Table 3-3, as well as by methods presented in Table 3-2. These samples will provide the necessary data to be able to dispose of the generated IDW at an appropriate disposal facility. Upon completion of the field program, the drums will be moved and stored per the direction of Public Works Department (PWD) personnel. The soil and water IDW will be removed and disposed of from the site by an approved vendor upon receipt and review of the IDW sample analytical data.

3.5.3 Decontamination

The drill rig, including all applicable soil sampling equipment (i.e. macro core samples, split-spoons, etc.), will be decontaminated between each sampling location in accordance with the EPA approved RCRA Facility Investigation Work Plans (Baker, 1995). The remaining contaminant free sampling equipment and materials utilized during this investigation will be disposable.

3.5.4 Surveying

All soil sampling locations have been pre-determined and presented on a figure prior to entering the field. This figure will be loaded into the global positioning system (GPS) unit for locating purposes in the field. This methodology reduces the need for a surveyor to identify the sampling locations in the field. Any of the locations that may need to be field modified will be located utilizing the GPS unit. A transit and rod or survey grade GPS unit will be utilized to obtain top of PVC elevations of the temporary wells for generating groundwater contours used for reporting purposes.

3.5.5 Health and Safety Procedures

The health and safety procedures found in the base RFI work plan (Baker, 1995), will be employed during this investigation.

3.5.6 Chain-of-Custody

Chain-of-Custody procedures will be followed to ensure a documented, traceable link between measurement results and the sample/parameter that they represent. These procedures are intended to provide a legally acceptable record of sample preparation, storage, and analysis.

To track sample custody transfers before ultimate disposition, sample custody will be documented using a similar chain-of-custody form as presented in the base RFI work plan (Baker, 1995).

A chain-of-custody form will be completed for each shipment in which the samples are shipped. After the samples are properly packaged, the shipping container will be sealed and prepared for shipment to the analytical laboratory.

4.0 REPORTING

This section outlines the reporting activities that are associated with the field investigation. The reports shall include at a minimum:

Introduction
Facility Investigation
Physical Characteristics of Study Area
Facility Investigation
Nature and Extent of Contamination
Conclusions and Recommendations
References

The Phase I RFI reports sections are discussed in the following subsection.

4.1 Introduction

The introduction will consist of a discussion of the historical background of any investigations conducted at the SWMUs. The introduction will also provide a regulatory framework for NAPR and the SWMU, as well as a discussion of current conditions.

4.2 Physical Characteristics of Study Area

The physical characteristics of each of the SWMUs will be recorded in the field. Those observations will be photographically recorded and summarized in this section.

4.3 Facility Investigation

The investigation methodologies employed to fulfill the Phase I RFI work plan objectives for the SWMU will be discussed. The sample locations, sample collection and handling procedures, QA/AC procedures, and analytical methods used. This section will also discuss any problems encountered including any deviations from the work plan and problem resolution.

4.4 Nature and Extent of Contamination

The nature and extent of contamination section will present analytical results and interpretation of the data. The soil data will be screened against US EPA Region IX Preliminary Remediation Goals (PRGs) and the ecological surface soil screening values developed for NAPR. The groundwater data will be compared to US EPA Region IX Tap Water PRGs and the Federal maximum contaminant levels (MCLs). Additionally, inorganics will be compared against their respective background values as presented in the Summary Report for Environmental Background Concentrations for Inorganic Compounds (Baker, 2006). The results of the screening of any these criteria will be presented and discussed. Data will be presented on tables and figures with textual explanation. Results of QA/QC procedures will also be presented.

4.5 Conclusions and Recommendations

Information from the nature and extent of contamination will be synthesized into conclusions regarding site conditions. Recommendations will be made from these conclusions as to whether further investigation is needed or the SWMU can proceed toward closeout.

All the documentation generated during the reporting task will be posted to the NAPR web site under the document library. Additionally, all data obtained during the field effort will be incorporated into the web based GIS system currently residing on the NAPR project team web site. Baker will also provide updates of current activities associated with this project in the quarterly RCRA Progress Report for NAPR.

5.0 SCHEDULE

A schedule for the implementation of this work plan, and follow-up reports for the Phase I RFI reports for SWMU 68, is provided as Figure 5-1. It should be noted that this schedule is dependent upon EPA review time. Many other factors can also extend the schedule such as resampling if further re-characterization is required, weather delays in the field, funding is delayed by the Navy, or consensus cannot be reached on how the EPA's comments are to be incorporated.

6.0 SITE MANAGEMENT

An organization chart presenting the proposed staffing for this project is provided on Figure 6-1. This section also outlines the responsibilities and reporting requirements of field personnel and staff.

6.1 Project Team Responsibilities

Ms. Jamie Butler, the Activity Coordinator, will provide senior technical review and administrative support. Ms. Butler's involvement will be to provide senior technical review of project deliverables and to monitor the project schedule and budget.

Mr. Mark Kimes, P.E, Activity Manager for all work in Puerto Rico, will manage the Baker Project Team. His responsibilities will be to direct the technical performance of the project staff, costs and schedule, ensuring that QA/QC procedures are followed during the course of the project. He will maintain communication with the Navy Base Realignment and Closure (BRAC) Project Management Office (PMO) Southeast (SE), Navy Technical Representative (NTR), Mr. Mark Davidson. Mr. John Mentz will administer overall QA/QC for this project.

The field portion of this project will consist of one field team managed by the Geologist, Mr. Mark DeJohn. Mr. DeJohn's responsibilities include directing the Baker field team and subcontractors. Ms. Christine Harwood will direct the reporting effort of the field investigation. Ms. Harwood will direct and ensure that all necessary staffing is utilized to assist in developing the Phase I RFI Reports for SWMU68.

6.2 Field Reporting Requirements

The Geologist will maintain a daily summary of each day's field activities. The following information will be included in this summary:

- Baker and subcontractor personnel on site
- Major activities of the day
- Samples collected
- Problems encountered
- Other pertinent site information

The Geologist will receive direction from the Project Manager regarding any changes in scope of the investigation.

7.0 REFERENCES

Baker Environmental, Inc. (Baker), 1995. Final RCRA Facility Investigation Management Plans, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. September 14, 1995. Coraopolis, Pennsylvania.

Baker, 2006. Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. September 1, 2006. Moon Township, Pennsylvania.

Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic), 2005. Final Phase I/II Environmental Condition of Property, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia.

TABLES

TABLE 3-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
SWMU 68 - FORMER SOUTHERN FIRE TRAINING AREA
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

		Fixed Based Analytical Lab Analysis								
Media	**Sample Depth (ft bgs)**	App IX VOCs	App IX SVOCs	App IX PCBs	Low Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH DRO	TPH GRO	**Comment**
Surface Soil Samples										
68SB01-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB02-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB03-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB04-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB05-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB06-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB07-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB08-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB09-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB10-00	0.0 - 1.0	X	X	X	X	X		X	X	
68SB10-00D	0.0 - 1.0	X	X	X	X	X		X	X	Duplicate
68SB10-00MS/MSD	0.0 - 1.0	X	X	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
Subsurface Soil Samples(2)										
68SB01-XX(1)	TBD	X	X	X	X	X		X	X	
68SB01-XX(1)	TBD	X	X	X	X	X		X	X	
68SB02-XX(1)	TBD	X	X	X	X	X		X	X	
68SB02-XX(1)	TBD	X	X	X	X	X		X	X	
68SB03-XX(1)	TBD	X	X	X	X	X		X	X	
68SB03-XX(1)	TBD	X	X	X	X	X		X	X	
68SB04-XX(1)	TBD	X	X	X	X	X		X	X	
68SB04-XX(1)	TBD	X	X	X	X	X		X	X	
68SB05-XX(1)	TBD	X	X	X	X	X		X	X	
68SB05-XX(1)	TBD	X	X	X	X	X		X	X	
68SB05-XXD(1)	TBD	X	X	X	X	X		X	X	Duplicate
68SB06-XX(1)	TBD	X	X	X	X	X		X	X	
68SB06-XX(1)	TBD	X	X	X	X	X		X	X	
68SB07-XX(1)	TBD	X	X	X	X	X		X	X	
68SB07-XX(1)	TBD	X	X	X	X	X		X	X	
68SB08-XX(1)	TBD	X	X	X	X	X		X	X	
68SB08-XX(1)	TBD	X	X	X	X	X		X	X	
68SB09-XX(1)	TBD	X	X	X	X	X		X	X	
68SB09-XX(1)	TBD	X	X	X	X	X		X	X	
68SB10-XX(1)	TBD	X	X	X	X	X		X	X	
68SB10-XX(1)	TBD	X	X	X	X	X		X	X	
68SB10-XXD(1)	TBD	X	X	X	X	X		X	X	Duplicate
68SB10-XXMS/MSD(1)	TBD	X	X	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate

TABLE 3-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
SWMU 68 - FORMER SOUTHERN FIRE TRAINING AREA
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

		Fixed Based Analytical Lab Analysis								
Media	**Sample Depth (ft bgs)**	App IX VOCs	App IX SVOCs	App IX PCBs	Low Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH DRO	TPH GRO	**Comment**
Groundwater Samples										
68TW01	NA	X	X	X	X	X	X	X	X	
68TW02	NA	X	X	X	X	X	X	X	X	
68TW03	NA	X	X	X	X	X	X	X	X	
68TW04	NA	X	X	X	X	X	X	X	X	
68TW05	NA	X	X	X	X	X	X	X	X	
68TW06	NA	X	X	X	X	X	X	X	X	
68TW07	NA	X	X	X	X	X	X	X	X	
68TW08	NA	X	X	X	X	X	X	X	X	
68TW09	NA	X	X	X	X	X	X	X	X	
68TW10	NA	X	X	X	X	X	X	X	X	
68TW10D	NA	X	X	X	X	X	X	X	X	Duplicate
68TW10MS	NA	X	X	X	X	X	X	X	X	Matrix Spike
68TW10MSD	NA	X	X	X	X	X	X	X	X	Matrix Spike Duplicate

Notes:

(1) - The sample depth designator in which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.) will be established in the field.

(2) - Although, two subsurface soil samples are proposed per boring, additional subsurface soil will be collected if areas of staining or other indicators of contamination are encountered at multiple depths. In this event, the number of QA/QC samples outlined in Section 3.4 and listed on Table 3-3 will be adjusted.

ft bgs - feet below ground surface.

NA - Not Applicable.

TBD - To be determined in the field

TABLE 3-2

**METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

Volatiles	Quantitation Limits*		Method Number
	Water (μg/L)	Low Soil (μg/kg)	
Acetone	25	50	8260B (5030B)(low level)
Acetonitrile	40	200	8260B (5030B)(low level)
Acrolein	20	100	8260B (5030B)(low level)
Acrylonitrile	20	100	8260B (5030B)(low level)
Benzene	1.0	5.0	8260B (5030B)(low level)
Bromodichloromethane	1.0	5.0	8260B (5030B)(low level)
Bromoform	1.0	5.0	8260B (5030B)(low level)
Bromomethane	1.0	10	8260B (5030B)(low level)
Carbon Disulfide	1.0	5.0	8260B (5030B)(low level)
Carbon Tetrachloride	1.0	5.0	8260B (5030B)(low level)
Chlorobenzene	1.0	5.0	8260B (5030B)(low level)
Chloroethane	1.0	10	8260B (5030B)(low level)
Chloroform	1.0	5.0	8260B (5030B)(low level)
Chloromethane	1.0	10	8260B (5030B)(low level)
Chloroprene	1.0	5.0	8260B (5030B)(low level)
3-Chloro-1-propene	1.0	5.0	8260B (5030B)(low level)
1,2-Dibromo-3-chloropropane	1.0	10	8260B (5030B)(low level)
Dibromochloromethane	1.0	5.0	8260B (5030B)(low level)
1,2-Dibromoethane	1.0	5.0	8260B (5030B)(low level)
Dibromomethane	1.0	5.0	8260B (5030B)(low level)
trans-1,4-Dichloro-2-butene	2.0	10	8260B (5030B)(low level)
Dichlorodifluoromethane	1.0	5.0	8260B (5030B)(low level)
1,1-Dichloroethane	1.0	5.0	8260B (5030B)(low level)
1,2-Dichloroethane	1.0	5.0	8260B (5030B)(low level)
trans-1,2-dichloroethene	1.0	5.0	8260B (5030B)(low level)
1,1-Dichloroethene	1.0	5.0	8260B (5030B)(low level)
Methylene Chloride	5.0	5.0	8260B (5030B)(low level)
1,2-Dichloropropane	1.0	5.0	8260B (5030B)(low level)
cis-1,3-Dichloropropene	1.0	5.0	8260B (5030B)(low level)
trans-1,3-Dichloropropene	1.0	5.0	8260B (5030B)(low level)
Ethyl benzene	1.0	5.0	8260B (5030B)(low level)
Ethyl methacrylate	1.0	5.0	8260B (5030B)(low level)
2-Hexanone	10	25	8260B (5030B)(low level)
Iodomethane	5.0	5.0	8260B (5030B)(low level)
Isobutanol	40	200	8260B (5030B)(low level)
Methacrylonitrile	20	100	8260B (5030B)(low level)
2-Butanone	10	25	8260B (5030B)(low level)
Methyl methacrylate	1.0	5.0	8260B (5030B)(low level)
4-Methyl-2-pentanone	10	25	8260B (5030B)(low level)

TABLE 3-2

**METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

Volatiles (Cont.)	Quantitation Limits*		Method Number
	Water (μg/L)	Low Soil (μg/kg)	
Pentachloroethane	5.0	25	8260B (5030B)(low level)
Propionitrile	20	100	8260B (5030B)(low level)
Stryene	1.0	5.0	8260B (5030B)(low level)
1,1,1,2-Tetrachloroethane	1.0	5.0	8260B (5030B)(low level)
1,1,2,2-Tetrachloroethane	1.0	5.0	8260B (5030B)(low level)
Tetrachloroethene	1.0	5.0	8260B (5030B)(low level)
Toluene	1.0	5.0	8260B (5030B)(low level)
1,1,1-Trichloroethane	1.0	5.0	8260B (5030B)(low level)
1,1,2-Trichloroethane	1.0	5.0	8260B (5030B)(low level)
Trichloroethene	1.0	5.0	8260B (5030B)(low level)
Trichlorofluoromethane	1.0	5.0	8260B (5030B)(low level)
1,2,3-Trichloropropane	1.0	5.0	8260B (5030B)(low level)
Vinyl Acetate	2.0	10	8260B (5030B)(low level)
Vinyl Chloride	1.0	10	8260B (5030B)(low level)
Xylene	2.0	10	8260B (5030B)(low level)

TABLE 3-2

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Semivolatiles	Quantitation Limits* Water (µg/L)	Quantitation Limits* Low Soil (µg/kg)	Method Number
Acenaphthene	10	330	8270C
Acenaphthylene	10	330	8270C
Acetophenone	10	330	8270C
2-Acetylaminofluorene	10	330	8270C
4-Aminobiphenyl	20	330	8270C
Aniline	20	660	8270C
Anthracene	10	330	8270C
Aramite	10	330	8270C
Benzo(a)anthracene	10	330	8270C
Benzo(b)fluoranthene	10	330	8270C
Benzo(k)fluoranthene	10	330	8270C
Benzo(g,h,i)perylene	10	330	8270C
Benzo(a)pyrene	10	330	8270C
Benzyl alcohol	10	330	8270C
Bis(2-chloroethoxyl)methane	10	330	8270C
Bis(2-chloroethyl)ether	10	330	8270C
Bis(2-ethylhexyl)phthalate	10	330	8270C
4-Bromophenyl phenyl ether	10	330	8270C
Butylbenzylphthalate	10	330	8270C
4-Chloroaniline	20	660	8270C
4-Chloro-3-methylphenol	10	330	8270C
2-Chloronaphthalene	10	330	8270C
2-Chlorophenol	10	330	8270C
4-Chlorophenyl phenyl ether	10	330	8270C
Chrysene	10	330	8270C
3&4 Methylphenol	10	330	8270C
2-Methylphenol	10	330	8270C
Diallate	10	330	8270C
Dibenzofuran	10	330	8270C
Di-n-butyl phthalate	10	330	8270C
Dibenzo(a,h)anthracene	10	330	8270C
o-Dichlorobenzene	10	330	8270C
m-Dichlorobenzene	10	330	8270C
p-Dichlorobenzene	10	330	8270C
3,3'-Dichlorobenzidine	20	660	8270C
2,4-Dichlorophenol	10	330	8270C
2,6-Dichlorophenol	10	330	8270C
Diethylphthalate	10	330	8270C
p-(Dimethylamino)azobenzene	10	330	8270C
7,12-Dimethyl benz(a)anthracene	10	330	8270C
3,3-Dimethyl benzidine	20	1,700	8270C
2,4-Dimethylphenol	10	330	8270C
alpha, alpha-Dimethylphenethylamine	2,000	67,000	8270C
Dimethyl phthalate	10	330	8270C

TABLE 3-2

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		
Semivolatiles (Cont.)	**Water (µg/L)**	**Low Soil (µg/kg)**	**Method Number**
m-Dinitrobenzene	10	330	8270C
4,6-Dinitro-2-methylphenol	50	1,700	8270C
2,4-Dinitrophenol	50	1,700	8270C
2,4-Dinitrotoluene	10	330	8270C
2,6-Dinitrotoluene	10	330	8270C
Di-n-octylphthalate	10	330	8270C
1,4-Dioxane	10	330	8270C
Dinoseb	10	330	8270C
Ethylmethanesulfonate	10	330	8270C
Fluoranthene	10	330	8270C
Fluorene	10	330	8270C
Hexachlorobenzene	10	330	8270C
Hexachlorobutadiene	10	330	8270C
Hexachlorocyclopentadiene	10	330	8270C
Hexachloroethane	10	330	8270C
Hexachlorophene	5,000	170,000	8270C
Hexachloropropene	10	330	8270C
Indeno(1,2,3-cd)pyrene	10	330	8270C
Isophorone	10	330	8270C
Isosafrole	10	330	8270C
Methapyrilene	2,000	67,000	8270C
3-Methylcholanthrene	10	330	8270C
Methyl methanesulfonate	10	330	8270C
2-Methylnaphthalene	10	330	8270C
Naphthalene	10	330	8270C
1,4-Naphthoquinone	10	330	8270C
1-Naphthylamine	10	330	8270C
2-Naphthylamine	10	330	8270C
2-Nitroaniline	50	1,700	8270C
3-Nitroaniline	50	1,700	8270C
4-Nitroaniline	50	1,700	8270C
Nitrobenzene	10	330	8270C
2-Nitrophenol	10	330	8270C
4-Nitrophenol	50	1,700	8270C
4-Nitroquinoline-1-oxide	20	3,300	8270C
n-Nitrosodi-n-butylamine	10	330	8270C
n-Nitrosodiethylamine	10	330	8270C
n-Nitrosodimethylamine	10	330	8270C
n-Nitrosodiphenylamine	10	330	8270C
n-Nitrosodi-n-propylamine	10	330	8270C
n-Nitrosomethylethylamine	10	330	8270C
n-Nitrosomorpholine	10	330	8270C
n-Nitrosopiperidine	10	330	8270C
n-Nitrosopyrrolidine	10	330	8270C

TABLE 3-2

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		
Semivolatiles (Cont.)	Water (μg/L)	Low Soil (μg/kg)	Method Number
5-Nitro-o-toluidine	10	330	8270C
bis-(2-chloroisopropyl)ether	10	330	8270C
Pentachlorobenzene	10	330	8270C
Pentachloronitrobenzene	10	330	8270C
Pentachlorophenol	50	1,700	8270C
Phenacetin	10	330	8270C
Phenanthrene	10	330	8270C
Phenol	10	330	8270C
1,4-Phenylenediamine	2,000	1,700	8270C
2-Picolin	10	330	8270C
Pronamide	10	330	8270C
Pyrene	10	330	8270C
Pyridine	50	330	8270C
Safrole	10	330	8270C
1,2,4,5-Tetrachlorobenzene	10	330	8270C
2,3,4,6-Tetrachlorophenol	10	330	8270C
o-Toluidine	20	330	8270C
1,2,4-Trichlorobenzene	10	330	8270C
2,4,5-Trichlorophenol	10	330	8270C
2,4,6-Trichlorophenol	10	330	8270C
1,3,5-Trinitrobenzene	10	330	8270C

	Quantitation Limits*		
Low Level PAHs	Water (μg/L)	Low Soil (μg/kg)	Method Number
Acenaphthene	0.2	6.7	8270C
Acenaphthylene	0.2	6.7	8270C
Anthracene	0.2	6.7	8270C
Benzo(a)anthracene	0.2	6.7	8270C
Benzo(b)fluoranthene	0.2	6.7	8270C
Benzo(k)fluoranthene	0.2	6.7	8270C
Benzo(g,h,i)perylene	0.2	6.7	8270C
Benzo(a)pyrene	0.2	6.7	8270C
Chrysene	0.2	6.7	8270C
Dibenzo(a,h)anthracene	0.2	6.7	8270C
Fluoranthene	0.2	6.7	8270C
Fluorene	0.2	6.7	8270C
Indeno(1,2,3-cd)pyrene	0.2	6.7	8270C
1-Methylnaphthalene	0.2	6.7	8270C
2-Methylnaphthalene	0.2	6.7	8270C
Naphthalene	0.2	6.7	8270C
Phenanthrene	0.2	6.7	8270C
Pyrene	0.2	6.7	8270C

TABLE 3-2

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		
PCBs	**Water (µg/L)**	**Low Soil (µg/kg)**	**Method Number**
Aroclor-1016	1.0	33	8082
Aroclor-1221	2.0	67	8082
Aroclor-1232	1.0	33	8082
Aroclor-1242	1.0	33	8082
Aroclor-1248	1.0	33	8082
Aroclor-1254	1.0	33	8082
Aroclor-1260	1.0	33	8082
	Quantitation Limits*		
Explosives	**Water (ug/L)**	**Low Soil (mg/kg)**	**Method Number**
HMX	0.1	0.25	8330
RDX	0.1	0.25	8330
1,3,5-Trinitrobenzene	0.1	0.25	8330
1,3-Dinitrobenzene	0.1	0.25	8330
Tetryl	0.1	0.25	8330
Nitrobenzene	0.1	0.25	8330
2,4,6-Trinitrotoluene	0.100	0.25	8330
4-Amino-2,6-dinitrotoluene	0.100	0.25	8330
2-Amino-4,6-dinitrotoluene	0.200	0.25	8330
2,4-Dinitrotoluene	0.100	0.25	8330
Picric Acid	1.000	1.00	8330
2,6-dinitrotoluene	0.100	0.25	8330
2-Nitrotoluene	0.500	0.25	8330
3-Nitrotoluene	0.500	0.25	8330
4-Nitrotoluene	0.500	0.25	8330
	Quantitation Limits*		
Total Petroleum Hydrocarbons	**Water (µg/L)**	**Low Soil (µg/kg)**	**Method Number**
TPH DRO	100	3300	5030B/8015B
TPH GRO	50	250	3550B/8015B

* 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.

TABLE 3-2

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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

RCRA Metals	Method Number	Quantitation Limits*		Method Description
		Soil (mg/kg)	Water (μg/L)	
Arsenic	6010B(3050B/3010A)	1.0	10	Inductively Coupled Plasma
Barium	6010B(3050B/3010A)	1.0	10	Inductively Coupled Plasma
Cadmium	6010B(3050B/3010A)	0.50	5	Inductively Coupled Plasma
Chromium	6010B(3050B/3010A)	1.0	10	Inductively Coupled Plasma
Lead	6010B(3050B/3010A)	0.50	5.0	Inductively Coupled Plasma
Mercury	7471A/7470A	0.020	0.20	Cold Vapor AA
Selenium	6010B(3050B/3010A)	1.0	10	Inductively Coupled Plasma
Silver	6010B(3050B/3010A)	1.0	10	Inductively Coupled Plasma

Notes:

* 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.

mg/kg - milligrams per kilogram.

Revised: November 10, 2006

TABLE 3-3

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
QA/QC SAMPLES
PHASE I RFI WORK PLAN SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

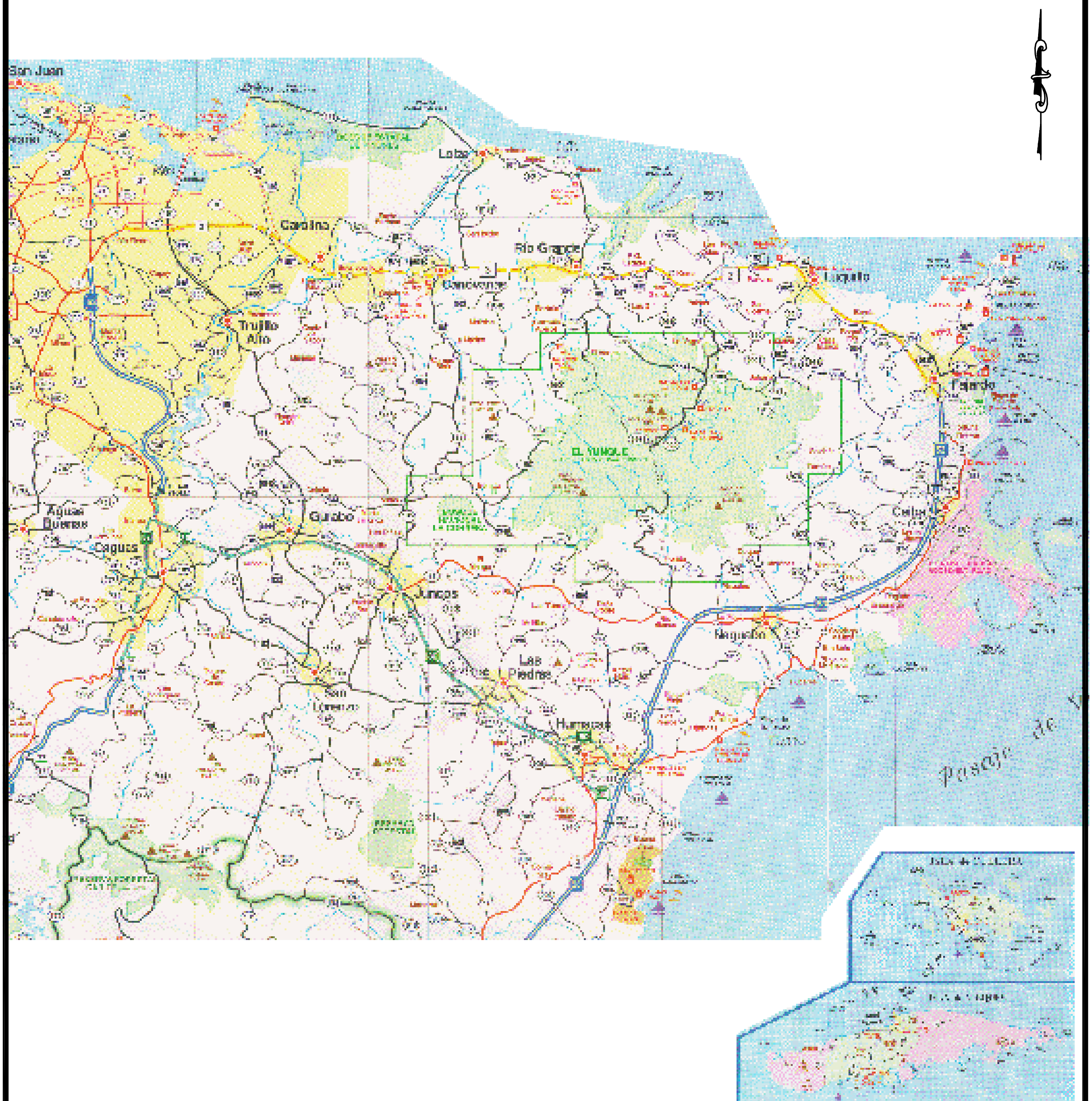
	Aqueous Samples Analysis Requested										Solid Samples Analysis Requested		
Media	App IX VOCs	App IX SVOCs	App IX PCBs	Low Level PAHs	App IX Metals (Total)	Explosives	TPH DRO	TPH GRO	Benzene	RCRA Metals	Benzene	RCRA Metals	**Comment**
Trip Blank Samples													
2006TB01	X[1]							X[1]					
2006TB02	X[1]							X[1]					
2006TB03	X[1]							X[1]					
2006TB04	X[1]							X[1]					
2006TB05	X[1]							X[1]					
2006TB06	X[1]							X[1]					
Equipment Rinsate Samples													
2006ER01	X	X	X	X	X	X	X	X					Split Spoon Sampler or Macro Core Liner
2006ER02	X	X	X	X	X	X	X	X					Split Spoon Sampler or Macro Core Liner
2006ER03	X	X	X	X	X	X	X	X					Polyethylene and Silicon Tubing
Field Blank Samples													
2006FB01	X	X	X	X	X	X	X	X					Lab Grade Deionized Water
2006FB02	X	X	X	X	X	X	X	X					Store Bought Distilled Warer
2006FB03	X	X	X	X	X	X	X	X					NAPR Potable Water
IDW Samples													
2006IDW01									X	X			Aqueous
2006IDW02											X	X	Solid

Note:

[1] - The analysis required for this sample will be dependent on which samples are being accompanied in the cooler.

FIGURES

K_CH2M HILL CLEAN III\CTO-121 (107872)\CAD\SWMU68\CH121F01



4 0 2 4 8

1 inch = 4 miles

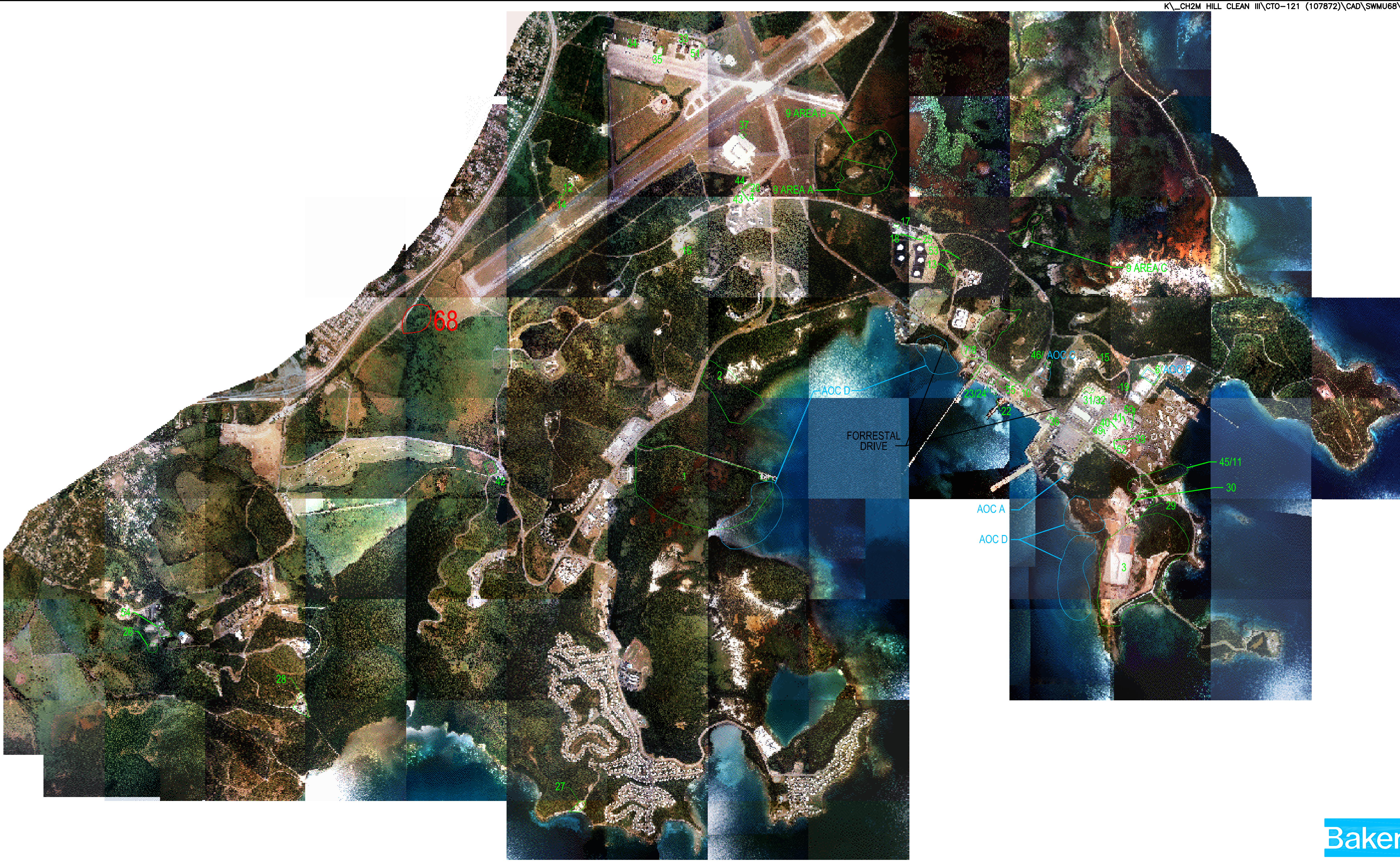
Baker

FIGURE 1-1
REGIONAL LOCATION MAP
PHASE I RFI WORK PLAN FOR
SWMU 68

NAVAL ACTIVITY PUERTO RICO
PUERTO RICO

SOURCE: METRODATA, INC., 1999.

K:_CH2M HILL CLEAN III\CTO-121 (107872)\CAD\SWMU68\CH121F02



LEGEND

1 – SWMUs

AOC D – AOCs

68 – AREA OF WHICH THIS INVESTIGATION PERTAINS TO

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

2500 0 1250 2500

1 inch = 2500 ft.

FIGURE 1–2
LOCATION MAP
PHASE I RFI WORK PLAN FOR
SWMU 68
NAVAL ACTIVITY PUERTO RICO
PUERTO RICO

Baker

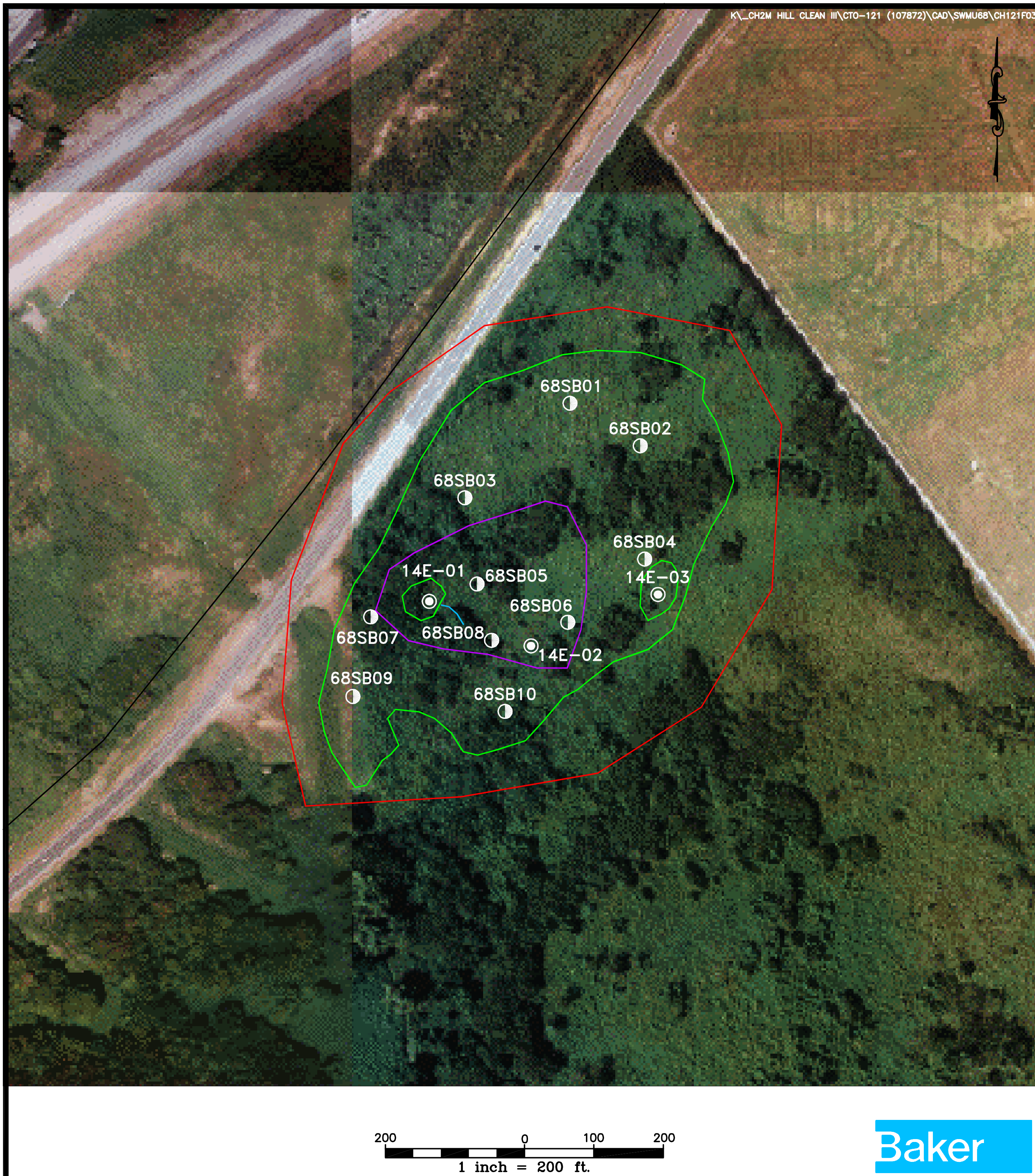
LEGEND

- 1961 POLYGON FEATURE
- 1961 DRAINAGE
- 1964 POLYGON FEATURE
- ECP SITE BOUNDARY

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

FIGURE 1-3
1961 AERIAL PHOTOGRAPH
FORMER SOUTHERN FIRE
TRAINING AREA
SWMU 68

NAVAL ACTIVITY PUERTO RICO



LEGEND

- 1961 POLYGON FEATURE
- 1961 DRAINAGE
- 1964 POLYGON FEATURE
- EXISTING SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (PHASE II ECP INVESTIGATION)
- PROPOSED SAMPLING LOCATIONS
- ECP SITE BOUNDARY

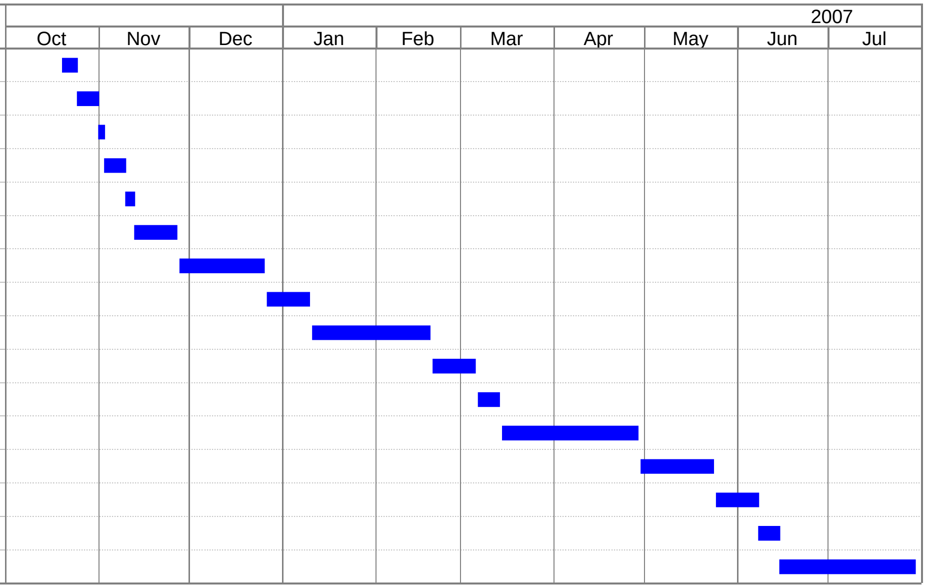
SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

FIGURE 3-1
SAMPLE LOCATION MAP
FORMER SOUTHERN
FIRE TRAINING AREA
SWMU 68

NAVAL ACTIVITY PUERTO RICO

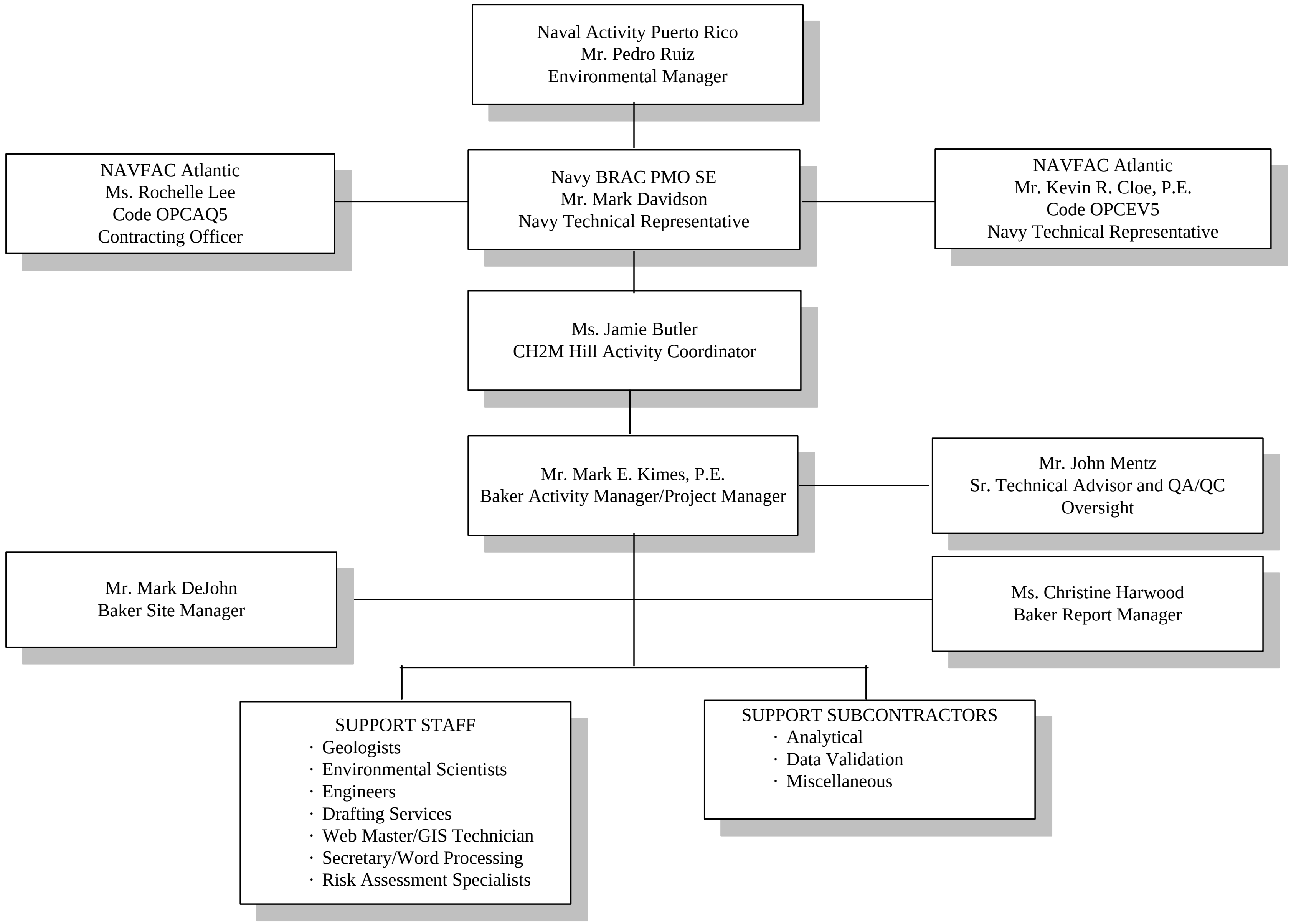
Figure 5-1
Phase I RFI Work Plan
SWMU 68
Naval Activity Puerto Rico, Ceiba, Puerto Rico
Proposed Project Schedule

ID	Task Name	Duration	Start	Finish
1	Draft RFI Work Plan to the EPA	5 edays	10/20/06	10/25/06
2	EPA Review	7 edays	10/25/06	11/1/06
3	Final RFI Work Plan to the EPA	2 edays	11/1/06	11/3/06
4	EPA Review & Approval	7 edays	11/3/06	11/10/06
5	Initiate Field Work	3 edays	11/10/06	11/13/06
6	Field Investigation	14 edays	11/13/06	11/27/06
7	Laboratory Analysis	28 edays	11/28/06	12/26/06
8	Data Validation	14 edays	12/27/06	1/10/07
9	Draft Phase I RFI Report for SWMU 68 to Navy	39 edays	1/11/07	2/19/07
10	Navy Review	14 edays	2/20/07	3/6/07
11	Draft Phase I RFI Report for SWMU 68 to EPA	7 edays	3/7/07	3/14/07
12	EPA Review	45 edays	3/15/07	4/29/07
13	Final Phase I RFI Report for SWMU 68 to Navy	24 edays	4/30/07	5/24/07
14	Navy Review	14 edays	5/25/07	6/8/07
15	Final Phase I RFI Report for SWMU 68 to EPA	7 edays	6/8/07	6/15/07
16	EPA Review & Approval	45 edays	6/15/07	7/30/07



Project:Phase I RFI Work Plan
Date: 10/25/06

FIGURE 6-1
PROJECT ORGANIZATION
Phase 1 RFI Work Plan - SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



APPENDIX A
USEPA Region II – Groundwater Sampling Procedure
Low Stress (Low Flow) Purging and Sampling

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

GROUND WATER SAMPLING PROCEDURE
LOW STRESS (Low Flow) PURGING AND SAMPLING

I. SCOPE & APPLICATION

This Low Stress (or Low-Flow) Purging and Sampling Procedure is the EPA Region II standard method for collecting low stress (low flow) ground water samples from monitoring wells. Low stress Purging and Sampling results in collection of ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by minimizing stress on the geological formation and minimizing disturbance of sediment that has collected in the well. The procedure applies to monitoring wells that have an inner casing with a diameter of 2.0 inches or greater, and maximum screened intervals of ten feet unless multiple intervals are sampled. The procedure is appropriate for collection of ground water samples that will be analyzed for volatile and semi-volatile organic compounds (VOCs and SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and microbiological and other contaminants in association with all EPA programs.

This procedure does not address the collection of light or dense non-aqueous phase liquids (LNAPL or DNAPL) samples, and should be used for aqueous samples only. For sampling NAPLs, the reader is referred to the following EPA publications: DNAPL Site Evaluation (Cohen & Mercer, 1993) and the RCRA Ground-Water Monitoring: Draft Technical Guidance (EPA/530-R-93-001), and references therein.

II. METHOD SUMMARY

The purpose of the low stress purging and sampling procedure is to collect ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing.

Sampling at the prescribed (low) flow rate has three primary benefits. First, it minimizes disturbance of sediment in the bottom of the well, thereby producing a sample with low turbidity (i.e., low concentration of suspended particles). Typically, this saves time and analytical costs by eliminating the need for collecting and analyzing an additional filtered sample from the same well. Second, this procedure minimizes aeration of the ground water during sample collection, which improves the sample quality for VOC analysis. Third, in most cases the procedure significantly reduces the volume of ground water purged from a well and the costs associated with its proper treatment and disposal.

III. ADDRESSING POTENTIAL PROBLEMS

Problems that may be encountered using this technique include a) difficulty in sampling wells with insufficient yield; b) failure of one or more key indicator parameters to stabilize; c) cascading of water and/or formation of air bubbles in the tubing; and d) cross-contamination between wells.

Insufficient Yield

Wells with insufficient yield (i.e., low recharge rate of the well) may dewater during purging. Care should be taken to avoid loss of pressure in the tubing line due to dewatering of the well below the level of the pump=s intake. Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should therefore be avoided to the extent possible in all cases. Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. Alternatively, ground water samples may be obtained with techniques designed for the unsaturated zone, such as lysimeters.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fails to stabilize after 4 hours, one of four options should be considered: a) continue purging in an attempt to achieve stabilization; b) discontinue purging, do not collect samples, and document attempts to reach stabilization in the log book; c) discontinue purging, collect samples, and document attempts to reach stabilization in the log book; or d) Secure the well, purge and collect samples the next day (preferred). The key indicator parameter for samples to be analyzed for VOCs is dissolved oxygen. The key indicator parameter for all other samples is turbidity.

Cascading

To prevent cascading and/or air bubble formation in the tubing, care should be taken to ensure that the flow rate is sufficient to maintain pump suction. Minimize the length and diameter of tubing (i.e., 1/4 or 3/8 inch ID) to ensure that the tubing remains filled with ground water during sampling.

Cross-Contamination

To prevent cross-contamination between wells, it is strongly recommended that dedicated, in-place pumps be used. As an alternative, the potential for cross-contamination can be reduced by performing the more thorough Adaily@ decontamination procedures between sampling of each well in addition to the start of each sampling day (see Section VII, below).

Equipment Failure

Adequate equipment should be on-hand so that equipment failures do not adversely impact sampling activities.

IV. PLANNING DOCUMENTATION AND EQUIPMENT

< Approved site-specific Field Sampling Plan/Quality Assurance Project Plan (QAPP). This plan must specify the type of pump and other equipment to be used. The QAPP must also specify the depth to which the pump intake should be lowered in each well. Generally, the target depth will correspond to the mid-point of the most permeable zone in the screened interval. Borehole geologic and geophysical logs can be used to help select the most permeable zone. However, in some cases, other criteria may be used to select the target depth for the pump

intake. In all cases, the target depth must be approved by the EPA hydrogeologist or EPA project scientist.

- Well construction data, location map, field data from last sampling event.

- Polyethylene sheeting.

- Flame Ionization Detector (FID) and Photo Ionization Detector (PID).

- Adjustable rate, positive displacement ground water sampling pump (e.g., centrifugal or bladder pumps constructed of stainless steel or Teflon). A peristaltic pump may only be used for inorganic sample collection.

- Interface probe or equivalent device for determining the presence or absence of NAPL.

- Teflon or Teflon-lined polyethylene tubing to collect samples for organic analysis. Teflon or Teflon-lined polyethylene, PVC, Tygon or polyethylene tubing to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.

- Water level measuring device, minimum 0.01 foot accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).

- Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).

- Power source (generator, nitrogen tank, etc.).
- Monitoring instruments for indicator parameters. Eh and dissolved oxygen must be monitored in-line using an instrument with a continuous readout display. Specific conductance, pH, and temperature may be monitored either in-line or using separate probes. A nephalometer is used to measure turbidity.

< Decontamination supplies (see Section VII, below).

< Logbook (see Section VIII, below).

< Sample bottles.

< Sample preservation supplies (as required by the analytical methods).

< Sample tags or labels, chain of custody.

V. SAMPLING PROCEDURES

Pre-Sampling Activities

1. Start at the well known or believed to have the least contaminated ground water and proceed systematically to the well with the most contaminated ground water. Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations.

2. Lay out sheet of polyethylene for placement of monitoring and sampling equipment.

3. Measure VOCs at the rim of the unopened well with a PID and FID instrument and record the reading in the field log book.

4. Remove well cap.

5. Measure VOCs at the rim of the opened well with a PID and an FID instrument and record the reading in the field log book.
6. If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Note that the reference point should be surveyed for correction of ground water elevations to the mean geodesic datum (MSL).

7. Measure and record the depth to water (to 0.01 ft) in all wells to be sampled prior to purging. Care should be taken to minimize disturbance in the water column and dislodging of any particulate matter attached to the sides or settled at the bottom of the well.

8. If desired, measure and record the depth of any NAPLs using an interface probe. Care should be taken to minimize disturbance of any sediment that has accumulated at the bottom of the well. Record the observations in the log book. If LNAPLs and/or DNAPLs are detected, install the pump at this time, as described in step 9, below. Allow the well to sit for several days between the measurement or sampling of any DNAPLs and the low-stress purging and sampling of the ground water.

Sampling Procedures

9. Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well in the EPA-approved QAPP or a depth otherwise approved by the EPA hydrogeologist or EPA project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Record the depth to which the pump is lowered.

10. Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

11. Purge Well: Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

12. Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO)

approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

±0.1 for pH
±3% for specific conductance (conductivity)
±10 mv for redox potential
±10% for DO and turbidity

Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling.

13. Collect Samples: Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.

    Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary. If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop, on a separate and equal volume of water (e.g., 40 ml). Ground water purged from the well prior to sampling can be used for this purpose.

14. Remove Pump and Tubing: After collection of the samples, the tubing, unless permanently installed, must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.

15. Measure and record well depth.

16. Close and lock the well.

VI. FIELD QUALITY CONTROL SAMPLES

Quality control samples must be collected to determine if sample collection and handling procedures have adversely affected the quality of the ground water samples. The appropriate EPA Program Guidance should be consulted in preparing the field QC sample requirements of the site-specific QAPP.

All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples should be collected during the sampling event:

< Field duplicates
< Trip blanks for VOCs only
< Equipment blank (not necessary if equipment is dedicated to the well)

As noted above, ground water samples should be collected systematically from wells with the lowest level of contamination through to wells with highest level of contamination. The equipment blank should be collected after sampling from the most contaminated well.

VII. DECONTAMINATION

Non-disposable sampling equipment, including the pump and support cable and electrical wires which contact the sample, must be decontaminated thoroughly each day before use (Adaily decon@) and after each well is sampled (Abetween-well decon@). Dedicated, in-place pumps and tubing must be thoroughly decontaminated using Adaily decon@ procedures (see #17, below) prior to their initial use. For centrifugal pumps, it is strongly recommended that non-disposable sampling equipment, including the pump and support cable and electrical wires in contact with the sample, be decontaminated thoroughly each day before use (Adaily decon@).

EPA=s field experience indicates that the life of centrifugal pumps may be extended by removing entrained grit. This also permits inspection and replacement of the cooling water in centrifugal pumps. All non-dedicated sampling equipment (pumps, tubing, etc.)

must be decontaminated after each well is sampled (Abetween-well decon,@ see #18 below).

17. **Daily Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Disassemble pump.

E) Wash pump parts: Place the disassembled parts of the pump into a deep basin containing 8 to 10 gallons of non-phosphate detergent solution. Scrub all pump parts with a test tube brush.

F) Rinse pump parts with potable water.

G) Rinse the following pump parts with distilled/ deionized water: inlet screen, the shaft, the suction interconnector, the motor lead assembly, and the stator housing.

H) Place impeller assembly in a large glass beaker and rinse with 1% nitric acid (HNO_3).

I) Rinse impeller assembly with potable water.

J) Place impeller assembly in a large glass bleaker and rinse with isopropanol.

K) Rinse impeller assembly with distilled/deionized water.

18. **Between-Well Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.
B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Final Rinse: Operate pump in a deep basin of distilled/deionized water to pump out 1 to 2 gallons of this final rinse water.

VIII. FIELD LOG BOOK

A field log book must be kept each time ground water monitoring activities are conducted in the field. The field log book should document the following:

< Well identification number and physical condition.
< Well depth, and measurement technique.
< Static water level depth, date, time, and measurement technique.
< Presence and thickness of immiscible liquid layers and detection method.
< Collection method for immiscible liquid layers.
< Pumping rate, drawdown, indicator parameters values, and clock time, at three to five minute intervals; calculate or measure total volume pumped.
< Well sampling sequence and time of sample collection.
< Types of sample bottles used and sample identification numbers.
< Preservatives used.
< Parameters requested for analysis.

- < Field observations of sampling event.
- < Name of sample collector(s).
- < Weather conditions.
- < QA/QC data for field instruments.

IX. REFERENCES

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