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# Final

# Phase I RCRA Facility Investigation Work Plan

## SWMU 9 Area B, Tank 214 Area

## 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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January 17, 2007

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Federal Programs Corp.

**FINAL**

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# SWMU 9 AREA B, TANK 214 AREA

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

**CONTRACT TASK ORDER 0147**

**JANUARY 17, 2007**

*Prepared for:*

**DEPARTMENT OF THE NAVY**
**NAVAL FACILITIESENGINEERING COMMAND**
**ATLANTIC DIVISION**
*Norfolk, Virginia*

*Under the:*

**LANTDIV CLEAN Program**
**Contract N62470-02-D-3052**

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AOC | Area of Concern |
| AVGAS | Aviation Gasoline |
| Baker | Baker Environmental, Inc. |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| CERCLA | Comprehensive Environmental Resource Conservation and Liability Act |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| CRQL | Contract Required Quantitation Limit |
| CTO | Contract Task Order |
| DoN's | Department of the Navy's |
| DRMO | Defense Reutilization and Marketing Office |
| DRO | Diesel Range Organics |
| EM | Electromagnetic |
| ERA | Ecological Risk Assessment |
| FMTUD | Facility Management Transportation and Utility Division |
| FT BGS | Feet Below Ground Surface |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GRO | Gasoline Range Organics |
| GPR | Ground Penetrating Radar |
| HSWA | Hazardous and Solid Waste Amendments |
| ICM | Interim Corrective Measure |
| IDW | Investigation Derived Waste |
| IR | Installation Restoration Program |
| LANTDIV | Naval Facilities Engineering Command Atlantic Division |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| MCL | Maximum Contaminant Level |
| MG/KG | Milligram per Kilogram |
| MS/MSD | Matrix Spike/Matrix Spike Duplicate |
| NAPR | Naval Activity Puerto Rico |
| NSSR | Naval Station Roosevelt Roads |
| NTR | Navy Technical Representative |
| OUs | Operable Units |
| PAH | Polynuclear Aromatic Hydrocarbons |
| PID | Photoionization Detector |

## LIST OF ACRONYMS AND ABBREVIATIONS
## (Continued)

| | |
|---|---|
| PMO | Project Management Office |
| PPM | Parts per Million |
| PRG | Preliminary Remediation Goal |
| PVC | Polyvinyl Chloride |
| PWD | Public Works Department |
| QA/QC | Quality Assurance/Quality Control |
| RCI | Reactivity, Corrosivity, Ignitibility |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| SE | Southeast |
| SVOCs | Semi-volatile Organic Compounds |
| SWMU | Solid Waste Management Unit |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TPH | Total Petroleum Hydrocarbons |
| USEPA | United States Environmental Protection Agency |
| USTs | Underground Storage Tanks |
| UVF | Ultraviolet Fluorescence |
| VOCs | Volatile Organic Compounds |

## 1.0 INTRODUCTION

This document presents the activities required for the performance of a Resource Conservation Recovery Act (RCRA) Phase I Facility Investigation (RFI) at the Solid Waste Management Unit (SWMU) 9, Area B, Tank 214 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) 147 under the LANTDIV Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Number N62470-02-D-3052.

### 1.1 Site History

This section provides a description of the site and its history. A description of regional and, where applicable, area-specific physiographic features, including climate, topography, geology, and hydrology was previously presented in the United States Environmental Protection Agency (USEPA)-approved *Revised Draft RCRA Facility Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico* (Baker, 2000).

NAPR occupies over 8,600 acres on the East Coast of Puerto Rico, along Vieques Passage, with Vieques Island lying approximately ten miles to the east. NAPR was commissioned in 1943 as a Naval Operations Base and re-designated a Naval Station in 1957. Naval Station Roosevelt Roads (NSRR) operated as a Naval Station 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 the USEPA Region II to NSRR. This permit contains requirements for RFI activities at 24 SWMUs and three areas of concern (AOC). 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 (DoN'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) provisions of RCRA.

The various SWMUs and AOCs at NAPR have been grouped together into Operable Units (OUs) based on similarity of investigation scope, geography, or similarity of contaminants potentially released. This work plan pertains to SWMU 9 Area B - Tank 214 Area, a fuel management area within OU 2. OU 2 consists of SWMUs 7 and 8 (Tow Way Fuel Farm) and SWMU 9 (Tanks 212-217).

SWMU 9 is comprised of six USTs, pipelines, and ancillary facilities. For investigation purposes, the SWMU had been divided into three separate areas:

- Area A – Tanks 212 to 213
- Area B – Tanks 214 to 215
- Area C – Tanks 216 and 217

Areas A and B are located north of Forrestal Drive, along Manila Bay Street. Area C is located approximately 4,000 feet southwest of Areas A and B, north of Forrestal Drive along Antietam Road.

The USTs were constructed in the 1940's for the storage of aviation gasoline (AVGAS) for piston-driven airplanes. Most recently, Tanks 212 and 213 (Area A) were used for the storage of diesel fuel and unleaded gasoline. Tanks 214 and 215 (Area B) were changed from AVGAS storage to diesel fuel marine, while Tank 216 (Area C) was most recently used for the storage of unleaded gasoline (Figure 1-2). In addition to AVGAS, Tank 217 (Area C) may have been used for the storage of diesel fuel marine and JP-5. All tanks were cleaned and put out of service in 2001.

Previous reports indicate that each UST was cleaned of petroleum-based sludge every five years. Sludge material collected during tank cleaning activities prior to 1978 was reportedly disposed of onsite in unlined earthen pits. Since 1978, any sludge materials generated during tank cleaning activities have been removed and disposed off-site by a licensed contractor. A geophysical investigation, using a combination of both electromagnetic (EM) terrain conductivity and ground penetrating radar (GPR), conducted during Phase I of the SWMU 9 RFI, as well as test pits excavated during Phases I and II of the SWMU 9 RFI did not identify the presence of the suspected sludge disposal pits (Baker, 2000).

Following the Phase II RFI, an ecological risk assessment (ERA) was undertaken to determine the impact of Navy activities on ecological receptors. Steps 3b and 4 of the ERA process were finalized in January, 2006 (Baker, 2006a), and sampling associated with Step 5 of the ERA was performed in August 2005. Prior to publication of the results of the work performed for Steps 5 and 6, however, an interim corrective measure (ICM) was undertaken at three locations at SWMU 9 Area B in the Tank 214 area in order to remove lead contaminated soil (see Figure 1-3). During the excavation in May 2006, petroleum impacted soil was discovered at one location at the floor of the excavation at a depth of approximately 1 foot below ground surface. One soil sample was collected from the suspected petroleum contaminated soils and analyzed for total petroleum hydrocarbons (TPH) diesel range organics (DRO) and gasoline range organics (GRO), and Appendix IX volatile organic compounds (VOCs). Results of this sample (S3-SW01-FL01) are identified on Figure 2-3. It was decided to halt the ERA process in order to determine the extent of the petroleum impacted soil with an RFI, to be conducted in accordance with the Work Plan contained herein.

## 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 9 Area B – Tank 214 Area. Previous investigations have been performed at this site, but no petroleum impacted soil was found prior to the excavation conducted under an ICM in May 2006. This RFI is performed under the RCRA Part B permit (EPA, 1994) and includes 1) the development of a work plan, 2) field investigation, and 3) 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 9 Area B – Tank 214 Area is shown on Figure 1-3. The objectives of the investigation to be performed are limited to determining the nature and extent of the petroleum impacted soil on the environment, including, if any, the impact on the estuarine wetland area located downgradient of the tank area. The focus of the work will begin around the area of the petroleum impacted soil and continue outward until delineation of the petroleum contamination is made. The results gathered during the investigation will be used to determine if any corrective measures are necessary at Area B, Tank 214 Area. In addition, refinement of the site conceptual model for the ERA and a supplemental human health risk assessment screening will be done once the findings of the RFI are completed.

## 1.3 Organization of the RFI 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, sediment sampling and analysis program, surface water sampling and analysis program, 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 Work Plan references.

## 2.0 CURRENT CONDITIONS

The following sections provide a discussion of the current conditions that exist at SWMU 9 Area B – Tank 214 Area along with any previous investigations that have been conducted.

### 2.1 Current Site Conditions/Usage

The USTs were constructed in the 1940's for the storage of AVGAS for piston-driven airplanes. Most recently, Tanks 214 and 215 were changed from AVGAS storage to diesel fuel marine. Previous reports indicate that each UST was cleaned of petroleum-based sludge every five years. Sludge material collected during tank cleaning activities prior to 1978 was reportedly disposed of onsite in unlined earthen pits. Since 1978, any sludge materials generated during tank cleaning activities have been removed and disposed off-site by a licensed contractor.

All tanks were cleaned and put out of service in 2001. No ongoing activities are occurring at the present time at this SWMU.

### 2.2 Previous Investigations

Sampling activities at SWMU 9 have been conducted under four separate investigations:

- RCRA Facility Investigation (RFI): Phase I (April 1996), Phase II (September/October 1997), and Phase III (June 1999);
- Corrective Measures Study (CMS) in December 2000;
- Additional Data Collection Field Investigation in July 2003; and
- Steps 5 and 6 of the Baseline Ecological Risk Assessment (conducted in August, 2005).

The RFI field investigations and associated analytical data were presented and discussed in the *Revised Draft RCRA Facility Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico* (Baker, 2000). The CMS field investigation and associated analytical data were presented and discussed in the *Final Corrective Measures Study Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico* (Baker, 2003), while the additional data collection field investigation and associated analytical data were presented and discussed in the *Final Additional Data Collection Investigation Report, SWMU 9, Naval Activity Puerto Rico, Ceiba, Puerto Rico* (Baker, 2004). The collection and analysis of sediment samples conducted in August 2005 for Steps 5 and 6 of the ERA process is complete. However, the results of that investigation have not been published as part of the ERA at this time due to the postponement of the ERA process as noted above in Section 1.1. Validated analytical results from that investigation will be used in Section 2.3 to describe current conditions at the SWMU.

### 2.3 Area of Investigation at SWMU 9 Area B – Tank 214 Area

The investigation for this RFI is limited in scope to determining the extent of contamination around the area where petroleum impacted soils were found during the ICM (Figure 1-3). Fortunately, analytical results for surface soils at several locations in the nearby area are available from previous investigations. Because lead is likely to be an indicator contaminant for petroleum and petroleum sludges that were disposed in unlined earthen pits, the analytical results for lead in surface soil from the previous investigations conducted at SWMU 9 Area B are shown on Figure 2-1. In addition to

results from the previous investigations at this SWMU, three additional surface soil samples were collected in September 2006 adjacent to the ICM excavation located northwest of Tank 214 and were analyzed for lead. These results are also shown on Figure 2-1, labeled as 9PB05, 9PB10, 9PB15. Analytical results for organics in surface soil in this area are found on Figure 2-2.

Subsurface soil sample locations and their associated analytical results are shown on Figure 2-3, and groundwater sample locations and their most recent associated analytical results are shown on Figure 2-4. These are provided to show where previous sampling occurred at SWMU 9 Area B – Tank 214 Area in order to avoid duplicating sampling locations during this RFI.

Since the estuarine wetland is located downgradient of this area, the RFI investigation will also continue into the estuarine wetland sediment. Figure 2-5 depicts the lead concentrations (again used as an indicator) in the sediment collected from the estuarine wetland during previous investigations, including the results from the Step 5 and 6 ERA Investigation conducted in August 2005.

## 3.0 SCOPE OF INVESTIGATION

Potential sampling locations for this investigation were selected based on 1) the proximity to the discovery of petroleum impacted soils during the ICM; 2) previous analytical results for lead (used as an indicator) in the surface soil and sediment in the estuarine wetland; 3) previous analytical results for organics in the surface soil; as well as 4) consideration of the sampling locations for subsurface soil and groundwater during previous investigations. Consideration was also given to site topography, utilities (if any), anticipated groundwater flow direction, and contaminant migration potential to the estuarine wetland.

Sample matrices for this investigation are provided as Table 3-1. The potential sample/boring locations are shown on Figure 3-1. The various investigation elements are bulleted below and described in detail in the subsections that follow.

- A soil boring program resulting in delineation of petroleum contamination will be implemented using on-site decision logic based on test kit analytical results for total petroleum hydrocarbons (TPH).
- Up to fifteen surface soil samples will be collected from fifteen soil boring locations and will be analyzed at a fixed-base laboratory. These locations will be determined in the field after the use of the test kits has determined delineation of petroleum contamination.
- Up to thirty subsurface soil samples will be collected from the fifteen boring locations identified above and will be analyzed at a fixed-base laboratory. Two samples will be collected from different depths at each boring location. It is expected that a maximum depth of 15 – 25 feet will be reached at twelve of the locations, and a maximum depth of 3 feet will be reached for the hand-augered locations, depending on the proximity to the estuarine wetland.
- Up to fifteen groundwater samples will be collected from temporary monitor wells installed at each of the fifteen boring locations identified above and analyzed at a fixed-base laboratory.
- Up to eight sediment samples will be collected from eight locations in the estuarine wetland and analyzed at a fixed-base laboratory.
- If test kit analysis indicates the presence of petroleum in groundwater near the estuarine wetland, surface water samples may be collected in lieu of groundwater samples and analyzed at a fixed-base laboratory to determine if there is groundwater discharge to the estuarine wetland.

The test kits will also be used on selected groundwater samples at boring locations in proximity to the estuarine wetland to determine the presence of TPH in the groundwater, if any. If groundwater tests positive for TPH with the test kits, then surface water samples from the estuarine wetland will be analyzed at a fixed-base laboratory to determine if groundwater contamination is discharging to the surface water in the estuarine wetland. Groundwater flow at the site is radial toward the estuarine wetland (Figure 1-3).

The test kit analytical results and other pertinent information (depth of sample, odor, color, etc.) will be recorded in the field notebook. For all boring locations determined on-site during the delineation process, a unique identifier, such as UVF1-00, will be used, and all locations will be surveyed as noted in Section 3.7.5.

## 3.1 Soil Sampling and Analysis Program

### 3.1.1 Soil Boring Installation—Primary Lines

The initial five soil boring locations will be installed in locations as shown in Figure 3-1. Although shown as being located on the mainland in this figure, it is noted that the aerial photography may be slightly inaccurate, resulting in placement of these initial locations in the wetland. If they are in the wetland, the field personnel should ensure that the sampling locations are relocated in order to be representative of the soil, and not the sediment. Subsequent locations of the soil borings are to be determined in the field based on the results of test kit pre-screening for TPH using the SiteLAB® ultraviolet fluorescence analyzer (UVF), but will proceed at 25-foot intervals in the same direction along the primary lines as indicated with positive test kit detections, until test kit results are non-detect. One exception to this boring scheme would be in the direction of estuarine wetland, since the first 25-foot boring is already at the edge of the estuarine wetland (see Section 3.5 for estuarine wetland sediment sampling procedures).

If two consecutive locations at 25 foot intervals in any direction test positive and have similar or increasing concentrations (i.e. not decreasing concentrations) for TPH with the UVF analyzer, the next boring location will be at least 50 feet away from the last location, in order to preserve resources.

If none of the four initial boring locations located around the center location where known contamination is present test positive for TPH, then the four locations at the intersections of the alternate primary lines just outside the original area of contamination will be installed (see Figure 3-1). If these four locations are also non-detect using the test kit analysis, then the last four soil borings will be installed at a radial distance of 12 feet around the location of contamination (9SB00) in order to delineate the contamination close in. If contamination is found at a close in location, one or two additional borings may be installed in the area inside the alternate primary lines for final delineation.

A flow chart depicting the soil boring installation strategy can be seen on Figure 3-2.

### 3.1.2 Soil Boring Installation—Secondary Lines

When test kit results are non-detect at a location on a primary line, soil boring locations at 25-foot spacing along the grid line (secondary line) perpendicular to the primary line just delineated, intersecting at the location of the outermost detection, will be installed and will continue in both directions, until non-detect results are obtained in the soil matrix with the test kits. After this direction is delineated, the driller will move back along the current secondary line to the last positive detection, and install borings at 25-foot intervals, in both directions if necessary, along a secondary line perpendicular to the previous line. This sampling scheme will continue until the soil contamination is delineated around the area of the known petroleum contamination (see Figure 3-2).

As in the primary line boring installation, if two consecutive locations at 25 foot intervals in any direction test positive and have similar or increasing concentrations (i.e. not decreasing concentrations) for TPH with the UVF analyzer, the next boring location will be at least 50 feet away from the last location, in order to preserve resources.

### 3.1.3 Surface and Subsurface Soil Sampling

The surface soil samples will be obtained with a stainless steel spoon. The subsurface soil samples will be obtained with both a hand auger (near the wetland) and the 66DT Geoprobe® drill rig capable of direct push and augering.

Because the petroleum contamination was found at a depth of one foot below ground surface (ft bgs), the expected depth of the initial subsurface soil samples will begin from one to one and a half feet. During soil boring installation, care will be taken to achieve maximum recovery so that a good stratigraphic profile can be developed. A boring log will be maintained indicating, among other things, lithology, and water occurrence. Soil samples will initially be screened at 6-inch intervals with a photoionization detector (PID) to develop a semi-quantitative profile. Soil samples will be collected continuously from ground surface to the water table (from approximately 15 to 25 feet) using 5-foot long Macro Core Sampler, with two subsurface soil samples and one surface soil sample per boring location being collected for possible fixed-base laboratory analysis. The two subsurface soil samples per boring will be collected from the depth of any suspected contamination, based on PID screening, and directly above the water table. Any sample of suspected contamination will be analyzed on site with the UVF analyzer.

It is expected that a few soil borings will be advanced using hand-augers in the vicinity of the estuarine wetland. Because of the likely shallow depth to water in this area, it is expected that no more than 3 feet depth will be achieved. Soil samples will be placed in aluminum pie pans. Samples for possible VOC analysis will be containerized and all pertinent sampling information such as soil description (e.g., color and texture), sample number and location, presence or absence of soil discoloration, and the time of sample collection will be recorded in the field logbook. The remaining soil will be thoroughly homogenized with a stainless steel spoon following the removal of debris (e.g., rocks or twigs) prior to placement in the appropriate jars for laboratory-based chemical analysis.

### 3.1.4 On-Site Test Kit Analyses

The SiteLAB UVF analyzer will be used to pre-screen suspected petroleum contamination in soil at a frequency of up to two soil samples per location in order to refine the extent of contamination during the installation of soil borings and temporary wells. The UVF analyzer can detect many different contaminants, including aromatic hydrocarbons commonly found in gasoline, jet fuel, diesel fuel, heating oils, waste oils, coal tars, coal ash, creosote, crude oils and many other petroleum products (http://www.environmental-expert.com/technology/sitelab/sitelab.htm). The detection limit for TPH (used for this investigation) is 0.5 ppm.

The initial samples will be taken from location 9SB00, at the area of known contamination in order to calibrate the UVF analyzer to the concentrations expected in the field. It is expected that up to 40 soil samples will be analyzed using this UVF analyzer.

### 3.1.5 Fixed Base Laboratory Soil Analysis

One surface soil sample and two subsurface soil samples (three total) will be collected from all boring locations. If more than fifteen borings are installed during the delineation process, select soil boring locations determined in the field using the UVF screening results will be renamed during preparation of the chain of custody with consecutive numbers (e.g., 9SB01, 9SB02, etc.), and the three soil samples from each chosen location submitted to the laboratory. The corresponding UVF sample identification number will be written in the "note" column on the chain of custody. This information will also be logged in the field notebook. These will be analyzed for:

- Appendix IX VOCs
- Appendix IX SVOCs
- Appendix IX Metals
- Low-level PAHs
- TPH DRO and GRO

as presented in Table 3-1. All results will also be submitted for third party data validation.

The first soil boring location at the site of observed petroleum contamination will be designated as 9SB00 and samples from this location will be sent to the fixed base laboratory. Additional soil boring locations chosen for fixed base laboratory analyses will be labeled consecutively (beginning with 9SB01) in a manner consistent with previous sample designations at NAPR. 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. Sample identification extensions will follow the pattern shown below.

| | |
|---|---|
| 9SB01-00— | SMWU 9 Sample |
| 9SB01-00— | Soil Boring Sample |
| 9SB01-00— | Soil boring location identifier |
| 9SB01-00— | 0 to 12 inches below ground surface (bgs) (surface soil) sampling interval |

Subsurface soil samples will be designated as follows:

| | |
|---|---|
| 9SB01-01— | First subsurface sampling interval, 1-3 feet |
| 9SB01-02— | Second subsurface sampling interval, 3-5 feet, and so on. |

The actual sample depth (sampling interval) 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 data validator will be determined at a later date.

## 3.2 Monitor Well Installation Program

Up to fifteen temporary monitor wells will be installed at relevant locations as determined by positive detections of TPH in soil during the soil test kit analysis program.

Up to twelve of the temporary monitor wells will be advanced using the 66DT Geoprobe rig capable of direct push and augering. These 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.

The appropriate method for installation of the temporary monitoring point at the hand-augered locations near the wetland will be determined in the field. If the formation will stay open, the hole may be allowed to fill overnight with water from the formation. If it appears to collapse, a PVC screen may be installed at the appropriate depth. As noted above, these temporary wells will also be sealed with plastic sheeting at the surface to prevent inflow of surface water or accidental introduction of foreign material into the hole.

Each well boring will be sampled and logged as described in Section 3.1.3.

## 3.3 Groundwater Sampling and Analysis Program

If soil contamination is present at any location based on test kit analyses, the groundwater may also be tested with the UVF analyzer. This analysis will be limited to locations where the UVF analyzer indicates soil contamination just above the water table. Once the site delineation has been completed, and the sample locations are chosen for submission to the analytical laboratory, then groundwater samples corresponding to those chosen soil samples locations will also be sent to the fixed base laboratory. All groundwater samples submitted to the laboratory for analysis will be analyzed for the following (see Table 3-1):

- Appendix IX VOCs
- Appendix IX SVOCs
- Appendix IX Metals (Total and Dissolved)
- Low-level PAHs
- TPH DRO and GRO

The groundwater will be sampled using a low flow sampling technique. Appendix A includes a detailed description of the low flow sampling technique. Field parameters of pH, temperature, turbidity, conductivity, dissolved oxygen, and oxidation-reduction potential will be obtained with appropriate instrumentation during sampling if enough volume of groundwater is present. The groundwater samples will be placed into appropriate laboratory supplied containers. The groundwater sampled will be filtered in the field for the dissolved metals analyses.

The groundwater sample designations will correspond to the soil boring location. For example, groundwater collected from soil boring location 9SB01 will have a groundwater sample identification of 9GW01.

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 3-2. The specific laboratory and data validator will be determined at a later date.

## 3.4 Sediment Sampling and Analysis Program

Up to eight sediment samples will be obtained from the estuarine wetland at locations already marked from the Step 5 and 6 ERA investigation (see Figure 3-1). The samples will be obtained using disposable, stainless steel spoons. The samples will be obtained by placing the sediment in a disposable aluminum pan. Samples for VOC analysis will be containerized, and the remaining sediment will be thoroughly homogenized following the removal of debris (e.g., vegetation/roots). All pertinent sampling information such as sediment description (e.g., color and texture), sample number and location, presence or absence of aquatic invertebrates, and the time of sample collection will be recorded in the field logbook. After homogenization, the sediment samples will be placed into appropriate jars for laboratory-based chemical analysis (see Table 3-1). All sample jars will be packed in ice and shipped to the analytical laboratory for:

- Appendix IX SVOCs
- Appendix IX Metals
- Low-level PAHs
- TPH DRO and GRO

All analyses at the laboratory will be performed using current methodologies as presented in Table 3-2. The specific laboratory and data validator will be determined at a later date.

## 3.5 Surface Water Sampling and Analysis Program

Surface water will be collected only if groundwater at the site is determined to contain petroleum contamination by the test kit analysis. Up to two surface water samples will be obtained from the estuarine wetland in locations downgradient of the contaminated groundwater (as determined by the test kit) in order to determine if contamination is discharging to the estuarine wetland. Surface water samples will be collected using the direct dip method from an appropriate water depth determined in the field. The direct dip method will utilize an 1-liter laboratory certified clean, unpreserved amber bottle. The surface water will then be decanted into appropriate laboratory supplied containers for laboratory-based chemical analysis (see Table 3-1). All sample jars will be packed in ice and shipped to the analytical laboratory for:

- Appendix IX VOCs
- Appendix IX SVOCs
- Appendix IX Metals (Total and Dissolved)
- Low-level PAHs
- TPH DRO and GRO

The surface water samples will be filtered in the field for the dissolved metals analyses.. All analyses at the laboratory will be performed using current methodologies as presented in Table 3-2. The specific laboratory and validator will be determined at a later date.

## 3.6 Quality Assurance/Quality Control Samples

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

### 3.6.1 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.

### 3.6.2 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 total of three equipment rinsates will be collected. These samples will be associated with the surface soil, subsurface soil, sediment, and groundwater sampling equipment. The samples will be obtained from a stainless steel spoon for collection of soil and sediment, a split spoon sampler or macro core liner for collection of subsurface soil, and from the polyethylene and silicon tubing used during the collection of groundwater. These samples will be analyzed for the analytes presented in Table 3-3.

### 3.6.3 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.

### 3.6.4 Field Duplicates

Field duplicate samples of the surface soil, subsurface soil, groundwater, and sediment samples will be collected during the same time the corresponding environmental sample is collected. One duplicate sample will be collected at a frequency of 10 percent of environmental samples collected per media. In addition approximately 5 percent of the UVF test kit samples will be duplicated in the field, with the duplicate sample being reanalyzed using the UVF analyzer.

### 3.6.5 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 at a frequency of 5 percent of environmental samples collected of a similar matrix. The sample matrices in the preceding paragraphs specify the collection and analysis of these samples.

## 3.7 Other Investigation Considerations

### 3.7.1 Clearing and Grubbing

It may be necessary for site clearing to be performed so the Geoprobe 66DT rig can gain access to delineate the suspected contamination. One day of site clearing will be performed by the direct push subcontractor.

### 3.7.2 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 (PWD) at NAPR. Some fuel lines are 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.

### 3.7.3 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 soil samples will be analyzed for TPH DRO and GRO and Toxicity Characteristic Leaching Procedure (TCLP) VOCs, and the water samples will be analyzed for TPH DRO and GRO, and reactivity, corrosivity, and ignitibility (RCI) 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 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.

### 3.7.4 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 USEPA approved RCRA Facility Investigation Work Plans (Baker, 1995). The remaining contaminant free sampling equipment and materials utilized during this investigation will be disposable.

### 3.7.5 Surveying

The sampling locations will be located utilizing a Global Positioning (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.

### 3.7.6 Health and Safety Procedures

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

### 3.7.7 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 RFI report shall include at a minimum:

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

The RFI report 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 SWMU 9. The introduction will also provide a regulatory framework for NAPR and SWMU 9, as well as a discussion of current conditions.

### 4.2 Physical Characteristics of Study Area

The physical characteristics of SWMU 9 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 RFI work plan objectives for the SWMU will be discussed. The sample locations, sample collection and handling procedures, QA/QC 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). The sediment data will be screened against the NAPR sediment screening values. Additionally, inorganics will be compared against their respective background values as presented in the Summary Report for Environmental Background Concentrations for Inorganic Compounds (Baker, 2006b). 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 project team 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 RCRA Quarterly Progress Report for NAPR.

## 5.0 SCHEDULE

A schedule for the implementation of this work plan and the RFI report is provided as Figure 5-1. It should be noted that this schedule is dependent upon USEPA 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 USEPA's comments are to be incorporated.

## 6.0 SITE MANAGEMENT

An organizational 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 RFI Report for SWMU 9 Area B – Tank 214 Area.

### 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 Activity Manager regarding any changes in scope of the investigation.

## 7.0 REFERENCES


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Baker, 2000. *Revised Draft RCRA Facility Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico.* Baker Environmental, Inc. March 10, 2000. Coraopolis, Pennsylvania.

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Baker, 2006a. *Revised Final Steps 3b and 4 of the Baseline Ecological Risk Assessment for SWMU 9 – Area B (Tanks 214-215), Naval Activity Puerto Rico, Ceiba, Puerto Rico.* Baker Environmental, Inc. January 10, 2006. Coraopolis, Pennsylvania.

Baker, 2006b. *Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico*. Baker Environmental, Inc. October 17, 2006. Coraopolis, Pennsylvania.

# TABLES

**TABLE 3-1**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM**
**ENVIRONMENTAL SAMPLES**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | | Fixed Based Analytical Lab Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Media** | **Sample Depth (ft bgs)** | App IX VOCs | App IX SVOCs | Low Level PAHs | App IX Metals (Total) | App IX Metals (Dissolved) | TPH DRO | TPH GRO | UVF - TPH | **Comment** |
| **Surface Soil Samples** | | | | | | | | | | |
| 9SB00-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB01-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB01-00D[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | Duplicate |
| 9SB01-00MS/MSD[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | Matrix Spike/Matrix Spike Duplicate |
| 9SB02-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB03-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB04-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB05-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB05-00D[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | Duplicate |
| 9SB05-00MS/MSD[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | Matrix Spike/Matrix Spike Duplicate |
| 9SB06-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB07-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB08-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB09-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB10-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB11-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB12-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB12-00D[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | Duplicate |
| 9SB12-00MS/MSD[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | Matrix Spike/Matrix Spike Duplicate |
| 9SB13-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |
| 9SB14-00[1] | 0.0 - 1.0 | X | X | X | X | | X | X | | |

**TABLE 3-1**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM**
**ENVIRONMENTAL SAMPLES**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | | Fixed Based Analytical Lab Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Media** | **Sample Depth (ft bgs)** | App IX VOCs | App IX SVOCs | Low Level PAHs | App IX Metals (Total) | App IX Metals (Dissolved) | TPH DRO | TPH GRO | UVF - TPH | **Comment** |
| **Subsurface Soil Samples** | | | | | | | | | | |
| 9SB00-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB00-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB01-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB01-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB02-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB02-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB03-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB03-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB04-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB04-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB05-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB05-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB06-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB06-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB07-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB07-02D[(1)(2)] | (2) | X | X | X | X | | X | X | X | Duplicate |
| 9SB07-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB08-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB08-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB09-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB09-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB10-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB10-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB11-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB11-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB12-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB12-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB13-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB13-02D[(1)(2)] | (2) | X | X | X | X | | X | X | X | Duplicate |
| 9SB13-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB14-01[(1)(2)] | (2) | X | X | X | X | | X | X | X | |
| 9SB14-02[(1)(2)] | (2) | X | X | X | X | | X | X | X | |

**TABLE 3-1**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM**
**ENVIRONMENTAL SAMPLES**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | | Fixed Based Analytical Lab Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Media** | **Sample Depth (ft bgs)** | App IX VOCs | App IX SVOCs | Low Level PAHs | App IX Metals (Total) | App IX Metals (Dissolved) | TPH DRO | TPH GRO | UVF - TPH | **Comment** |
| **Sediment Samples** | | | | | | | | | | |
| 9SD19 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| 9SD30 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| 9SD44 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| 9SD48 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| 9SD48D | 0.0 - 0.5 | X | X | X | X | | X | X | | Duplicate |
| 9SD48MS/MSD | 0.0 - 0.5 | X | X | X | X | | X | X | | Matrix Spike/Matrix Spike Duplicate |
| 9SD49 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| 9SD50 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| 9SD52 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| 9SD53 | 0.0 - 0.5 | X | X | X | X | | X | X | | |
| **Groundwater Samples** | | | | | | | | | | |
| 9GW00(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW01(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW02(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW03(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW03D(1) | NA | X | X | X | X | X | X | X | X | Duplicate |
| 9GW03MS(1) | NA | X | X | X | X | X | X | X | | Matrix Spike |
| 9GW03MSD(1) | NA | X | X | X | X | X | X | X | | Matrix Spike Duplicate |
| 9GW04(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW05(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW06(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW07(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW08(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW09(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW10(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW11(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW11D(1) | NA | X | X | X | X | X | X | X | X | Duplicate |
| 9GW12(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW13(1) | NA | X | X | X | X | X | X | X | X | |
| 9GW14(1) | NA | X | X | X | X | X | X | X | X | |
| **Surface Water Samples, if needed** | | | | | | | | | | |
| 9SWXX(3) | NA | X | X | X | X | X | X | X | | |
| 9SWXX(3) | NA | X | X | X | X | X | X | X | | |

**Notes:**
(1) - The sample designator will be determined based on the soil boring location identifier.
(2) - Two subsurface samples will be collected at depths to be established in the field and reported with analytical results.
(3) - The sample designator will be determined based on the sediment sample identification.
ft bgs - feet below ground surface.

**TABLE 3-1**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM**
**ENVIRONMENTAL SAMPLES**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | | Fixed Based Analytical Lab Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Media** | **Sample Depth (ft bgs)** | App IX VOCs | App IX SVOCs | Low Level PAHs | App IX Metals (Total) | App IX Metals (Dissolved) | TPH DRO | TPH GRO | UVF - TPH | **Comment** |

NA - Not Applicable.

**TABLE 3-2**

**METHOD PERFORMANCE LIMITS**
**APPENDIX IX COMPOUND LIST AND CONTRACT**
**REQUIRED QUANTITATION LIMITS (CRQL)**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

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

**TABLE 3-2**

**METHOD PERFORMANCE LIMITS**
**APPENDIX IX COMPOUND LIST AND CONTRACT**
**REQUIRED QUANTITATION LIMITS (CRQL)**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**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 (5030)(low level) |
| Propionitrile | 20 | 100 | 8260B (5030)(low level) |
| Stryene | 1.0 | 5.0 | 8260B (5030)(low level) |
| 1,1,1,2-Tetrachloroethane | 1.0 | 5.0 | 8260B (5030)(low level) |
| 1,1,2,2-Tetrachloroethane | 1.0 | 5.0 | 8260B (5030)(low level) |
| Tetrachloroethene | 1.0 | 5.0 | 8260B (5030)(low level) |
| Toluene | 1.0 | 5.0 | 8260B (5030)(low level) |
| 1,1,1-Trichloroethane | 1.0 | 5.0 | 8260B (5030)(low level) |
| 1,1,2-Trichloroethane | 1.0 | 5.0 | 8260B (5030)(low level) |
| Trichloroethene | 1.0 | 5.0 | 8260B (5030)(low level) |
| Trichlorofluoromethane | 1.0 | 5.0 | 8260B (5030)(low level) |
| 1,2,3-Trichloropropane | 1.0 | 5.0 | 8260B (5030)(low level) |
| Vinyl Acetate | 2.0 | 10 | 8260B (5030)(low level) |
| Vinyl Chloride | 1.0 | 10 | 8260B (5030)(low level) |
| Xylene | 2.0 | 10 | 8260B (5030)(low level) |

**TABLE 3-2**

**METHOD PERFORMANCE LIMITS**
**APPENDIX IX COMPOUND LIST AND CONTRACT**
**REQUIRED QUANTITATION LIMITS (CRQL)**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Semivolatiles | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| 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 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Semivolatiles (Cont.) | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| 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 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Semivolatiles (Cont.) | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| 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 |
| **Low Level PAHs** | **Quantitation Limits*** | | **Method Number** |
| | **Water (µg/L)** | **Low Soil (µg/kg)** | |
| 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 |

Revised: January 17, 2007

**TABLE 3-2**

**METHOD PERFORMANCE LIMITS**
**APPENDIX IX COMPOUND LIST AND CONTRACT**
**REQUIRED QUANTITATION LIMITS (CRQL)**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | **Quantitation Limits*** | | |
|---|---|---|---|
| **Total Petroleum Hydrocarbons** | **Water (µg/L)** | **Soil (µg/kg)** | **Method Number** |
| TPH DRO | 100 | 3300 | 5030B/8015B |
| TPH GRO | 50 | 250 | 3550B/8015B |
| | **Quantitation Limits*** | | |
| **Toxicity Characteristic Leaching Procedure** | **Water (µg/L)** | **Soil (µg/kg)** | **Method Number** |
| TCLP Volatiles | 20 | NA | 1311 |
| | **Quantitation Limits*** | | |
| **Reactivity, Corrosivity, Ignitibility** | **Water** | **Soil (µg/kg)** | **Method Number** |
| RCI | various | various | 9014/9040C/9034/ 9045D/1010A |

* Quantitation limits listed for soil/sediment are based on wet weight. The quanitiation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.
µg/L - micrograms per liter.
NA- not applicable

**TABLE 3-2**

**METHOD PERFORMANCE LIMITS**
**APPENDIX IX COMPOUND LIST AND CONTRACT**
**REQUIRED QUANTITATION LIMITS (CRQL)**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Inorganics | Method Number | Quantitation Limits* Water (µg/L) | Quantitation Limits* Low Soil (mg/kg) | Method Description |
|---|---|---|---|---|
| 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* Soil (mg/kg) | Quantitation Limits* Water (µg/L) | Method Description |
|---|---|---|---|---|
| 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.

**TABLE 3-3**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM**
**QA/QC AND IDW SAMPLES**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | Samples Analysis Requested | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Media** | App IX VOCs | App IX SVOCs | App IX Metals (Dissolved) | App IX Metals (Total) | Low Level PAHs | TPH GRO | TPH DRO | RCI | TCLP (VOCs) | TPH DRO | TPH GRO | RCI | **Comment** |
| **Trip Blank Samples** | | | | | | | | | | | | | |
| 2007TB01 | X(1) | | | | | X(1) | | | | | | | |
| 2007TB02 | X(1) | | | | | X(1) | | | | | | | |
| 2007TB03 | X(1) | | | | | X(1) | | | | | | | |
| 2007TB04 | X(1) | | | | | X(1) | | | | | | | |
| 2007TB05 | X(1) | | | | | X(1) | | | | | | | |
| 2007TB06 | X(1) | | | | | X(1) | | | | | | | |
| **Equipment Rinsate Samples** | | | | | | | | | | | | | |
| 2007ER01 | X | X | X | X | X | X | X | | | | | | Stainless Steel Spoon |
| 2007ER02 | X | X | X | X | X | X | X | | | | | | Macro Core Liner |
| 2007ER03 | X | X | X | X | X | X | X | | | | | | Polyethylene and Silicon Tubing |
| **Field Blank Samples** | | | | | | | | | | | | | |
| 2007FB01 | X | X | X | X | X | X | X | | | | | | Lab Grade Deionized Water |
| 2007FB02 | X | X | X | X | X | X | X | | | | | | Store Bought Distilled Warer |
| 2007FB03 | X | X | X | X | X | X | X | | | | | | NAPR Potable Water |
| **IDW Samples** | | | | | | | | | | | | | |
| 2007IDW01 | | | | | | X | X | X | | | | | Aqueous |
| 2007IDW02 | | | | | | | | | X | X | X | X | Solid |

**Note:**

(1) - The analysis required for this sample will be dependent on which samples are being accompanied in the cooler.
In addition approximately 5 percent of the UVF test kit samples will be duplicated in the field, with one sample being reanalyzed using the UVF analyzer.

# FIGURES

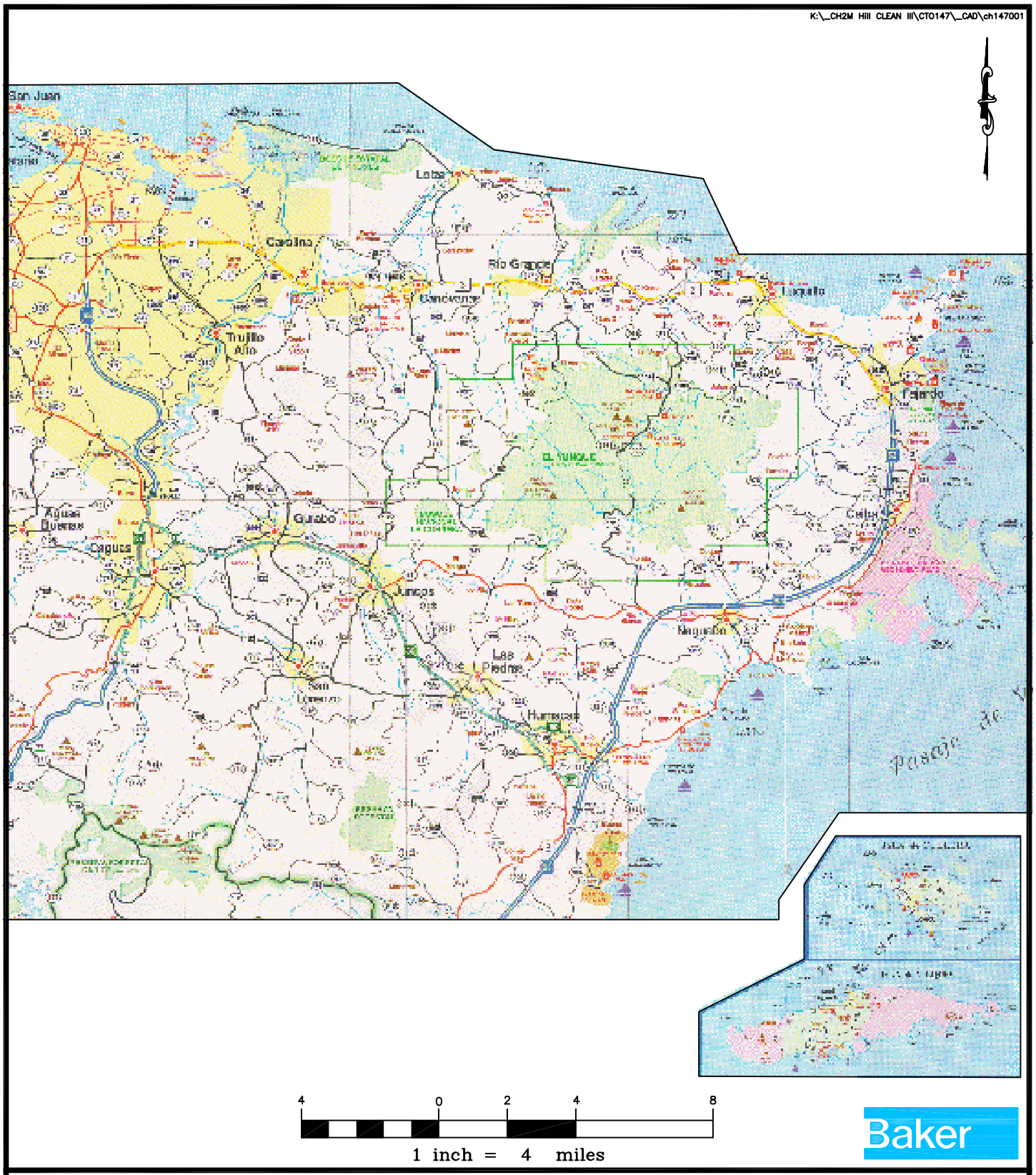
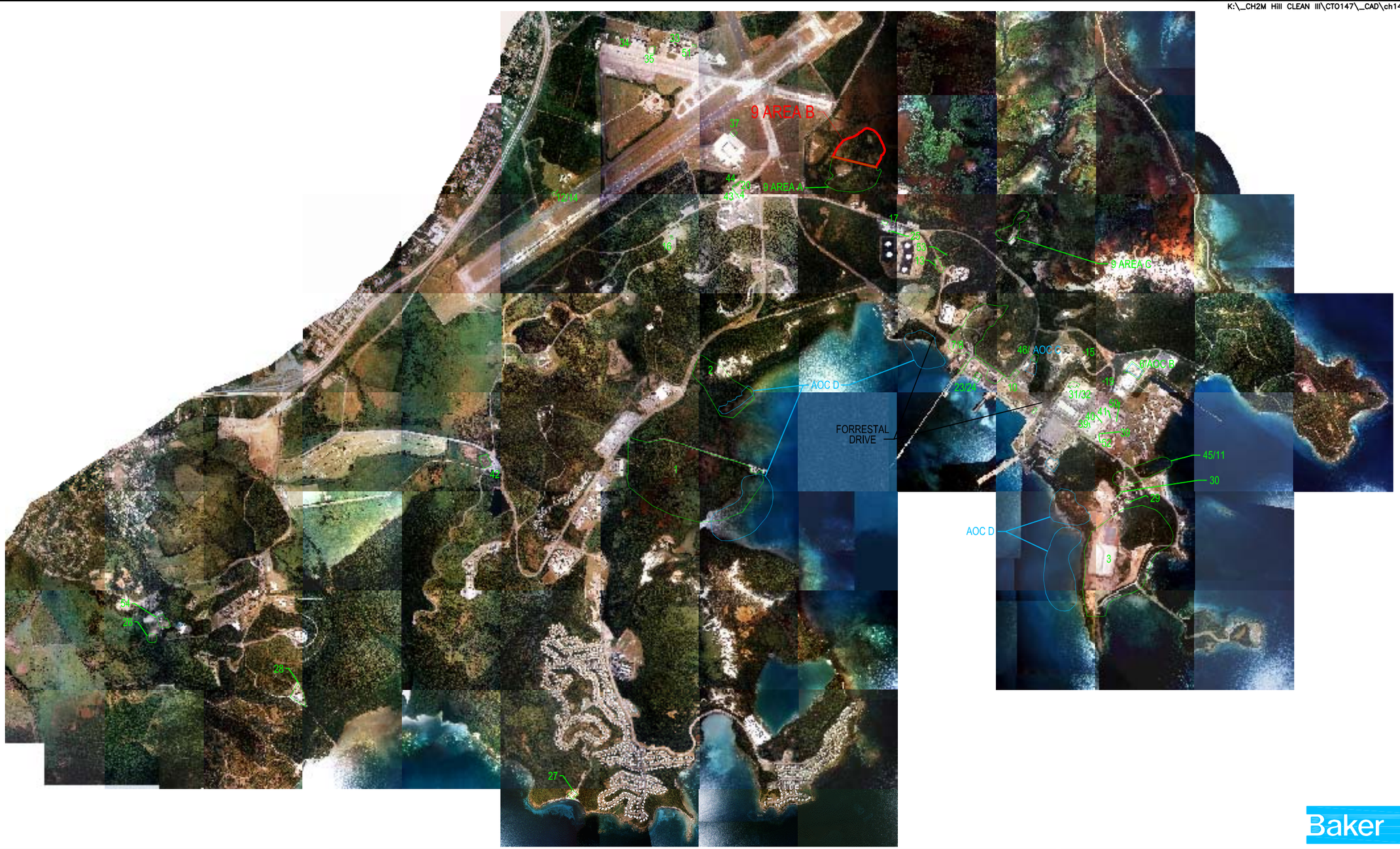



FIGURE 1–1
REGIONAL LOCATION MAP

NAVAL ACTIVITY PUERTO RICO

SOURCE: METRODATA, INC., 1999.

K:_CH2M Hill CLEAN III\CTO147_CAD\ch147002




LEGEND

1 – SWMUs

9 – AREA OF WHICH THIS INVESTIGATION PERTAINS TO

AOC D – AOCs

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

2500 0 1250 2500

1 inch = 2500 ft.

FIGURE 1–2
LOCATION MAP
RCRA FACILITY INVESTIGATION WORK PLAN
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

K:_CH2M Hill CLEAN III\CTO147_CAD\ch147005

AREA OF SUSPECTED PETROLEUM CONTAMINATION

13GW05

TANK 214

AREA B

AREA B (TANK 214)

100

105

110

115

50

150

50 0 25 50

1 inch = 50 ft.

Baker

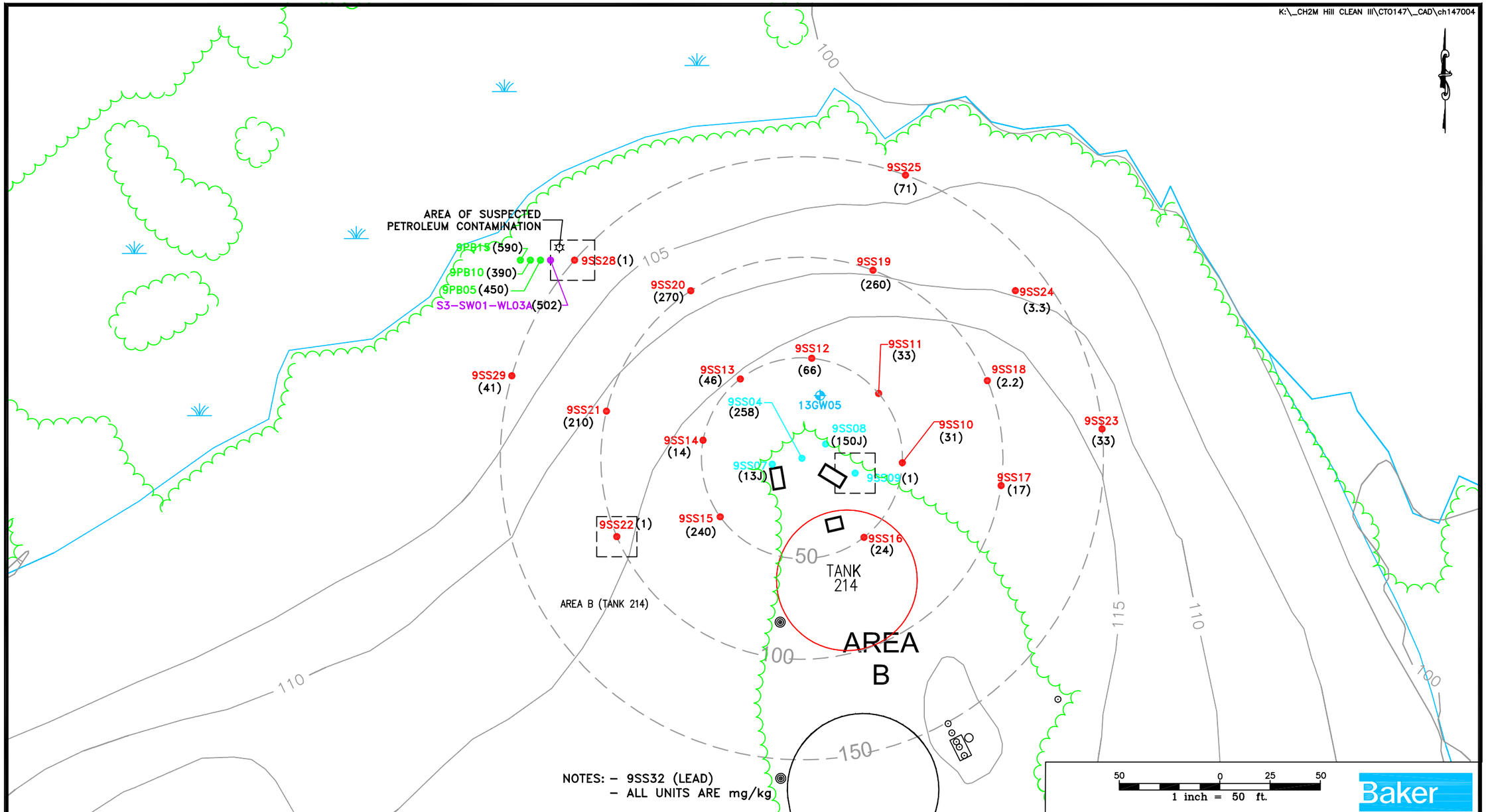
LEGEND

- EXISTING MONITORING WELL LOCATION
- TELEPHONE POLE
- MAY 2006 EXCAVATION (INTERIM CORRECTIVE MEASURE)
- AREA OF SUSPECTED PETROLEUM CONTAMINATION

FIGURE 1-3
LOCATION MAP
SWMU 9 AREA B (TANK 214)
RCRA FACILITY INVESTIGATION WORK PLAN

NAVAL ACTIVITY PUERTO RICO
CEIBA,PUERTO RICO

K:_CH2M Hill CLEAN III\CTO147_CAD\ch147004



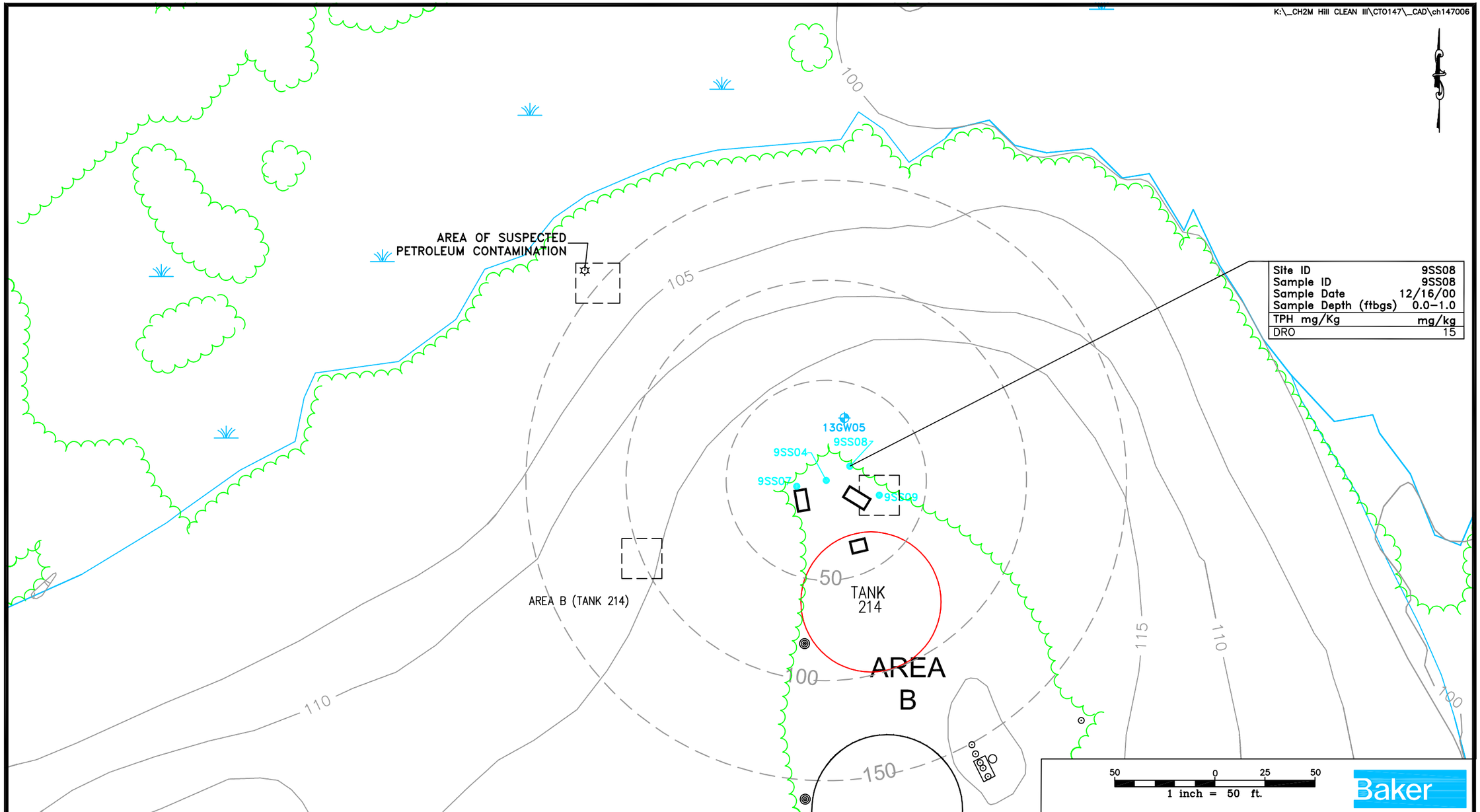

LEGEND

- EXISTING MONITORING WELL LOCATION
- SURFACE SOIL SAMPLE LOCATION (PHASE I RFI AND CMS INV.-1996/2000)
- SURFACE SOIL SAMPLE (ADDITIONAL DATA COLLECTION-2003)
- SURFACE SOIL SAMPLE LOCATION (SEPTEMBER 2006)
- SURFACE SOIL SAMPLE LOCATION (MAY 2006 EXCAVATION)
- TELEPHONE POLE
- MAY 2006 EXCAVATION (INTERIM CORRECTIVE MEASURE)
- AREA OF SUSPECTED PETROLEUM CONTAMINATION
- (1) - SOILS EXCAVATED IN MAY 2006

FIGURE 2-1
POSITIVE DETECTIONS OF LEAD IN SURFACE SOIL SWMU 9 AREA B (TANK 214)
RCRA FACILITY INVESTIGATION WORK PLAN

NAVAL ACTIVITY PUERTO RICO
CEIBA,PUERTO RICO

K:_CH2M Hill CLEAN III\CTO147_CAD\ch147006



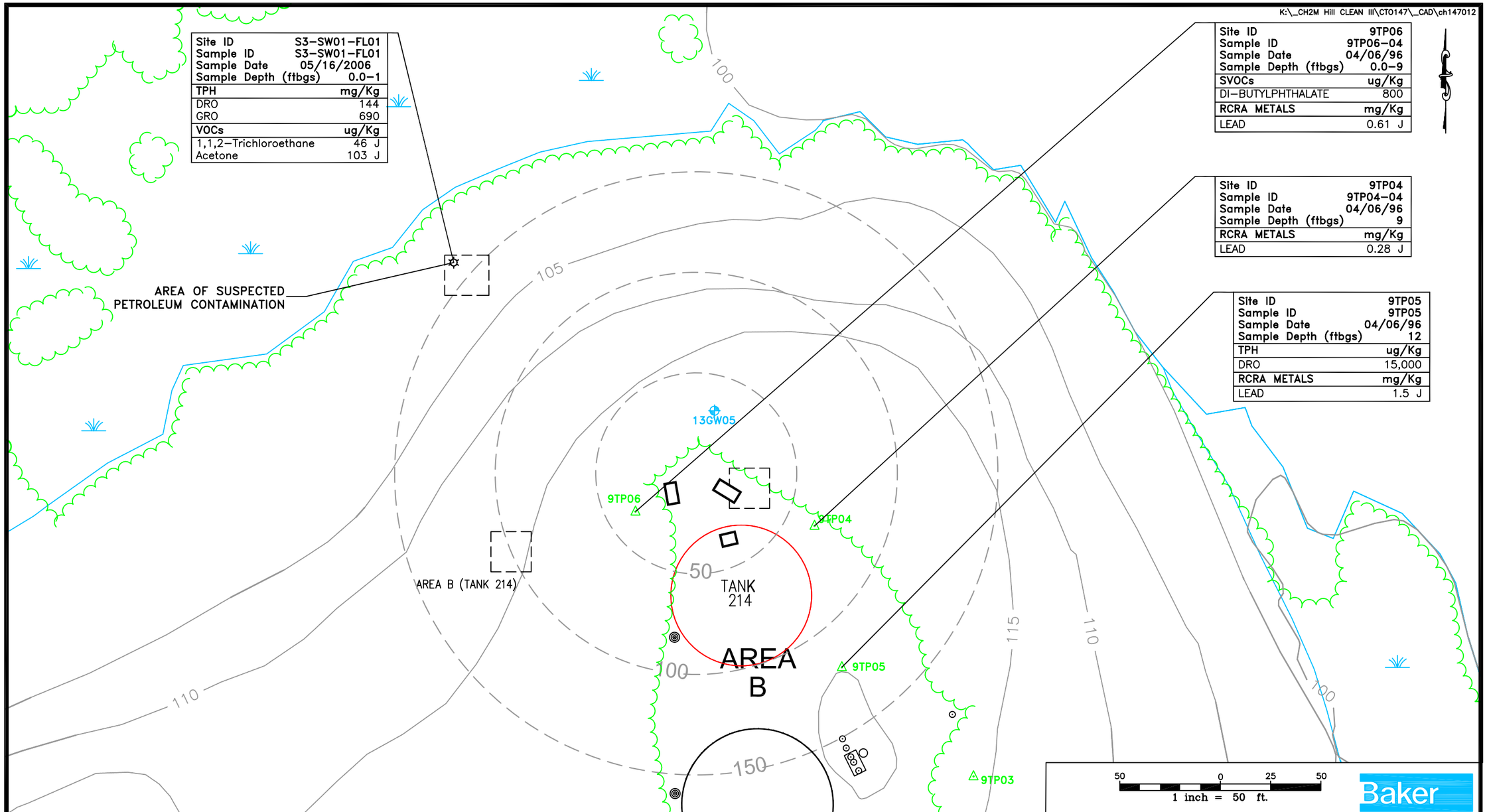

LEGEND

- EXISTING MONITORING WELL LOCATION
- SURFACE SOIL SAMPLE LOCATION (PHASE I RFI AND CMS INV.–1996/2000)
- TELEPHONE POLE
- MAY 2006 EXCAVATION (INTERIM CORRECTIVE MEASURE)
- AREA OF SUSPECTED PETROLEUM CONTAMINATION

FIGURE 2–2
POSITIVE DETECTIONS OF ORGANIC COMPOUNDS IN SURFACE SOIL
SWMU 9 AREA B (TANK 214)
RCRA FACILITY INVESTIGATION WORK PLAN

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

K:_CH2M Hill CLEAN III\CTO147_CAD\ch147012




| Site ID | S3-SW01-FL01 |
|---|---|
| Sample ID | S3-SW01-FL01 |
| Sample Date | 05/16/2006 |
| Sample Depth (ftbgs) | 0.0-1 |
| **TPH** | **mg/Kg** |
| DRO | 144 |
| GRO | 690 |
| **VOCs** | **ug/Kg** |
| 1,1,2-Trichloroethane | 46 J |
| Acetone | 103 J |

| Site ID | 9TP06 |
|---|---|
| Sample ID | 9TP06-04 |
| Sample Date | 04/06/96 |
| Sample Depth (ftbgs) | 0.0-9 |
| **SVOCs** | **ug/Kg** |
| DI-BUTYLPHTHALATE | 800 |
| **RCRA METALS** | **mg/Kg** |
| LEAD | 0.61 J |

| Site ID | 9TP04 |
|---|---|
| Sample ID | 9TP04-04 |
| Sample Date | 04/06/96 |
| Sample Depth (ftbgs) | 9 |
| **RCRA METALS** | **mg/Kg** |
| LEAD | 0.28 J |

| Site ID | 9TP05 |
|---|---|
| Sample ID | 9TP05 |
| Sample Date | 04/06/96 |
| Sample Depth (ftbgs) | 12 |
| **TPH** | **ug/Kg** |
| DRO | 15,000 |
| **RCRA METALS** | **mg/Kg** |
| LEAD | 1.5 J |

50 0 25 50
1 inch = 50 ft.

Baker

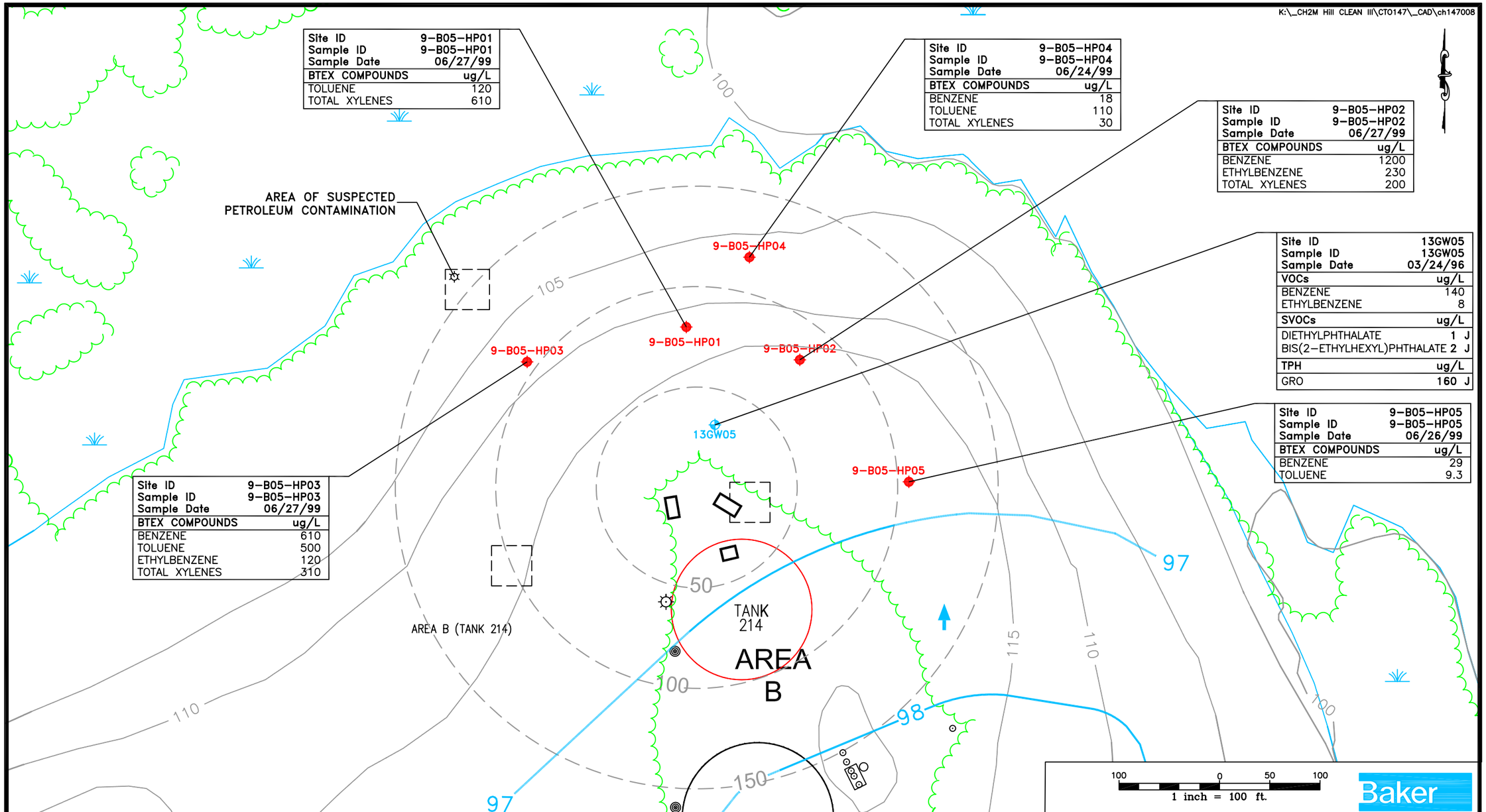
LEGEND

- TEST PIT LOCATION (PHASE I)
- EXISTING MONITORING WELL LOCATION
- TELEPHONE POLE
- MAY 2006 EXCAVATION (INTERIM CORRECTIVE MEASURE)
- AREA OF SUSPECTED PETROLEUM CONTAMINATION

FIGURE 2-3
POSITIVE DETECTIONS OF LEAD AND ORGANIC COMPOUNDS IN SUBSURFACE SOIL
SWMU 9 AREA B (TANK 214)
RCRA FACILITY INVESTIGATION WORK PLAN

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

K:_CH2M Hill CLEAN III\CTO147_CAD\ch147008




| Site ID | 9-B05-HP01 |
|---|---|
| Sample ID | 9-B05-HP01 |
| Sample Date | 06/27/99 |
| **BTEX COMPOUNDS** | **ug/L** |
| TOLUENE | 120 |
| TOTAL XYLENES | 610 |

| Site ID | 9-B05-HP04 |
|---|---|
| Sample ID | 9-B05-HP04 |
| Sample Date | 06/24/99 |
| **BTEX COMPOUNDS** | **ug/L** |
| BENZENE | 18 |
| TOLUENE | 110 |
| TOTAL XYLENES | 30 |

| Site ID | 9-B05-HP02 |
|---|---|
| Sample ID | 9-B05-HP02 |
| Sample Date | 06/27/99 |
| **BTEX COMPOUNDS** | **ug/L** |
| BENZENE | 1200 |
| ETHYLBENZENE | 230 |
| TOTAL XYLENES | 200 |

| Site ID | 13GW05 |
|---|---|
| Sample ID | 13GW05 |
| Sample Date | 03/24/96 |
| **VOCs** | **ug/L** |
| BENZENE | 140 |
| ETHYLBENZENE | 8 |
| **SVOCs** | **ug/L** |
| DIETHYLPHTHALATE | 1 J |
| BIS(2-ETHYLHEXYL)PHTHALATE | 2 J |
| **TPH** | **ug/L** |
| GRO | 160 J |

| Site ID | 9-B05-HP05 |
|---|---|
| Sample ID | 9-B05-HP05 |
| Sample Date | 06/26/99 |
| **BTEX COMPOUNDS** | **ug/L** |
| BENZENE | 29 |
| TOLUENE | 9.3 |

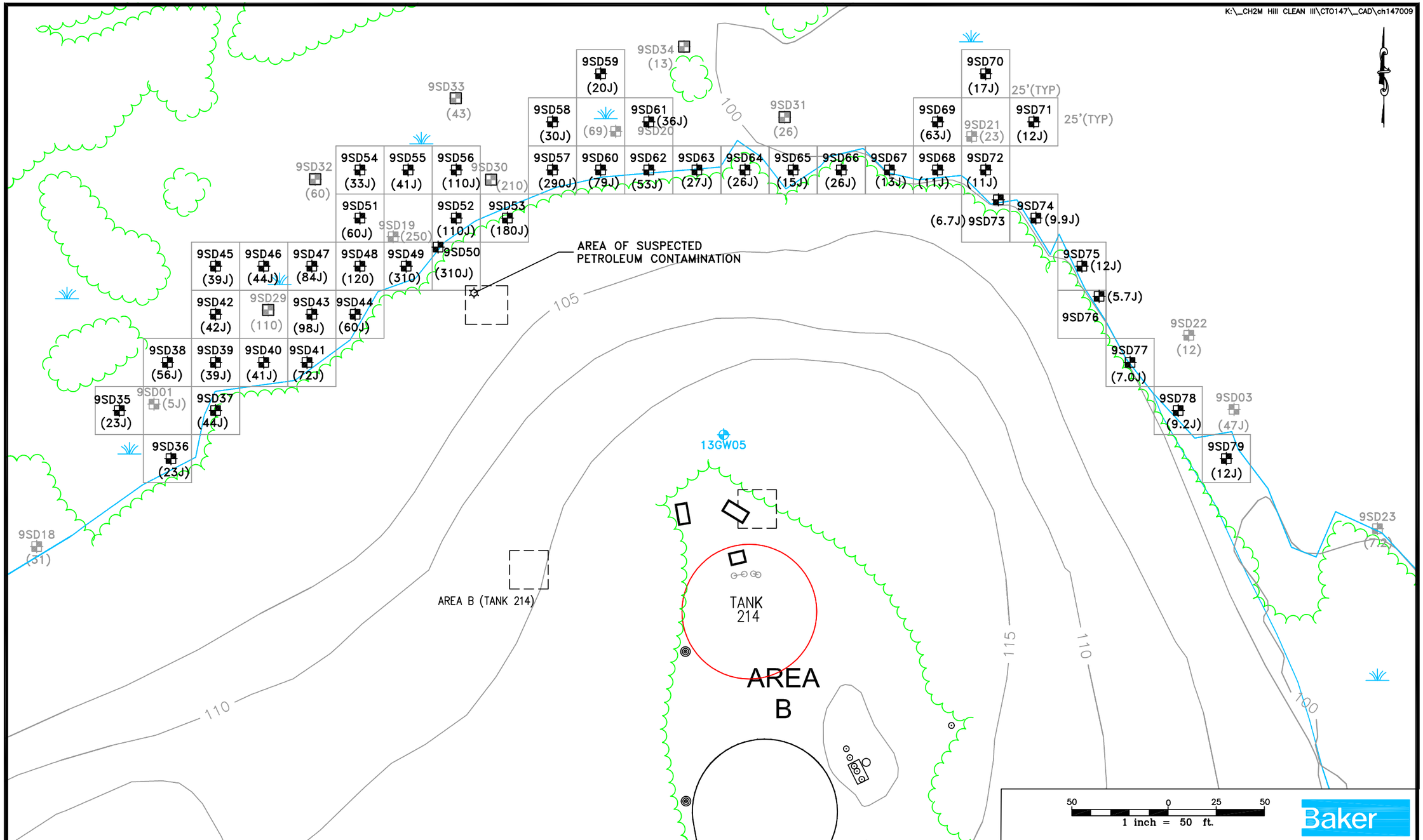
| Site ID | 9-B05-HP03 |
|---|---|
| Sample ID | 9-B05-HP03 |
| Sample Date | 06/27/99 |
| **BTEX COMPOUNDS** | **ug/L** |
| BENZENE | 610 |
| TOLUENE | 500 |
| ETHYLBENZENE | 120 |
| TOTAL XYLENES | 310 |

LEGEND

- HYDROPUNCH SOIL AND/OR GROUNDWATER SAMPLE LOCATION (PHASE III)
- EXISTING MONITORING WELL LOCATION
- TELEPHONE POLE
- MAY 2006 EXCAVATION (INTERIM CORRECTIVE MEASURE)
- AREA OF SUSPECTED PETROLEUM CONTAMINATION
- GROUNDWATER FLOW DIRECTION
- 97 – GROUNDWATER CONTOUR LINE AND ELEVATION

FIGURE 2-4
POSITIVE DETECTIONS OF ORGANIC COMPOUNDS IN GROUNDWATER
SWMU 9 AREA B (TANK 214)
RCRA FACILITY INVESTIGATION WORK PLAN

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

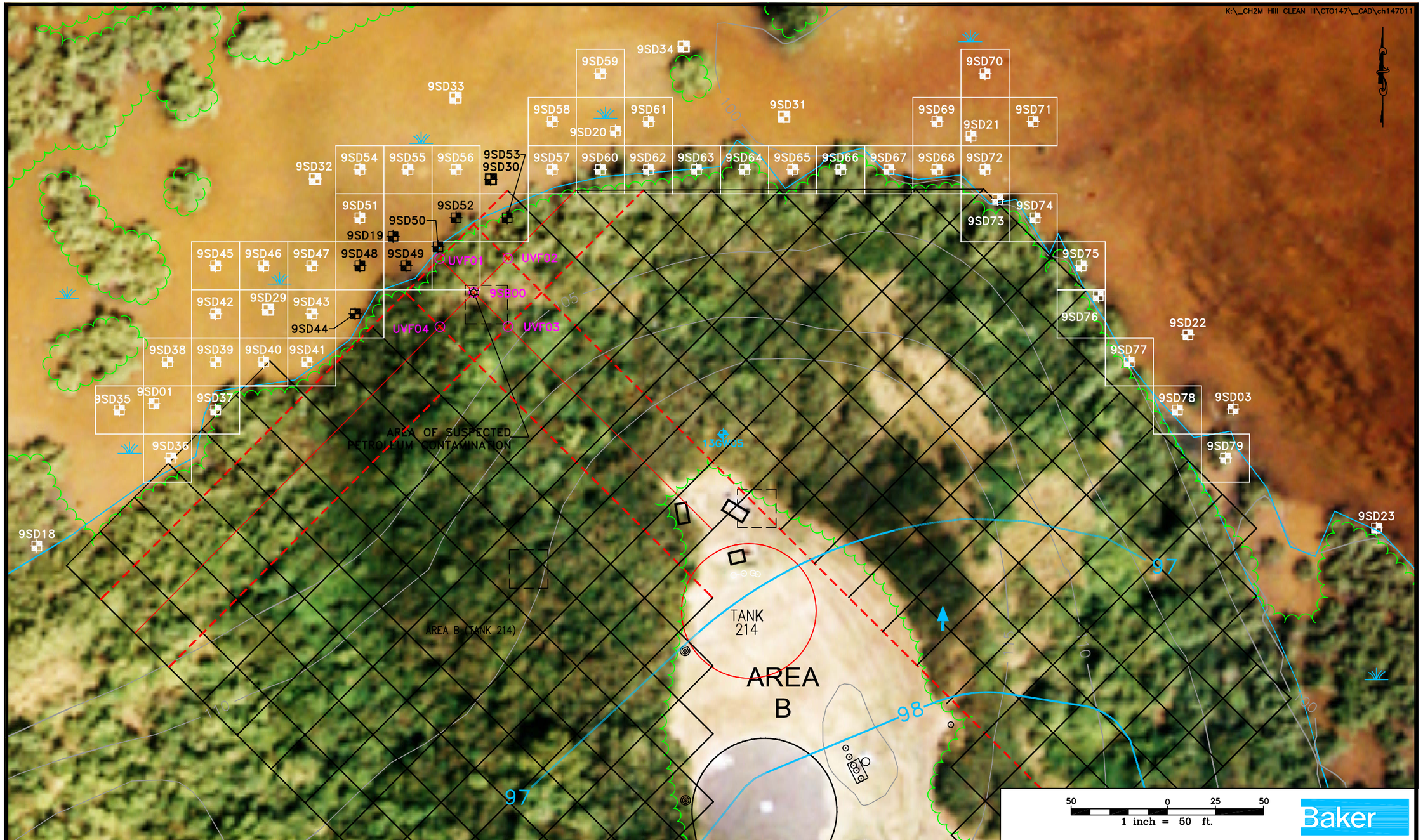



NOTES:
- 9SD32 (LEAD)
- ALL UNITS ARE mg/kg

LEGEND
- MONITOR WELL LOCATION (PHASE I–1996)
- SEDIMENT SAMPLE LOCATION (ADDITIONAL DATA COLLECTION–2003)
- SEDIMENT SAMPLE LOCATION (CMS INVESTIGATION–2000)
- SEDIMENT SAMPLE LOCATION (PHASE III RFI–1999)
- SEDIMENT SAMPLE LOCATION (ERA STEPS 5+6–2006)
- EXISTING MONITORING WELL LOCATION
- TELEPHONE POLE
- MAY 2006 EXCAVATION (INTERIM CORRECTIVE MEASURE)
- AREA OF SUSPECTED PETROLEUM CONTAMINATION

FIGURE 2–5
POSITIVE DETECTIONS OF LEAD IN SEDIMENT
SWMU 9 AREA B (TANK 214)
RCRA FACILITY INVESTIGATION WORK PLAN

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO




NOTES:
– LOCATIONS SUBJECT TO CHANGE DEPENDING ON TEST KIT RESULTS

LEGEND

- – PREVIOUS SEDIMENT SAMPLE LOCATION
- – GROUNDWATER SAMPLE LOCATION (PHASE III RFI–1999)
- – TELEPHONE POLE
- – MAY 2006 EXCAVATION (INTERIM CORRECTIVE MEASURE)
- – AREA OF SUSPECTED PETROLEUM CONTAMINATION
- – SOIL GRID SAMPLE
- – SEDIMENT GRID SAMPLE
- – PROPOSED SAMPLE LOCATION
- – GROUNDWATER FLOW DIRECTION
- 97 – GROUNDWATER CONTOUR LINE AND ELEVATION
- – SECONDARY LINES
- – ALTERNATE PRIMARY LINES
- – PRIMARY LINES

FIGURE 3–1
PROPOSED SAMPLING GRID
SWMU 9 AREA B (TANK 214)
RCRA FACILITY INVESTIGATION WORK PLAN

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

**FIGURE 3-2**

**SOIL DELINEATION DECISION DIAGRAM**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**CTO-147**
**NAVAL ACTIVITY PUERTO RICO, CIEBA, PUERTO RICO**

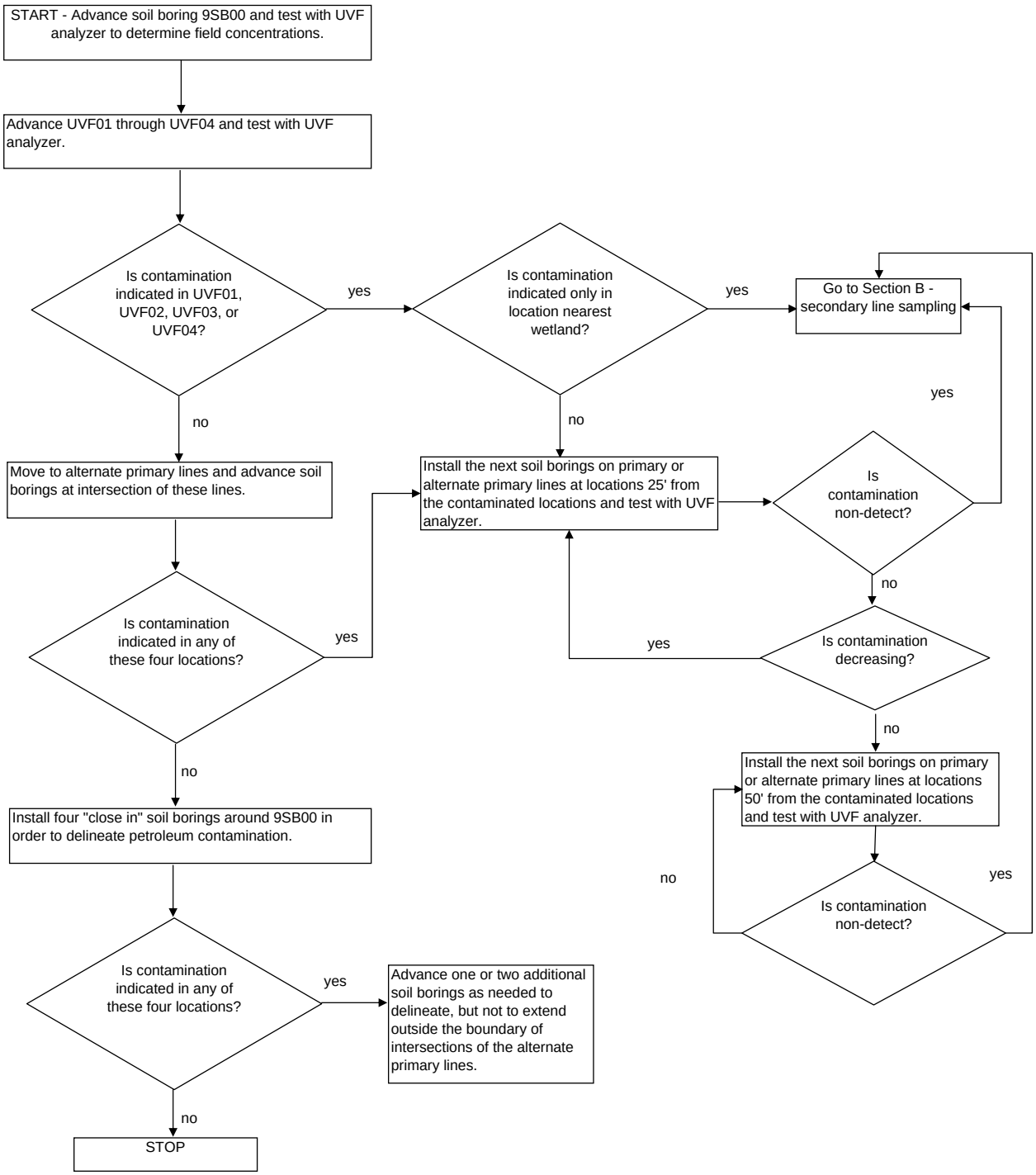


**FIGURE 3-2**

**SOIL DELINEATION DECISION DIAGRAM**
**PHASE I RFI WORK PLAN, SWMU 9 TANK 214 AREA**
**CTO-147**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

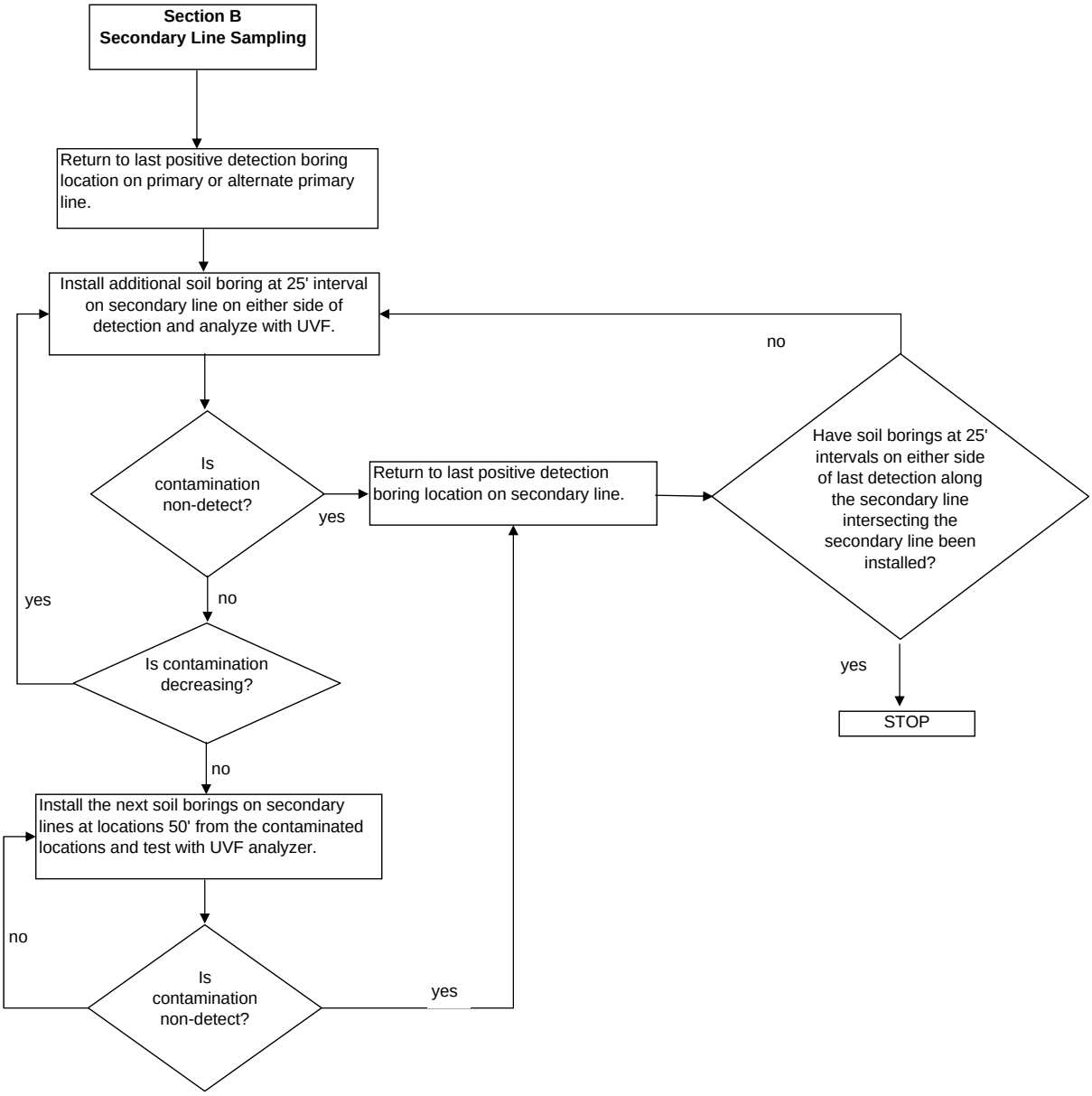
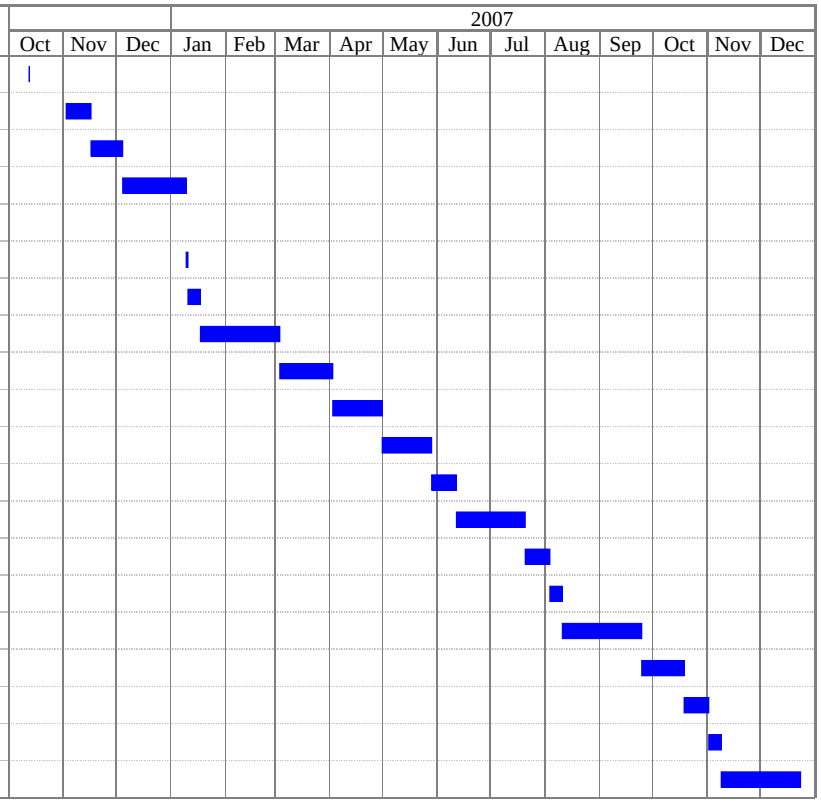


**Figure 5-1**

Revised: January 17, 2007

**Phase I RFI Work Plan**
**SWMU 9 Area B (Tank 214)**
**Naval Activity Puerto Rico, Ceiba, Puerto Rico**
**Proposed Project Schedule**

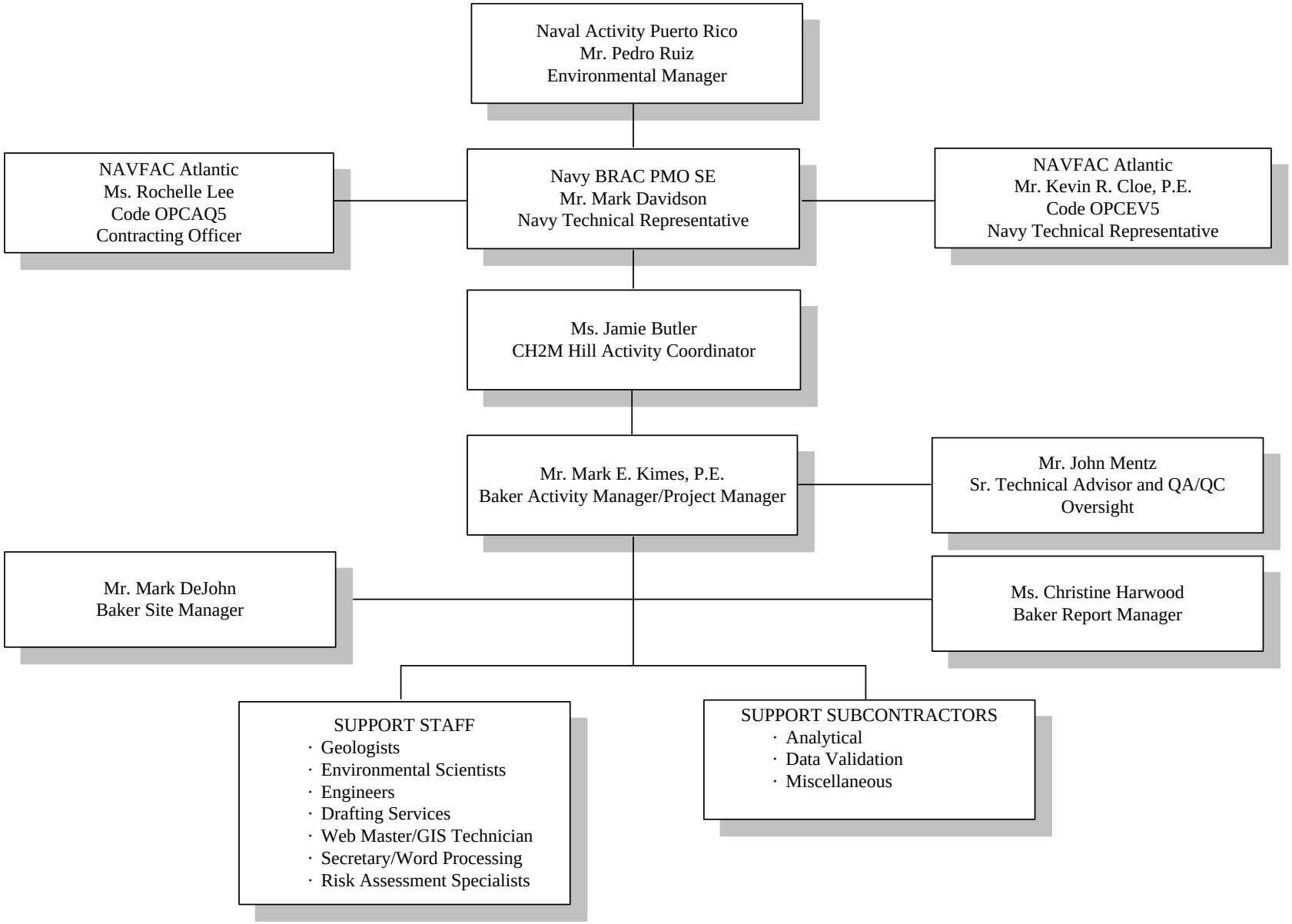
| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | Draft RFI Work Plan to the Navy | 21 edays | 10/12/06 | 11/2/06 |
| 2 | Navy Review | 14 edays | 11/2/06 | 11/16/06 |
| 3 | Draft RFI Work Plan to the EPA | 18 edays | 11/16/06 | 12/4/06 |
| 4 | EPA Review | 36 edays | 12/4/06 | 1/9/07 |
| 5 | Final RFI Work Plan to the Navy | 0 edays | 1/9/07 | 1/9/07 |
| 6 | Navy Review | 1 eday | 1/9/07 | 1/10/07 |
| 7 | Final RFI Work Plan to the EPA | 7 edays | 1/10/07 | 1/17/07 |
| 8 | EPA Review & Approval | 45 edays | 1/17/07 | 3/3/07 |
| 9 | Initiate Field Work | 30 edays | 3/3/07 | 4/2/07 |
| 10 | Field Investigation | 28 edays | 4/2/07 | 4/30/07 |
| 11 | Laboratory Analysis | 28 edays | 4/30/07 | 5/28/07 |
| 12 | Data Validation | 14 edays | 5/28/07 | 6/11/07 |
| 13 | Draft Phase I RFI Report for SWMU 9 Area B to Navy | 39 edays | 6/11/07 | 7/20/07 |
| 14 | Navy Review | 14 edays | 7/20/07 | 8/3/07 |
| 15 | Draft Phase I RFI Report for SWMU 9 Area B to EPA | 7 edays | 8/3/07 | 8/10/07 |
| 16 | EPA Review | 45 edays | 8/10/07 | 9/24/07 |
| 17 | Final Phase I RFI Report for SWMU 9 Area B to Navy | 24 edays | 9/24/07 | 10/18/07 |
| 18 | Navy Review | 14 edays | 10/18/07 | 11/1/07 |
| 19 | Final Phase I RFI Report for SWMU 9 Area B to EPA | 7 edays | 11/1/07 | 11/8/07 |
| 20 | EPA Review & Approval | 45 edays | 11/8/07 | 12/23/07 |




Project:Phase I RFI Work Plan
Date: 1/16/07

Task

**FIGURE 6-1**
**PROJECT ORGANIZATION**
**PHASE I RFI WORK PLAN – SWMU 9 AREA B, TANK 214 AREA**
**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

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley Press, Boca Raton, Florida.

Puls, R.W. and M.J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures, EPA/540/S-95/504.

U.S. EPA, 1993, RCRA Ground-Water Monitoring: Draft Technical Guidance, EPA/530-R-93-001.

U.S. EPA Region II, 1989, CERCLA Quality Assurance Manual.