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Additional Data Collection Investigation Report

SWMU 9

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

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June 14, 2004

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FINAL

ADDITIONAL DATA COLLECTION INVESTIGATION REPORT

SWMU 9

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

CONTRACT TASK ORDER 0033

JUNE 14, 2004

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DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
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Norfolk, Virginia

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LIST OF ACRONYMS AND ABBREVIATIONS

AET	Apparent Effects Threshold
AOC	Areas of Concern
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	Corrective Measures Study
CNO	Chief of Naval Operations
COPCs	Chemicals of Potential Concern
CTO	Contract Task Order
D	Duplicate
DoN	Department of the Navy
DRMO	Defense Reutilization and marketing Office
ER	Equipment Rinsate
ERA	Ecological Risk Assessment
ER-L	Effects Range – Low
ER-M	Effects Range - Median
FB	Field Blank
GPS	Global Positioning System
GRO	Gasoline Range Organics
HI	Hazard Index
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
IDW	Investigation Derived Waste
IR	Installation Restoration
LANTDIV	United States Navy, Atlantic Division
LEL	Low Effect Level
LOAEL	Lowest Observed Adverse Effect Level
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MATC	Maximum Acceptable Toxicant Concentration
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NFESC	Naval Facilities Engineering Command
NOAEL	No Observed Adverse Effect Level
NSRR	Naval Station Roosevelt Roads
PEC	Probable Effects Concentration
QA/QC	Quality Assurance/Quality Control

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SEL	Severe Effect Level
SSI	Supplemental Site Investigation
SVOCs	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TEC	Threshold Effect Concentration
TEL	Threshold Effect Level
TPH	Total Petroleum Hydrocarbons
UCL	upper confidence level
USEPA	United States Environmental Protection Agency
USTs	Underground Storage Tanks

1.0 INTRODUCTION

This report presents results from the Additional Data Collection Investigation performed in July 2003 in support of the Corrective Measures Study (CMS) for Solid Waste Management Unit (SWMU) 9, Tanks 212-217 located at Naval Station Roosevelt Roads (NSRR), Ceiba, Puerto Rico. This report has been prepared under the Corrective Action provisions of the NSRR's Resource Conservation and Recovery Act (RCRA) Permit No. PR2170027203. This report on the Additional Data Collection Investigation in Support of the CMS at SWMU 9 has been prepared under contract to the Atlantic Division, Naval Facilities Engineering Command (LANTDIV), Contract Number N62470-95-D-6007, Contract Task Order (CTO) 033.

1.1 Objectives of the Report on the Additional Data Collection Investigation in Support of the CMS

The objective of the Additional Data Collection Field Investigation was to perform additional sampling of surface soils in the vicinity of Tank 214 at Area B for characterization of lead and zinc contamination. Another objective of the field investigation was to perform additional sampling of sediment in the vicinity down gradient of Areas A and B for characterization of lead contamination, in the vicinity of previous sediment sample locations 9SD19 and 9SD20. These objectives were met with the performance of the field investigation conducted in July 2003.

The objectives of this report are as follows:

- The objective of this report is to present the data collected during the additional data collection field investigation, as well as to present the revised Step 3A of the ERA incorporating the new data collected.

- Make a determination whether or not this site will move forward to Step 3B of the ERA or continue in the Corrective Measures Study (CMS) planning stage.

1.2 Facility and Site Description

This section contains a description of the physical layout and a background history of NSRR, as well as a description of the physical layout of SWMU 9.

1.2.1 Facility Description

NSRR occupies over 8,600 acres on the northern side of the east coast of Puerto Rico, along Vieques Passage with Vieques Island lying to the east about 10 miles off the harbor entrance. The north entrance to NSRR is about 35 miles east along the coast road (Route 3) from San Juan. The closest large town is Fajardo (population approximately 37,000), which is about 10 miles north of NSRR off Route 3. Ceiba (population approximately 17,000) adjoins the west boundary of NSRR (see Figure 1-1).

NSRR was commissioned in 1943 as a Naval Operations Base, and redesignated a Naval Station in 1957. The current primary mission of NSRR is limited. NSRR is currently preparing for closure.

1.2.2 SWMU 9 Description

SWMU 9 is located at NSRR as shown on Figure 1-2, and is comprised of six fuel storage tanks, pipelines, and ancillary facilities. The SWMU was divided into three separate areas for

investigation purposes. Area A, located along Forrestal Drive, consists of Tanks 212 and 213. Area B, also located along Forrestal Drive, consists of Tanks 214 and 215. Area C, located along Antietam Road, consists of Tanks 216 and 217. Previous reports indicate that the tanks were constructed in 1948 for the storage of aviation gasoline, and that the tanks were cleaned every five years until 1978. This facility was included as a Solid Waste Management Unit in the RCRA Part B Permit, as a result of petroleum sludge generated and disposed of onsite in unlined earthen pits. According to base personnel, Tanks 212 and 213 are now used for the storage of diesel fuel and unleaded gasoline, respectively. Tanks 214 and 215 were later changed from aviation gasoline storage to marine diesel fuel and are currently out of service. Tank 216 was most recently used for storage of gasoline but is currently out of service. Previous investigations indicate that Tank 217 was used for the storage of marine diesel fuel and JP-5. The RCRA Facility Investigation (RFI) conducted at the site indicated that various environmental media were impacted by past site operations. The additional data collection field investigation was designed to fill identified data gaps necessary to select corrective measures to mitigate human health and ecological risks associated with contamination related to site operations as presented in the Draft Additional Data Collection Work Plan (Baker, 2003a). The work plan was written and submitted based on recommendations made in the Final CMS Investigation Report (Baker, 2003b), as well as concurrence of these recommendations by the United States Environmental Protection Agency (USEPA) (USEPA, 2003).

1.3 Regulatory Framework and Site Status

In 1943, NSRR was commissioned as a Naval Operations Base. NSRR continued in this status until 1957 when it was redesignated a naval station with the mission of providing full support for Atlantic Fleet weapons training and development activities. Until 1993 all environmental operations, with the exception of underground storage tanks (USTs), were conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations as part of the Department of the Navy's (DoN) Installation Restoration (IR) Program. Naval Station Roosevelt Roads submitted a RCRA Part B Permit application for the storage of hazardous waste on the Base. Recognizing that corrective action would apply to unpermitted waste management units, the Navy performed a Supplemental Site Investigation (SSI) at a variety of units (including SWMU 9) to provide additional site characterization information to the USEPA to assist in their permitting decisions. On October 20, 1994, a Final RCRA Part B permit was issued by the USEPA Region II to the Defense Reutilization and Marketing Office (DRMO), at NSRR as RCRA/HSWA Permit No. PR2170027203. The corrective action provisions of the permit contained specific requirements for investigation, and potentially, remediation at SWMU 9, as well as required RFI activities at 25 SWMUs and 3 Areas of Concern (AOCs). Two additional SWMUs (53 and 54) were identified during May of 2000 bringing the total to 27 SWMUs and 3 AOCs.

RCRA regulations provide a procedure to investigate and remediate areas that may have been affected by a release of hazardous wastes. The first steps for investigating a site are the RCRA Facility Assessment (RFA) and the RFI. These assessments and investigations are studies on a property to determine if there has been a release of hazardous waste and to quantify any releases that have occurred. If these studies determine that a release has occurred, a CMS is performed to identify the most appropriate corrective measure for a given site.

A RFA was performed in 1988 and updated in 1993 by A.T. Kearney, Inc. for the USEPA to identify SWMUs and AOCs, and to assess the potential for the release of hazardous constituents from any areas or units. The RFA identified 52 SWMUs and 4 AOCs, and recommended additional investigation at 25 of the SWMUs and three of the AOCs.

The RCRA Part B permit required a full RFI for SWMU 9. RFI Work Plans (Baker, 1995) were developed for NSRR that included SWMU 9. The work plan provided the framework for site characterization activities; its scope was guided by the results of the SSI. The field investigation for the work under this work plan is designated the Phase I investigation in this report. The field investigation for Phase I of the RFI for Operable Unit 2, including SWMU 9, was conducted during April 1996 and resulted in the development of the Draft RCRA Facility Investigation Report for Operable Unit 2, Naval Station Roosevelt Roads, Ceiba, Puerto Rico, September 1996 (Baker, 1996). The EPA Region II reviewed the September 1996 RFI document and provided comments in a March 4, 1997 letter. A Work Plan Addendum (Baker, 1997) was developed to perform additional fieldwork to address EPA comments. Phase II of the RFI field investigation took place during the fall (September/October) 1997 following EPA comments on the Draft RFI Report for Operable Unit 2, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. The results of Phase II of the RFI investigation were presented in the Draft RCRA Facility Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico, March 1998 (Baker, 1998a). The EPA Region II reviewed the March 1998 RFI document and provided comments in a June 15, 1998 letter. A Work Plan (Baker, 1998b) was developed to address these comments. This additional work is described as the Phase III investigation in this report. Phase III of the RFI investigatory work was conducted during June 1999 and led to the development of the Revised Draft RCRA Facility Investigation Report for SWMU 9, March 10, 2000 (Baker, 2000).

The EPA Region II reviewed the March 2000 RFI document and provided comments in a May 4, 2000 letter. The EPA approved the Revised Draft RFI and warranted a CMS where comments would be addressed and additional samples collected. A Draft CMS Work Plan for SWMU 9 was submitted to the EPA Region II on July 14, 2000. EPA commented on the Draft CMS Work Plan in a letter dated September 15, 2000. A Final CMS Work Plan was prepared in January of 2001 to address EPA comments expressed in their September 15, 2000 letter. The work plan was designed to fill identified data gaps and to provide a guide for selecting corrective measures to mitigate human health and ecological risks associated with contamination related to site operations. The EPA approved this work plan in their comment letter dated May 4, 2001. The CMS investigations at SWMU 9 were completed in February 2001. The corresponding CMS Investigation Report was submitted in July 2001, which presented the results of the CMS field investigation, as well as the ecological risk assessment. The EPA requested an addendum be developed for the CMS investigation report on October 4, 2001. A response to EPA comment letter dated October 4, 2001 was submitted on December 23, 2003. The EPA approved the Draft CMS Investigation Report on February 19, 2003 based on the Navy's response to EPA comment letter dated December 23, 2003. The Final CMS Investigation Report was submitted on April 25, 2003. A Draft Additional Data Collection Work Plan in support of the Final CMS Investigation Report was submitted on April 25, 2003, and EPA approved on June 3, 2003. The corresponding field investigation was initiated on July 13, 2003 and was completed on July 15, 2003.

1.4 Findings of Previous Investigations

Each phase of the RFI presented various analytical results from the different areas within SWMU 9. The data from each investigation were combined and evaluated under the Revised Draft RFI (Baker, 2000) and again for the Final CMS Investigation Report (Baker, 2003b). The paragraphs that follow provide a summary of the previous investigation findings at SWMU 9. This information is provided to assist in developing a complete understanding of the SWMU. Additional details from these investigations can be located in the above referenced documents.

1.4.1 Area A

There is evidence of the impact of past site operations on the environmental media sampled, particularly subsurface soil and groundwater. Benzene and toluene, as well as total petroleum hydrocarbons (TPH) gasoline range organics (GRO), were the primary contaminants. Several inorganic compounds exceeded the screening criteria in various media. However, many of these inorganics only exceeded the background screening criteria, and they do not appear to be site related, as they are not associated with diesel fuel and gasoline.

The Human Health Risk Assessment (HHRA) did not identify a cancer risk greater than the acceptable USEPA limits in Area A. Non-carcinogenic risk may exist for future, young-child military residents, mostly attributable to exposures to benzene and chromium in groundwater (Hazard Index [HI]=1.06). Additionally, future construction workers in Area A may potentially be at risk due to chromium in subsurface soil and groundwater and benzene in groundwater (HI=1.11). The HI is primarily the result of exposures to potential hexavalent chromium in subsurface soil and groundwater and benzene in groundwater. A HI value of 1.0 or higher indicates the potential for adverse health effects. Although the HI values for future, young-child military residents and future construction workers were above a HI of 1.0, unacceptable systematic health affects are not likely to occur. The reason for this is that benzene likely affects the blood and chromium affects the gastrointestinal tract, therefore, the HQ values should not be summed. The HHRA concluded that a minimal noncarcinogenic risk may potentially exist for future military child resident and future construction worker in Area A, while no increase in carcinogenic risk would be expected in any Area located at SWMU 9.

The screening-level ecological risk assessment (ERA) identified a potential for an unacceptable risk to aquatic life receptors and piscovore-bird receptors for certain metals in surface water and sediment. However, there was insufficient data to address bioavailability of these metals. Additionally, there was an unacceptable uncertainty due to the limited number of samples collected. The implementation of the Final CMS Work Plan (Baker, 2001) was designed to alleviate this uncertainty.

The refined ERA, performed in the Draft CMS Investigation Report (Baker, 2001b), indicated that there were no chemicals retained as ecological Chemicals of Potential Concern (COPCs) in the surface soil or the surface water at Area A. Lead was retained as a COPC for the sediment in Area A/B based on potential risks to lower trophic level receptor groups (i.e. benthic invertebrates).

1.4.2 Area B

There is evidence of the impact of past site operations on the environmental media sampled, particularly subsurface soil and groundwater. Benzene, Toluene, Ethylbenzene, and xylene (BTEX) were the primary contaminants. Several inorganic compounds exceeded screening criteria in various media. Lead for instance, although associated with gasoline, exceeded the background screening criteria in only one sample located up-slope of Tank 215. The remaining inorganic constituents can either be associated with natural occurrence, or generally appear in concentrations similar to those found at Area A.

The HHRA did not identify a cancer risk greater than the acceptable USEPA limits. There were no unacceptable non-carcinogenic risks associated with exposures to contaminants detected in Area B as estimated in the HHRA. However, results indicated that untreated groundwater is not suitable for human use because of odor, color, and staining problems.

The screening-level ERA identified a potential for an unacceptable risk to aquatic life receptors and piscovore-bird receptors for certain metals in surface water and sediment. However, there was insufficient data to address bioavailability of these metals. Additionally, there was an unacceptable uncertainty due to the limited number of samples collected. The implementation of the Final CMS Work Plan (Baker, 2001a) alleviated this uncertainty.

The refined ERA, performed in the Final CMS Investigation Report (Baker, 2003b), indicated that the COPCs of lead and zinc were retained in the surface soil at Area B based on the comparison of the mean and maximum concentrations found when compared to background mean and maximum concentrations. Mean exposure doses of lead and zinc to ingestion-based screening values resulted in retaining them as ecological COPCs for upper trophic level food web exposures. As discussed in Area A, there were no surface water COPCs, and lead was retained as a sediment COPC in Area A/B. Chromium did not exceed any criteria at Area B

1.4.3 Area C

There is limited evidence of the impact of past site operations on the environmental media sampled, particularly surface and subsurface soil, as well as surface water and sediment. Several semivolatile organic and inorganic compounds exceeded screening criteria in various media. Although the semivolatile organic compounds (SVOCs) are typically associated with tars, greases, heavy oils, and poorly refined fuels, they are present in limited extent and concentration. The inorganic compounds did exceed screening criteria, however, most of these compounds are not associated with fuel storage operations.

The HHRA did not identify a cancer risk greater than the acceptable USEPA limits. The HHRA concludes that a minimal non-carcinogenic risk may potentially exist for future, young-child military resident due to chromium and vanadium in surface water and sediment (HI=1.29). Also the results indicated that untreated groundwater is not suitable for human use because of odor, color, and staining problems.

The screening-level ERA identified a potential for an unacceptable risk to aquatic life receptors and piscovore-bird receptors for certain metals in surface water and sediment. However, there was insufficient data to address bioavailability of these metals. Additionally, there was an unacceptable uncertainty due to the limited number of samples collected.

After implementation of the Final CMS Work Plan (Baker, 2001), as well as the performance of a refined ERA (Baker, 2003b), no chemicals were retained as COPCs in the surface soil, surface water, or sediment in Area C.

1.5 Current Site Conditions

According to base personnel, Tanks 212 and 213 are now used for the storage of diesel fuel and unleaded gasoline, respectively. Tanks 214 and 215 were later changed from aviation gasoline storage to marine diesel fuel and are currently out of service. Tank 216 was most recently used for storage of gasoline but is currently out of service. Previous investigations indicated that Tank 217 was used for the storage of marine diesel fuel and JP-5 and is currently out of service.

1.6 Report Organization

This Report on the Ecological Field Investigation at SWMU 9 is organized into six sections. Section 1.0, the Introduction, is designed to introduce the reader to the objectives of the additional data collection investigation, a description of the base, as well as SWMU 9, regulatory framework established at this site, and findings of previous investigations and current conditions at SWMU 9. Section 2.0 provides the methodologies utilized during the field investigation, while Section 3.0 describes the results from the field investigation. The risk calculation and risk evaluation for the surface soil and sediment is described in Section 4.0. Section 5.0 provides the conclusions and recommendations based on the results obtained from the additional data collection field investigation, while Section 6.0 provides the references cited in this report.

2.0 INVESTIGATION METHODOLOGIES

The additional data collection field investigation consisted of the collection of surface soil and sediment for the purpose of characterizing lead and zinc in Areas A and B. The methods and procedures utilized during the field investigation are presented in the following subsections.

2.1 Sampling Procedures

All the investigation tasks described in subsequent sections of this plan were performed in accordance with the techniques and methodologies provided in the original USEPA approved work plan (Baker, 1995). Therefore, only the work elements themselves are discussed in the sections that follow.

2.1.1 Surface Soil

Surface soil samples were collected using new disposable stainless steel spoons. During sample collection, vegetation (grass and roots), rocks and twigs, if present were removed. Surface soil samples were collected between 0.0 and 0.5 foot below ground surface (bgs) as presented in Table 2-1. Surface soils samples were collected and placed directly into the laboratory prepared sample container. Samples were labeled and kept in coolers on ice and under strict chain-of-custody until delivered to the laboratory. Chain-of-custody forms for the samples collected are provided as Appendix A. Samples were collected and analyzed for lead and zinc as presented in Table 2-1.

2.1.2 Sediment

Sediment samples were also collected using new disposable stainless steel spoons. During sample collection, vegetation (i.e., roots), rocks and twigs, if present were removed. Sediment samples were collected between 0.0 and 0.5 foot bgs as presented in Table 2-1. Sediment samples were collected and placed directly into the laboratory prepared sample container. Samples were labeled and kept in coolers on ice and under strict chain-of-custody until delivered to the laboratory. Chain-of-custody forms for the samples collected are provided as Appendix A. Samples were collected and analyzed for lead only as presented in Table 2-1.

2.1.3 Quality Assurance/Quality Control Samples

Quality Assurance/Quality Control (QA/QC) samples were collected during the additional data collection investigation at SWMU 9. These samples were obtained to:

(1) ensure that the new stainless steel spoons were free of contamination (i.e., equipment rinsate blank);
(2) evaluate field methodology (i.e., duplicate samples); and,
(3) verify that the lab grade deionized water used to collect the equipment rinsate blank sample was free of contamination (i.e., field blanks).

Several types of field QA/QC samples were collected and analyzed including duplicate samples, equipment rinsate samples, field blanks, and matrix spike/matrix spike duplicate (MS/MSD).

These QA/QC samples are defined below:

- Duplicate Sample (D): Two samples collected simultaneously into separate containers from the same source under identical conditions. One duplicate sample was collected for every 10 environmental samples collected for each media type.

- Equipment Rinsate Sample (ER): Sample obtained by running laboratory supplied deionized water over new disposable sample collection equipment. One equipment rinsate sample (9ER01) was taken by running deionized water over a new disposable stainless steel spoon to determine if it was free of contamination.

- Field Blank (FB): Sample obtained by collecting laboratory grade deionized water used in the collection of the equipment rinsate sample. One field blank sample (9FB01) was collected to determine if the laboratory grade deionized water was free of contamination.

- Matrix Spike/Matrix Spike Duplicate: MS/MSDs are not field samples but are laboratory derived, and are collected to evaluate the matrix effect of the sample upon the analytical methodology. An MS and MSD must be performed for each group of samples of a similar matrix. MS/MSD samples were collected at a frequency of five percent.

2.2 Surface Soil Investigation

A total of 18 surface soil samples (9SS10 through 9SS25, 9SS28, and 9SS29) along with two duplicate samples were collected radially in 50 foot rings from sample location 9SS04 as shown on Figure 2-1. These samples were analyzed for lead and zinc at a fixed base mainland laboratory. The samples were collected downgradient of Tank 214 in three circles with increasing radii as shown on Figure 2-1. It is believed that the high levels of lead in previous samples collected at this site are a result of suspected lead based paint flaking from the adjacent valve pit box and possible contamination from leaded gasoline held in the tank. Therefore, the additional sampling was proposed to assist in delineating the lead and zinc contamination for purposes of the CMS evaluation. The locations sampled during the additional data collection investigation were determined in the field based on visual observation of drainage areas downgradient of the tank, as well as previous sample locations. The outer ring of samples contained two locations (9SS26 and 9SS27) that fell within the estuarine wetland portion of the site. The available surface soils near these two locations were closer to the 100-foot ring then to the 150-foot ring. Therefore, as outlined in the EPA approved work plan (Baker, 2003a), these two surface soil samples were not collected. Surface soil sample location 9SS24 was collected approximately 15 feet in towards the 100 foot surface soil sampling ring due its location near the edge of the mangrove (sediment)/surface soil interface. The EPA approved work plan (Baker, 2003a) stated that if a surface soil location is near the edge of the land water interface, then the sample will be moved closer until it is in an upland location. Appendix B provides the field notes taken during the additional data collection field investigation conducted in July 2003.

All surface soil samples were extracted for analysis by the laboratory, but only the samples from the 50-foot ring were analyzed initially. Due to the results of lead and/or zinc exceeding 50 milligrams per kilogram (mg/kg) from the more than half of the samples from the 50-foot ring, the remaining samples from the 100-foot and 150-foot rings were also analyzed for lead and zinc. This process assisted in determining if there is a correlation between the lead in the surface soil around Tank 214 to the lead in the sediment (9SD19 and 9SD20) north and northwest of Tank 214.

All surface soil sampling locations were flagged in the field and surveyed for horizontal location using a global positioning system (GPS) unit.

2.3 Sediment Investigation

Six sediment samples (9SD29 through 9SD34) and one duplicate sample were collected down gradient from Area A/B as shown on Figure 2-1, and analyzed for lead. Based on groundwater flow directions determined in the Revised Draft RFI Report (Baker, 2000), samples were placed in areas located downgradient of site operations. They were also placed flanking the samples identified as having higher lead concentrations (9SD19 and 9SD20) per the recommendations in the Final CMS Investigation Report (Baker, 2003b). Samples 9SD29, 9SD30, and 9SD31 were collected 10 to 30 feet from the shore (edge of the mangrove), and samples 9SD32, 9SD33, and 9SD34 were collected approximately 50 feet further away from the previous sample locations. Appendix B provides the field notes taken during the additional data collection field investigation conducted in July 2003.

All sediment sampling locations were surveyed for horizontal location using a GPS unit.

2.4 QA/QC Samples

One equipment rinsate sample (9ER01) was collected during this investigation by running lab grade deionized water over a stainless steel spoon. This sample was analyzed for lead and zinc as presented in Table 2-1.

One field blank sample was collected and analyzed for lead and zinc as presented in Table 2-1. The field blank sample collected (9FB01), consisted of lab grade deionized water supplied by the analytical laboratory.

2.5 Laboratory Analyses

Surface soil samples from Area B were submitted to the mainland laboratory for analysis of lead and zinc as presented in Table 2-1. The same firm (STL Savannah Laboratories) was retained for this investigation that performed the laboratory analysis for the previous CMS investigation. This ensured a consistency of techniques for analysis of the samples. Specific analytical methods are presented on Table 2-2.

Sediment samples from Area A/B were submitted to the mainland laboratory for analysis of lead as presented in Table 2-1. Specific analytical methods are presented in Table 2-2.

2.6 Data Validation

All mainland laboratory data generated by the investigation was subjected to independent, third party, validation. The USEPA Region II Data Validation Standard Operating Procedures were followed. The same firm (Heartland Environmental Services, Inc.) was retained for this investigation that performed data validation for the previous RFI and CMS Investigation Reports. This ensured a consistency of techniques and that an equivalent review of the data were performed.

2.7 Investigation Derived Waste

No investigation-derived waste (IDW) was generated during surface soil or sediment sampling at SWMU 9. Clean disposable stainless steel spoons were utilized during sample collection. Therefore no equipment decontamination was needed to be performed.

3.0 INVESTIGATION RESULTS

This section presents an overview of chemical analytical results obtained from samples taken during the additional data collection field investigation at SWMU 9. The SWMU 9 data was obtained through sample collection and analysis of surface soil and sediment samples. The analytical results for environmental and QA/QC samples also are included in this section.

The surface soil and sediment data reported for SWMU 9 was not screened against any criteria in this section. However, this data is screened against criteria in the ecological risk calculation and risk evaluation for surface soil and sediment (Section 4.0) of this document. The two duplicate surface soil samples (9SS10D and 9SS20D) and one duplicate sediment sample (9SD29D) were combined with their respective environmental sample. The maximum concentration between the environmental sample and its duplicate are used on Tables 3-1 and 3-2. The lead and zinc results for 9SS10D were 31 mg/kg and 50J mg/kg, respectively, while 9SS10 contained detections of lead and zinc of 27 mg/kg and 46J mg/kg, respectively. The lead and zinc results for 9SS20D were 270 mg/kg and 130 mg/kg, respectively, while 9SS20 contained detections of lead and zinc of 260 mg/kg and 100 mg/kg, respectively. The lead result of 9SD29D was 110 mg/kg, while the lead result for 9SD29 was 55 mg/kg.

Appendix C provides the data validation report narratives for the analytical results provided in this section.

3.1 Surface Soil Analytical Results

A total of 18 surface soil samples and two duplicate samples were collected during this investigation. The new data collected during this investigation was combined with the existing lead and zinc surface soil data from the previous investigations for the area in question. Table 3-1 presents the complete surface soil data set for lead and zinc at Area B (Tanks 214-215). Lead was detected in all 22 surface soil samples that have been collected at Area B. The range of detections for this lead data is 2.2 mg/kg found at sample location 9SS18, to 1,300 mg/kg found at sample location 9SS22 collected during this most recent field investigation, as presented in Table 3-1. The average concentration of lead detected in the 22 surface soil samples is 212 mg/kg. The soils impacted by lead are isolated to the west and north of Tank 214 as shown on Figure 3-1. The results from the latest round of sampling has developed uncertainty with respect to the extent of lead in the surface soils in the vicinity of 9SS22. Sample 9SS22 contained the highest detection of lead at 1,300 mg/kg and is the furthest sample to the southwest.

Zinc was detected in all 21 surface soil samples that have been collected at Area B. The range of detections for the zinc data is 35 mg/kg (9SS18) to 520J mg/kg (9SS07) collected in December 2000, as presented in Table 3-1 and on Figure 3-1. The average concentration of zinc detected in the 21 surface soil samples is 86.5 mg/kg. The characterization of zinc in the surface soils was accomplished through the sampling conducted during this investigation. The highest concentrations of zinc in the surface soils has been contained in the area of the valve pits located north of Tank 214.

The risks associated with the listed detections are covered in Section 4.0 (Risk Calculation and Risk Evaluation for Surface Soil and Sediment) of this document.

3.2 Sediment Analytical Results

A total of six sediment samples and one duplicate sample were collected during this investigation as presented in Table 2-1. As was the case for the surface soil samples mentioned above, the

sediment samples collected during this investigation were combined with the existing lead sediment data from the previous investigations. Table 3-2 presents the complete sediment data set for lead at Area B (Tanks 214-15). Lead was detected in all 21 samples that have been collected at this site as presented on Figure 3-1. The range of detections for the lead data is 3.2 mg/kg found in sample 9SD14, to 250 mg/kg found in sample 9SD19 collected during the December 2000 field investigation. The average concentration of lead detected in the 21 sediment samples is 46 mg/kg. The highest concentrations of lead in the sediment are located along the estuarine wetland shoreline northeast of Tank 214 as shown on Figure 3-1.

The risks associated with the listed detections are covered in Section 4.0 (Risk Calculation and Risk Evaluation for Surface Soil and Sediment) of this document.

3.3 QA/QC Sample Results

A total of two QA/QC samples were collected during this investigation, consisting of one equipment rinsate sample (9ER01) and one field blank sample (9FB01) as presented in Table 3-3.

Lead was not detected in either of the two QA/QC samples collected during this investigation as presented in Table 3-3. Zinc was only detected in field blank sample (9FB01) collected at this site, with a concentration of 2.6J micrograms per liter (µg/L) found.

4.0 RISK CALCULATION AND RISK EVALUATION FOR LEAD AND ZINC

As part of the CMS conducted at SWMU 9, an ecological risk assessment (ERA) was conducted using the process outlined in the Chief of Naval Operations (CNO) document entitled Navy Policy for Conducting Ecological Risk Assessments (CNO 1999). The ERA, presented in the document entitled Final Corrective Measures Study Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico (Baker 2003a) included Tier 1 of the Navy ERA process:

- Screening-level problem formulation and ecological effects evaluation (Step 1).
- Screening-level exposure estimate and risk calculation (Step2).

Under Navy policy, if the results of Steps 1 and 2 (Tier 1 screening-level ERA) indicates that, based on a set of conservative exposure assumptions, there are chemicals present in environmental media that may present a risk to receptor species/communities, the ERA process proceeds to the baseline ERA. According to Superfund guidance (USEPA 1997), Step 3 represents the problem formulation phase of the baseline ERA. Under Navy policy, the baseline ERA is defined as Tier 2, and the first activity under Tier 2 is Step 3a. In Step 3a, the conservative exposure assumptions applied in Tier 1 are refined and risk estimates are recalculated using the same conceptual site model. Because the results of the Tier 1 screening-level ERA indicated that, based on a set of conservative exposure assumptions, there are multiple chemicals that may present a risk to ecological receptor groups/species, the ERA process at SWMU 9 (Area B) included Step 3a of the baseline ERA.

Based on the results of the assessment, lead and zinc were identified as potential risk drivers for terrestrial plants and/or invertebrates in SWMU 9 (Area B) surface soil (hazard quotient [HQ] = 4.59 for lead and 4.91 for zinc [see Table 4-1]). These two metals were also identified as potential risk drivers for one or more upper trophic level receptors (lead HQ = 3.77 for the American robin and 2.09 for the mourning dove; zinc HQ = 1.95 for the American robin [see Table 4-2]). In addition to potential risks to terrestrial receptor groups/species, lead was identified as a potential risk driver for aquatic invertebrates (HQ = 1.11 [see Table 4-3]) and an upper trophic level aquatic receptor species (HQ = 2.43 for the spotted sandpiper [see Table 4-4]).

Given the limited surface soil and sediment data for these two metals, the Final CMS Report for SWMU 9 recommended the collection of additional surface soil samples from Area B (in the vicinity of Tank 214) for lead and zinc analyses and the collection of additional sediment samples from Area A/B (in the vicinity of Sample 9SD19) for lead analyses prior to making a decision on whether or not the SWMU should move forward in the ERA process (i.e., Step 3b of the baseline ERA [baseline ERA problem formulation]) or move into the CMS Stage. A work plan, dated April 25, 2003 (Baker 2003b), presenting the technical approach for conducting an additional data collection effort, was prepared and submitted to the USEPA. The Work Plan, approved in a letter from the USEPA dated June 3, 2003, was implemented in July 2003. A description and summary of the results of the July 2003 field sampling effort was presented in Sections 2.0 and 3.0, respectively. The re-evaluation of lead and zinc risks to the ecological receptor groups/species discussed above is presented in the sections that follow.

4.1 Sources of Available Analytical Data

Surface soil and sediment sampling activities at SWMU 9 (Area B) have been conducted under separate investigations:

- RFI field investigation (Phase I) in 1996 (surface soil)
- CMS field investigation in 2000 (surface soil and sediment)
- Additional Data collection field investigation in 2003 (surface soil and sediment)

The RFI field investigations and associated analytical results were presented and discussed in the Revised Draft RFI report for SWMU 9 (Baker 2000), while the CMS field investigation and associated analytical results were presented and discussed in the Final CMS investigation report (Baker 2003a). A description of the additional data collection field investigation and associated analytical data are presented in Section 2.0 and Section 3.0, respectively.

A listing of the abiotic media quantitatively evaluated by this evaluation is summarized in Table 4-5. Surface soil analytical data obtained during the Phase I RFI, CMS, and additional data collection field investigations and sediment data obtained during the CMS and additional data collection field investigation were combined into unified data sets (by media) for the evaluation of potential risks presented in Sections 4.3 and 4.4. Unified data sets for surface soil and sediment are presented in Tables 4-6 and 4-7, respectively. Detected concentrations at each surface soil and sediment sampling locations are depicted on Figure 3-1.

4.2 Risk Calculation and Risk Evaluation for Surface Soil

Table 4-8 presents the results of the media-specific risk calculation for lead and zinc in surface soil. Results of the risk calculation (HQs) for terrestrial food web exposures to lead and zinc in surface soil is presented in Table 4-9. An evaluation of the risk calculations presented in Tables 4-8 and 4-9 is provided in the sections that follow.

4.2.1 Terrestrial Receptor Groups

As evidenced by the Table 4-8, mean HQ values for lead and zinc exceeded surface soil screening values (HQ = 3.92 and 1.73, respectively). The surface soil screening values used in risk calculations for both metals were toxicological thresholds for terrestrial plants (Efroymson et al. 1997a). Lead exceeded the surface soil screening value in eleven of twenty-two samples, while zinc exceeded the surface soil screening value in sixteen of twenty-one samples.

To evaluate the significance of lead and zinc detections in surface soil, SWMU 9 (Area B) analytical data for these two metals were compared statistically to available background surface soil data (combined background database consisting of base background data and SWMU 9 background data in accordance with USEPA and Navy guidance (USEPA 2002 and NFESC 2002, respectively). Note that the comparability of base background data and SWMU 9 background data was previously demonstrated in the CMS Investigation Report for SWMU 9 (Baker 2003a). Statistical comparisons included descriptive summaries of each data set (frequency of detection, range of detections, mean, and 95 percent upper confidence limit of the mean [95 percent UCL]), tests on the mean of the distribution (two sample t-test for lead and Wilcoxin Rank Sum Test for zinc), as well as tests on the right-tail of the distribution. (Quantile Test and Slippage Test). The significance level (alpha, the probability criteria for rejecting the null hypothesis that the data sets were sampled from the same population) was set at 0.05 for all tests. A non-parametric procedure (Wilcoxin Rank Sum Test) was used to statistically evaluate the mean of the distributions for zinc due to a failure of the test for normality (Shaparo-Wilkes Test)

As evidenced by Table 4-10, the statistical test on the mean of zinc distributions resulted in a probability level of 0.1287, which is above the significance threshold of 0.05, indicating a non-significant result (i.e., the distribution of zinc concentrations in SWMU 9 (Area B) surface soil is statistically equivalent to zinc concentrations in background surface soil). This indicates that this metal is not presenting risks to terrestrial receptors at the site above background levels. Although an isolated "hot spot" was identified during the CMS field investigation (520 mg/kg in 9SS07), samples collected immediately adjacent to this location during the additional data collection field investigation had zinc concentrations less than the maximum background concentration of 106 mg/kg and 95 percent UCL concentration of 70.6 (see Figure 3-1).

The descriptive statistics and distributional statistics (two sample t-test, Quantile Test, and Slippage Test) indicated that the distribution of lead concentrations in SWMU 9 (Area B) surface soil is elevated above background levels. As was previously stated, detected concentrations above the surface soil screening value occurred in eleven of twenty-two surface soil samples. All detections exceeding the surface soil screening value also exceeded the maximum background concentration (21J mg/kg). Based on a mean HQ greater than 1.0 and the statistical evaluation presented in Table 4-10, lead is considered a potential risk driver for terrestrial plant populations, and additional evaluation is recommended. To further evaluate the significance of lead detections in SWMU 9 (Area B) surface soil, the mean concentration was also compared to literature-based toxicological thresholds for invertebrates (500 mg/kg [Efroymson et al., 1997b]). The mean HQ for terrestrial invertebrates was less than 1.0 (HQ = 0.39). As evidenced by Figure 3-1, only three of twenty-two surface soil samples had detected concentrations of lead greater than the terrestrial invertebrate screening value (1,300 mg/kg in 9SS22, 910 J mg/kg at 9SS09, and 670 mg/kg at 9SS28). Based on a mean HQ less than 1.0 and the low spatial coverage of detections above the surface soil screening value, lead is not identified as a potential risk driver for terrestrial invertebrate populations at the site.

In summary, zinc is not considered a potential risk driver for terrestrial plants and invertebrates at SWMU 9 (Area B), and additional evaluation is not recommended. This recommendation is based on the statistical evaluation presented in Table 4-10, which demonstrated that zinc concentrations at the site are statistically equivalent to background levels. Lead is considered a potential risk driver for terrestrial plant populations at the site, and additional evaluation is recommended for this metal. This recommendation is based on a mean HQ greater than 1.0 (3.92), the spatial coverage and magnitude of detected concentrations greater than the screening value and maximum background concentration, and the statistical evaluation presented in Table 4-10.

4.2.2 Terrestrial Food Web Exposures

Based on the comparison of mean exposure doses to NOAEL-based screening values (see Table 4-9), lead had mean HQ values greater than 1.0 for the American robin (HQ = 3.23) and morning dove (HQ = 1.78). The statistical evaluation presented in Table 4-10 demonstrated that the distribution of zinc concentrations in SWMU 9 (Area B) surface soil is statistically equivalent to background. As such, zinc is not considered a potential risk driver for avian omnivore and herbivore populations at the site, and additional evaluation is not recommended.

The statistical evaluation presented in Table 4-10 demonstrated that lead concentrations at the site are elevated above background levels. A spatial examination of the lead data indicated that eleven detected concentrations (i.e., concentrations greater than 60 mg/kg) would result in a modeled exposure dose greater than the NOAEL-based screening value for the American robin, and nine detected concentrations (i.e., concentrations greater than 109 mg/kg) would result in a modeled exposure dose greater than the NOAEL-based screening value for the morning dove.

This analysis indicates that the spatial distribution of lead concentrations in SWMU 9 (Area B) surface soil above ecologically relevant concentrations is high. To further evaluate the significance of lead in surface soil, the home range of the American robin and mourning dove were compared to the area encompassed by the terrestrial habitat surrounding Tank 214. USEPA (1993) reported a home range (foraging) of 0.5 hectares for the American robin. This compares to an approximate site area of 1.3 hectares. Based on the spatial coverage and magnitude of detections that result in a modeled exposure dose greater than the NOAEL-based screening value, as well as the size of the American robin home range relative to the site, lead is identified as a potential risk driver for avian omnivore populations at the site, and additional evaluation is recommended. Lead is not identified as a potential risk driver for the morning dove. Although the spatial coverage of detections that result in a modeled exposure dose greater than the NOAEL-based screening value is high, the home range of the mourning dove (956 hectares [Losito and Mirarchi 1991]) relative to the site indicates that avian herbivore populations at the site would not be adversely affected by lead concentrations in SWMU 9 (Area B) surface soil.

4.3 Risk Calculation and Risk Evaluation for Sediment

Table 4-11 presents the results of the media-specific risk calculation for lead in sediment. Results of the risk calculation (HQs) for aquatic food web food web exposures to lead in sediment are presented in Table 4-12. An evaluation of the risk calculations presented in Tables 4-11 and 4-12 is provided in the sections that follow.

4.3.1 Aquatic Receptor Groups

As evidenced by Table 4-11, the mean lead concentration exceeded the sediment screening value (HQ = 1.52). To evaluate the significance of potential risks presented by lead relative to background, the lead data were statistically compared to background sediment data in accordance with Navy guidance (NFEESC 2002). Results of the statistical evaluation (two sample t-test, Quantile test, and Slippage Test), presented in Table 4-13, show that the distribution of lead concentrations at SWMU 9 (Area B) is elevated above background concentrations. The descriptive statistics presented in Table 4-13 also show elevated lead concentrations when maximum, mean, and upper 95 percent UCL concentrations (250 mg/kg, 45.88 mg/kg, and 71.2 mg/kg, respectively) are compared to background values (13 mg/kg, 6.10 mg/kg, and 9.84 mg/kg, respectively).

To further evaluate the significance of lead concentrations in estuarine wetland sediment downgradient from SWMU 9 (Area) B), the mean lead concentration was compared to alternative toxicological thresholds available from the literature. The sediment screening value used in the risk calculation (see Table 4-11) was a Threshold Effect Concentration (TEC) from MacDonald (1994). Long et al. (1995) reported an Effects Range-Low (ER-L) and Effects Range-Median (ER-M) value of 46.7 mg/kg and 218 mg/kg, respectively for estuarine and marine sediments. Buchman (1999) reported an Apparent Effects Threshold (AET) value of 400 mg/kg for marine sediments. A consensus-based Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC) has also been reported by MacDonald et al. (2000) for freshwater ecosystems (35.8 mg/kg and 128 mg/kg, respectively), while Persaud et al. (1993) reported a Low Effect Level (LEL) and Severe Effect Level (SEL) of 31 mg/kg and 250 mg/kg, respectively for the protection and management of aquatic sediment quality in Ontario. Although the mean lead concentration in estuarine wetland sediment downgradient from SWMU 9 (Area B) fell within the range of these alternative literature values, in every case, chronic-based thresholds (TEL, ER-L, TEC, and LEL) were exceeded. Based on a mean HQ greater than 1.0, the descriptive and distributional statistics presented in Table 4-10, and the comparison of the mean lead concentration to alternative screening values, lead is considered a potential risk driver for benthic

macroinvertebrates populations within the estuarine wetland system downgradient from SWMU 9 (Area B). As such, additional evaluation is recommended.

4.3.2 Aquatic Food Web Exposures

Based on the comparison of mean exposure doses to NOAEL-based screening values, lead had an HQ greater than 1.0 for the spotted sandpiper. The mean exposure dose for this receptor also exceeded the MATC-based screening value. As discussed in Section 4.3.1, the distribution of lead concentrations in estuarine wetland sediment downgradient from SWMU 9 (area B) is elevated above background levels. A spatial examination of the lead data also indicated that eleven detected concentrations (i.e., concentrations greater than 13.7 mg/kg) would result in a modeled exposure dose greater than the NOAEL-based screening value for the spotted sandpiper. The frequency and magnitude of detections above the threshold concentration is significant given the small home range of the spotted sandpiper (0.25 hectares [USEPA 1993]). Based on the spatial coverage and magnitude of detections above an ecologically relevant concentration (i.e., 13.7 mg/kg) and the statistical evaluation presented in Table 4-10, lead is considered a potential risk driver for avian invertebrate consumer populations at the site, and additional evaluation is recommended.

4.4 Summary and Conclusions

In summary, lead is considered a potential risk driver for terrestrial plant and avian omnivore populations at SWMU 9 (Area B). Lead is also considered a potential risk driver to aquatic invertebrates and upper avian invertebrate consumers within the estuarine wetland downgradient from SWMU 9 (Area B). It is recommended that the ERA process at SWMU 9 proceed to Step 3b (baseline risk assessment problem formulation). The baseline ERA should focus on the potential risk driver-receptor combinations identified above.

4.5 References

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5.0 CONCLUSIONS AND RECOMMENDATIONS

The results from the Additional Data Collection Investigation have successfully characterized the zinc in the surface soil and lead in the sediments. The highest concentrations of zinc in the surface soils are located near the valve pits north of Tank 214. The delineation of the highest concentrations of lead in the sediment are located along the estuarine wetland shoreline northeast of Tank 214. The additional samples collected to delineate the lead in surface soils were only partially successful. The results from the latest round of sampling has developed uncertainty with respect to the extent of lead in the surface soils in the vicinity of 9SS22. Sample 9SS22 contained the highest detection of lead at 1,300 mg/kg and is the furthest sample to the southwest.

A re-evaluation of lead and zinc risks to the ecological receptor groups/species (terrestrial plants and/or invertebrates) including the data from the Additional Data Collection Investigation was conducted. This re-evaluation of lead and zinc risks has summarized that lead is considered a potential risk driver for terrestrial plant and omnivore populations at SWMU 9. Lead is also considered a potential risk driver to aquatic invertebrates and upper avian invertebrate consumers within the estuarine wetland downgradient from SWMU 9 (Area B).

It is recommended that the ERA process at SWMU 9 proceed to Step 3b (baseline risk assessment problem formulation). The baseline ERA should focus on the potential risk driver-receptor combinations identified above.

6.0 REFERENCES

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TABLES

TABLE 2-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTIO INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Sample Media	Sample Designation	Sample Depth (ft bgs)	Lead	Zinc	Comments
Surface Soil	9SS10	0.0 - 0.5	X	X	
	9SS10D	0.0 - 0.5	X	X	Duplicate
	9SS10MS/MSD	0.0 - 0.5	X	X	Matrix Spike/Matrix Spike Duplicate
	9SS11	0.0 - 0.5	X	X	
	9SS12	0.0 - 0.5	X	X	
	9SS13	0.0 - 0.5	X	X	
	9SS14	0.0 - 0.5	X	X	
	9SS15	0.0 - 0.5	X	X	
	9SS16	0.0 - 0.5	X	X	
	9SS17	0.0 - 0.5	X	X	
	9SS18	0.0 - 0.5	X	X	
	9SS19	0.0 - 0.5	X	X	
	9SS20	0.0 - 0.5	X	X	
	9SS20D	0.0 - 0.5	X	X	Duplicate
	9SS21	0.0 - 0.5	X	X	
	9SS22	0.0 - 0.5	X	X	
	9SS23	0.0 - 0.5	X	X	
	9SS24	0.0 - 0.5	X	X	
	9SS25	0.0 - 0.5	X	X	
	9SS28	0.0 - 0.5	X	X	
	9SS29	0.0 - 0.5	X	X	
Sediment	9SD29	0.0 - 0.5	X		
	9SD29D	0.0 - 0.5	X		Duplicate
	9SD29MS/MSD	0.0 - 0.5	X		Matrix Spike/Matrix Spike Duplicate
	9SD30	0.0 - 0.5	X		
	9SD31	0.0 - 0.5	X		
	9SD32	0.0 - 0.5	X		
	9SD33	0.0 - 0.5	X		
	9SD34	0.0 - 0.5	X		
QA/QC	9ER01	NA	X	X	Stainless Steel Spoon - Equipment Rinsate
	9FB01	NA	X	X	Lad Grade DI Water - Field Blank

Notes:
(ft bgs) - feet below ground surface
NA - Not Applicable.

TABLE 2-2

METHOD PERFORMANCE LIMITS
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTIO INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Inorganics	Method Number	Quantitation Limits* Low Soil (mg/kg)	Method Description
Lead	6010	0.5	Inductively Coupled Plasma
Zinc	6010	2.0	Inductively Coupled Plasma

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

Note:
mg/kg - milligrams per kilogram.

TABLE 3-1

SUMMARY OF LEAD AND ZINC IN SURFACE SOIL
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SS04	9SS07	9SS08	9SS09	9SS10	9SS11	9SS12	9SS13
Sample ID	9SS04	9SS07	9SS08	9SS09	9SS10	9SS11	9SS12	9SS13
Sample Date	03/20/96	12/16/00	12/16/00	12/16/00	07/14/03	07/14/03	07/14/03	07/14/03
Sample Depth (ft bgs)	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Metals (mg/kg)								
Lead	258	13 J	150 J	910 J	31	33	66	46
Zinc	NA	520 J	96 J	120 J	50 J	61 J	45 J	50 J

Notes:
J - Estimated Value.
NA - Not Analyzed.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 3-1

SUMMARY OF LEAD AND ZINC IN SURFACE SOIL
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SS14	9SS15	9SS16	9SS17	9SS18	9SS19	9SS20	9SS21
Sample ID	9SS14	9SS15	9SS16	9SS17	9SS18	9SS19	9SS20	9SS21
Sample Date	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Metals (mg/kg)								
Lead	14	240	24	17	2.2	260	270	210
Zinc	52 J	70 J	86 J	53	35	54	130	47

Notes:
J - Estimated Value.
NA - Not Analyzed.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 3-1

SUMMARY OF LEAD AND ZINC IN SURFACE SOIL
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SS22	9SS23	9SS24	9SS25	9SS28	9SS29	Frequency of Detections	Range of Detections	Location of Maximum Detections
Sample ID	9SS22	9SS23	9SS24	9SS25	9SS28	9SS29			
Sample Date	07/14/03	07/15/03	07/15/03	07/15/03	07/14/03	07/14/03			
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5			
Metals (mg/kg)									
Lead	1,300	33	3.3	71	670	41	22/22	2.2 - 1,300	9SS22
Zinc	79	68	51	49	47	54	21/21	35 - 520 J	9SS07

Notes:
J - Estimated Value.
NA - Not Analyzed.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 3-2

SUMMARY OF LEAD IN SEDIMENT
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SW/SD01	9SW/SD02	9SW/SD03	9SW/SD04	9SW/SD13	9SW/SD14	9SW/SD15	9SW/SD16
Sample ID	9SD01	9SD02	9SD03	9SD04	9SD13	9SD14	9SD15	9SD16
Sample Date	06/29/99	06/29/99	06/29/99	06/29/99	12/17/00	12/17/00	12/17/00	12/17/00
Sample Depth (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Metals (mg/kg)								
Lead	5 J	12 J	47 J	24 J	4.2	3.2	5.3	3.9

Notes:
J - Estimated Value.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 3-2

SUMMARY OF LEAD IN SEDIMENT
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SW/SD17	9SW/SD18	9SW/SD19	9SW/SD20	9SW/SD21	9SW/SD22	9SW/SD23	9SD29
Sample ID	9SD17	9SD18	9SD19	9SD20	9SD21	9SD22	9SD23	9SD29
Sample Date	12/17/00	12/17/00	12/17/00	12/17/00	12/17/00	12/17/00	12/17/00	07/15/03
Sample Depth (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0.0 - 0.5
Metals (mg/kg)								
Lead	4.6	31	250	69	23	12	7.2	110

Notes:
J - Estimated Value.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 3-2

SUMMARY OF LEAD IN SEDIMENT
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SD30	9SD31	9SD32	9SD33	9SD34	Frequency of Detections	Range of Detections	Location of Maximum Detections
Sample ID	9SD30	9SD31	9SD32	9SD33	9SD34			
Sample Date	07/15/03	07/15/03	07/15/03	07/15/03	07/15/03			
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5			
Metals (mg/kg)								
Lead	210	26	60	43	13	21/21	3.2 - 250	9SD19

Notes:
J - Estimated Value.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 3-3

SUMMARY OF LEAD AND ZINC IN QA/QC SAMPLES
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9ER01	9FB01
Sample ID	9ER01	9FB01
Sample Date	07/15/03	07/15/03
Metals (ug/L)		
Lead	5 U	5 U
Zinc	20 U	2.6 J

Notes:
J - Estimated Value.
U - Not detected.
ug/L - micrograms per liter.

TABLE 4-1

SURFACE SOIL ANALYTICAL DATA (MEAN CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES: LEAD AND ZINC
RISK CALCULATIONS PRESENTED IN CMS INVESTIGATION REPORT
SWMU 9 - AREA B (TANKS 214-215)
REPORT ON ECOLOGICAL FIELD INVESTIGATION AT SWMU 9
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Mean HQ [1]	Comments
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Maximum Value				
Inorganics:									
Lead	6/6	13J - 910J	NA	229	910	50	Efroymson et. al. 1997b	4.59	HQ > 1.0
Zinc	3/3	96J - 520J	NA	245	520	50	Efroymson et. al. 1997b	4.91	HQ > 1.0

Notes:

J = Value is estimated
HQ = Hazard Quotient
COPC = Ecological Chemical of Potential Concern
NA = Not Applicable
Shading indicates HQ value greater than 1.0.

[1] The mean HQ value is the mean (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used

TABLE 4-2

SUMMARY OF HAZARD QUOTIENTS FOR LESS CONSERVATIVE TERRESTRIAL FOOD WEB EXPOSURES: LEAD AND ZINC RISK CALCULATIONS PRESENTED IN CMS INVESTIGATION REPORT
SWMU 9 - AREA B (TANKS 214-215)
REPORT ON ECOLOGICAL FIELD INVESTIGATION AT SWMU 9
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics:									
Lead	[illegible]	0.38	1.19	[illegible]	0.21	0.66	0.16	0.02	0.05
Zinc	1.95	0.22	0.65	0.79	0.09	0.26	0.31	0.03	0.10

Notes:

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
Shading indicates HQ value greater than 1.0.

TABLE 4-3

FREQUENCY AND RANGE OF SEDIMENT ANALYTICAL DATA (MEAN CONCENTRATIONS) COMPARED TO MARINE SEDIMENT SCREENING VALUES
RISK CALCULATIONS PRESENTED IN CMS INVESTIGATION REPORT
SWMU 9 - AREAS A/B (TANKS 212-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Contaminant Frequency/Range					Sediment Screening Value (SSV)	Reference	Mean HQ [1]	COPC?	Comments
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen					
Inorganics:										
Lead	15/15	3.2 - 250	NA	33.5867	33.5867	30.2	MacDonald 1994	1.11	Yes	HQ > 1.0

Notes:

HQ = Hazard Quotient
SSV = Sediment Screening Value
NA = Not Applicable
Shading indicates HQ value greater than 1.0.

[1] The mean HQ value is the mean (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used.

TABLE 4-4

SUMMARY OF HAZARD QUOTIENTS FOR LESS CONSERVATIVE AQUATIC FOOD WEB EXPOSURES: LEAD RISK CALCULATIONS PRESENTED IN CMS INVESTIGATION REPORT SWMU 9 - AREA B (TANKS 214-215) REPORT ON ECOLOGICAL FIELD INVESTIGATION AT SWMU 9 NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Spotted sandpiper			Belted kingfisher			Great blue heron		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics:									
Lead	[illegible]	0.24	0.77	0.39	0.04	0.12	0.54	0.05	0.17

Notes:

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
Shading indicates HQ value greater than 1.0.

TABLE 4-5

SUMMARY OF ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT SWMU 9 AREA B (TANKS 214-215) ADDITIONAL DATA COLLECTION INVESTIGATION NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Investigation	Sample ID	Sample Depth (feet bgs)	Date Collected	Analysis Performed	
				Lead	Zinc
BACKGROUND SURFACE SOIL					
SWMU 9 Phase III RFI	9BGSS01	0.0-0.5	06/26/99	X	X
	9BGSS02	0.0-0.5	06/26/99	X	X
	9BGSS03	0.0-0.5	06/26/99	X	X
	9BGSS04	0.0-0.5	06/26/99	X	X
	9BGSS05	0.0-0.5	06/27/99	X	X
OU 3/5 RFI	BGMW01-00	0.0-1.0	04/04/96	X	X
	BGMW02-00	0.0-1.0	04/04/96	X	X
	BGMW03-00	0.0-1.0	04/04/96	X	X
	BGMW04-00	0.0-1.0	04/04/96	X	X
AREA B SURFACE SOIL					
SWMU 9 Phase I RFI	9SS03	0.0-1.0	03/20/96	X	
	9SS04	0.0-1.0	03/20/96	X	
	9MW03-00	0.0-1.0	03/20/96	X	
SWMU 9 CMS Investigation	9SS07	0.0-0.5	12/16/00	X	X
	9SS08	0.0-0.5	12/16/00	X	X
	9SS09	0.0-0.5	12/16/00	X	X
SWMU 9 Additional Data Collection Investigation	9SS10	0.0 - 0.5	07/14/03	X	X
	9SS11	0.0 - 0.5	07/14/03	X	X
	9SS12	0.0 - 0.5	07/14/03	X	X
	9SS13	0.0 - 0.5	07/14/03	X	X
	9SS14	0.0 - 0.5	07/14/03	X	X
	9SS15	0.0 - 0.5	07/14/03	X	X
	9SS16	0.0 - 0.5	07/14/03	X	X
	9SS17	0.0 - 0.5	07/14/03	X	X
	9SS18	0.0 - 0.5	07/14/03	X	X
	9SS19	0.0 - 0.5	07/14/03	X	X
	9SS20	0.0 - 0.5	07/14/03	X	X
	9SS21	0.0 - 0.5	07/14/03	X	X
	9SS22	0.0 - 0.5	07/14/03	X	X
	9SS23	0.0 - 0.5	07/14/03	X	X
	9SS24	0.0 - 0.5	07/14/03	X	X
	9SS25	0.0 - 0.5	07/14/03	X	X
	9SS28	0.0 - 0.5	07/14/03	X	X
	9SS29	0.0 - 0.5	07/14/03	X	X

Notes: bgs - below ground surface.

TABLE 4-5

SUMMARY OF ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT SWMU 9 AREA B (TANKS 214-215) ADDITIONAL DATA COLLECTION INVESTIGATION NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Investigation	Sample ID	Sample Depth (feet bgs)	Date Collected	Analysis Performed	
				Lead	Zinc
BACKGROUND ESTUARINE WETLAND SEDIMENT					
SWMU 9 CMS Investigation	9SD05	0.0-0.5	12/20/00	X	X
	9SD08	0.0-0.5	12/20/00	X	X
	9SD09	0.0-0.5	12/20/00	X	X
	9SD10	0.0-0.5	12/20/00	X	X
	9SD11	0.0-0.5	12/20/00	X	X
	9SD12	0.0-0.5	12/20/00	X	X
AREA B SEDIMENT					
SWMU 9 Phase III RFI	9SD01	0.0 - 0.5	06/29/99	X	
	9SD02	0.0 - 0.5	06/29/99	X	
	9SD03	0.0 - 0.5	06/29/99	X	
	9SD04	0.0 - 0.5	06/29/99	X	
SWMU 9 CMS Investigation	9SD13	0.0 - 0.5	12/17/00	X	
	9SD14	0.0 - 0.5	12/17/00	X	
	9SD15	0.0 - 0.5	12/17/00	X	
	9SD16	0.0 - 0.5	12/17/00	X	
	9SD17	0.0 - 0.5	12/17/00	X	
	9SD18	0.0 - 0.5	12/17/00	X	
	9SD19	0.0 - 0.5	12/17/00	X	
	9SD20	0.0 - 0.5	12/17/00	X	
	9SD21	0.0 - 0.5	12/17/00	X	
	9SD22	0.0 - 0.5	12/17/00	X	
	9SD23	0.0 - 0.5	12/17/00	X	
SWMU 9 Additional Data Collection Investigation	9SD29	0.0 - 0.5	07/15/03	X	
	9SD30	0.0 - 0.5	07/15/03	X	
	9SD31	0.0 - 0.5	07/15/03	X	
	9SD32	0.0 - 0.5	07/15/03	X	
	9SD33	0.0 - 0.5	07/15/03	X	
	9SD34	0.0 - 0.5	07/15/03	X	

Notes: bgs - below ground surface.

TABLE 4-6
SUMMARY OF LEAD AND ZINC IN SURFACE SOIL
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SS04	9SS07	9SS08	9SS09	9SS10	9SS11	9SS12	9SS13
Sample ID	9SS04	9SS07	9SS08	9SS09	9SS10	9SS11	9SS12	9SS13
Sample Date	03/20/96	12/16/00	12/16/00	12/16/00	07/14/03	07/14/03	07/14/03	07/14/03
Sample Depth (ft bgs)	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0	0.0 - 1.0	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Metals (mg/kg)								
Lead	258	13 J	150 J	910 J	31	33	66	46
Zinc	NA	520 J	96 J	120 J	50 J	61 J	45 J	50 J

Notes:

J - Estimated Value.
NA - Not Analyzed.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 4-6
SUMMARY OF LEAD AND ZINC IN SURFACE SOIL
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SS14	9SS15	9SS16	9SS17	9SS18	9SS19	9SS20	9SS21
Sample ID	9SS14	9SS15	9SS16	9SS17	9SS18	9SS19	9SS20	9SS21
Sample Date	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03	07/14/03
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Metals (mg/kg)								
Lead	14	240	24	17	2.2	260	270	210
Zinc	52 J	70 J	86 J	53	35	54	130	47

Notes:

J - Estimated Value.
NA - Not Analyzed.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 4-6
SUMMARY OF LEAD AND ZINC IN SURFACE SOIL
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SS22	9SS23	9SS24	9SS25	9SS28	9SS29			
Sample ID	9SS22	9SS23	9SS24	9SS25	9SS28	9SS29	Frequency of Detections	Range of Detections	Location of Maximum Detections
Sample Date	07/14/03	07/15/03	07/15/03	07/15/03	07/14/03	07/14/03			
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5			
Metals (mg/kg)									
Lead	1,300	33	3.3	71	670	41	22/22	2.2 - 1,300	9SS22
Zinc	79	68	51	49	47	54		35 - 520 J	9SS07

Notes:

J - Estimated Value.
NA - Not Analyzed.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 4-7

SUMMARY OF LEAD IN SEDIMENT
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SW/SD01	9SW/SD02	9SW/SD03	9SW/SD04	9SW/SD13	9SW/SD14	9SW/SD15	9SW/SD16
Sample ID	9SD01	9SD02	9SD03	9SD04	9SD13	9SD14	9SD15	9SD16
Sample Date	06/29/99	06/29/99	06/29/99	06/29/99	12/17/00	12/17/00	12/17/00	12/17/00
Sample Depth (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Metals (mg/kg)								
Lead	5 J	12 J	47 J	24 J	4.2	3.2	5.3	3.9

Notes:

J - Estimated Value.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 4-7

SUMMARY OF LEAD IN SEDIMENT
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SW/SD17	9SW/SD18	9SW/SD19	9SW/SD20	9SW/SD21	9SW/SD22	9SW/SD23	9SD29
Sample ID	9SD17	9SD18	9SD19	9SD20	9SD21	9SD22	9SD23	9SD29
Sample Date	12/17/00	12/17/00	12/17/00	12/17/00	12/17/00	12/17/00	12/17/00	07/15/03
Sample Depth (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0.0 - 0.5
Metals (mg/kg)								
Lead	4.6	31	250	69	23	12	7.2	110

Notes:

J - Estimated Value.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 4-7

SUMMARY OF LEAD IN SEDIMENT
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	9SD30	9SD31	9SD32	9SD33	9SD34	Frequency of Detections	Range of Detections	Location of Maximum Detections
Sample ID	9SD30	9SD31	9SD32	9SD33	9SD34			
Sample Date	07/15/03	07/15/03	07/15/03	07/15/03	07/15/03			
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5			
Metals (mg/kg)								
Lead	210	26	60	43	13	21/21	3.2 - 250	9SD19

Notes:

J - Estimated Value.
ft - feet.
bgs - below ground surface.
mg/kg - milligrams per kilogram.

TABLE 4-8

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MEAN CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES: LEAD AND ZINC
SWMU 9 AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Contaminant Frequency/Range					Surface Soil Screening Values (SSSV)	Reference	Mean HQ[3]	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used Screen				
Inorganics:									
Lead	24/24	2.2 - 1300	NA	196.15	196.15	50	Efroymson et al. 1997a	3.92	HQ > 1.0
Zinc	21/21	35 - 520J	NA	86.52	86.52	50	Efroymson et al. 1997a	1.73	HQ > 1.0

Notes:

HQ = Hazard Quotient
SSSV = Surface Soil Screening Value
Shading indicates HQ value greater than 1.0.

TABLE 4-9

SUMMARY OF HAZARD QUOTIENTS FOR LESS CONSERVATIVE FOOD WEB EXPOSURES - TERRESTRIAL RECEPTORS
SWMU 9 - AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1]	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics:									
Lead	[illegible]	0.32	1.02	1.78	0.18	0.56	0.14	0.01	0.04
Zinc	0.69	0.08	0.23	0.28	0.03	0.09	0.11	0.01	0.04

Notes:

NOAEL - No Observed Adverse Effect Level
LOAEL - Lowest Observed Adverse Effect Level
MATC - Maximum Accepatble Toxicant Concentration
Shading indicates HQ value greater than 1.0.

TABLE 4-10

SUMMARY STATISTICS AND RESULTS: LEAD AND ZINC SURFACE SOIL
SWMU 9 - AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1]	SSSV	Population	Descriptive Statistics					Distributional Statistics [3]			Retain as Ecological COPC?
			Frequency of Detection	Range of Detections	Mean [2]	SE	95% UCL	Mean of the Distribution [4]	Right Tail of the Distribution [5]		
									Quantile Test	Slippage Test	
Lead	50	SWMU 9	24/24	2.2 - 1300	196	66	309	t-test, p = 0..00001 COPC	Likely a COPC at $\alpha = 0.05$	Likely COPC at $\alpha = 0.05$	COPC
		Background	9/9	2.4 - 21J	9.24	2.07	13.09				
Zinc	50	SWMU 9	21/21	35 - 520J	86.52	22.34	125	WRS, p=0.1287, Not a COPC (power= 0.3351)	Not likely a COPC	Not likely a COPC	Not a COPC
		Background	9/9	34.2J - 106J	57.03	7.31	70.63				

Notes:

(1) Units in mg/kg
(2) Mean based on 1/2 non-detected values.
(3) Unless otherwise noted, a=0.10.
(4) Normality verified with Shapiro-Wilks test, Homogeneity of variance verified with F-test.
(5) Quantile and Slippage tests only determines whether or not a particluar contaminant is likely a COPC. If not likely, then there is insufficient evidence to conclude that it is a COPC.

NA = Test Not Applicable
ND = Not Detected
SE = Standard Error
SSSV = Surface Soil Screening Value
WRS = Wilcoxon Rank-Sum Test
95% UCL = 95% Upper Confidence Limit of the Mean
--- = Indeterminate test due to censoring of data set

TABLE 4-11

FREQUENCY AND RANGE OF SEDIMENT ANALYTICAL DATA (MEAN CONCENTRATIONS) COMPARED TO MARINE SEDIMENT SCREENING VALUES
SWMU 9 - AREAS A/B (TANKS 212-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Contaminant Frequency/Range					Sediment Screening Value (SSV)	Reference	Mean HQ [1]	COPC?	Comments
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen					
Lead	21/21	3.2 - 250	NA	45.8762	45.8762	30.2	MacDonald 1994	1.52	Yes	HQ > 1.0

Notes:

HQ = Hazard Quotient
SSV = Sediment Screening Value
Shading indicates HQ value greater than 1.0.
[1] The mean HQ value is the mean (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used.

TABLE 4-12

SUMMARY OF HAZARD QUOTIENTS FOR LESS CONSERVATIVE FOOD WEB EXPOSURES - AQUATIC RECEPTORS
SWMU 9 - AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INIVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1]	Spotted sandpiper			Belted kingfisher			Great blue heron		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics:									
Lead	[illegible]	0.33	[illegible]	0.54	0.05	0.17	0.74	0.07	0.23
Zinc	0.58	0.06	0.19	0.17	0.02	0.06	0.23	0.03	0.08

Notes:

NOAEL - No Observed Adverse Effect Level
LOAEL - Lowest Observed Adverse Effect Level
MATC - Maximum Accepatble Toxicant Concentration
Shading indicates HQ value greater than 1.0.

TABLE 4-13

SUMMARY STATISTICS AND RESULTS: SEDIMENT
SWMU 9 - AREA B (TANKS 214-215)
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

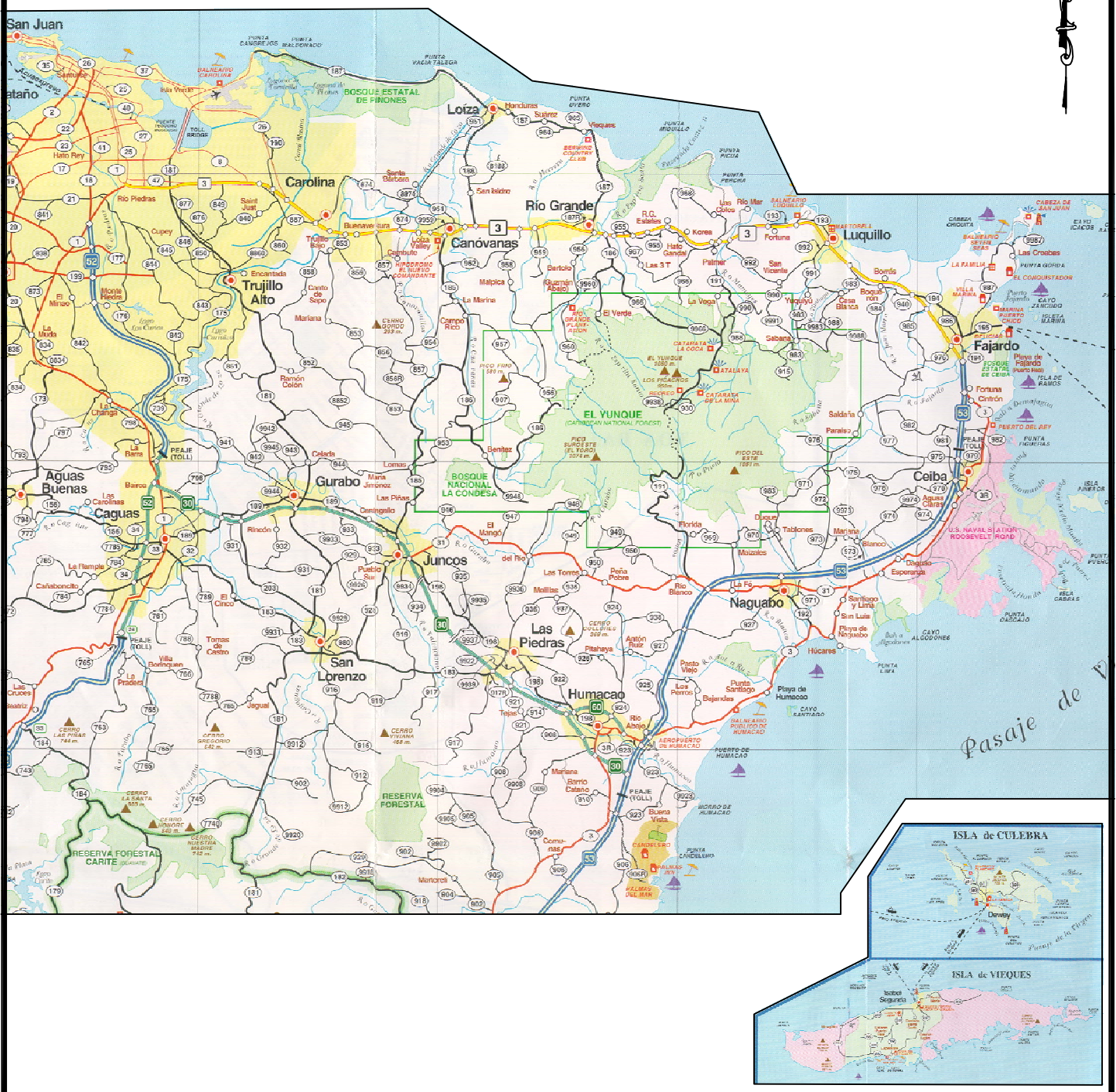
Chemical [1]	SSV	Population	Descriptive Statistics					Distributional Statistics [3]			Retain as Ecological COPC?
			Frequency of Detection	Range of Detections	Mean [2]	SE	95% UCL	Mean of the Distribution [4]	Right Tail of the Distribution [5]		
									Quantile Test	Slippage Test	
Lead	30.2	SWMU 9	21/21	3.2 - 250	45.88	14.66	71.16	t-test, p = 0.0093 COPC	Likely COPC at α = 0.05	Likely COPC at α = 0.05	COPC
		Background	6/6	1.7 - 13	6.10	1.86	9.84				

Notes:

(1) Units in mg/kg
(2) Mean based on 1/2 non-detected values.
(3) Unless otherwise noted, a=0.05.
(4) Normality verified with Shapiro-Wilks test, Homogeneity of variance verified with F-test.
(5) Quantile and Slippage tests only determines whether or not a particular contaminant is likely a COPC. If not likely, then there is insufficient evidence to conclude that it is a COPC.

NA = Test Not Applicable
SE = Standard Error
SSV = Sediment Screening Value
95% UCL = 95% Upper Confidence Limit of the Mean
--- = Indeterminate test due to censoring of data set

FIGURES



4 0 2 4 8

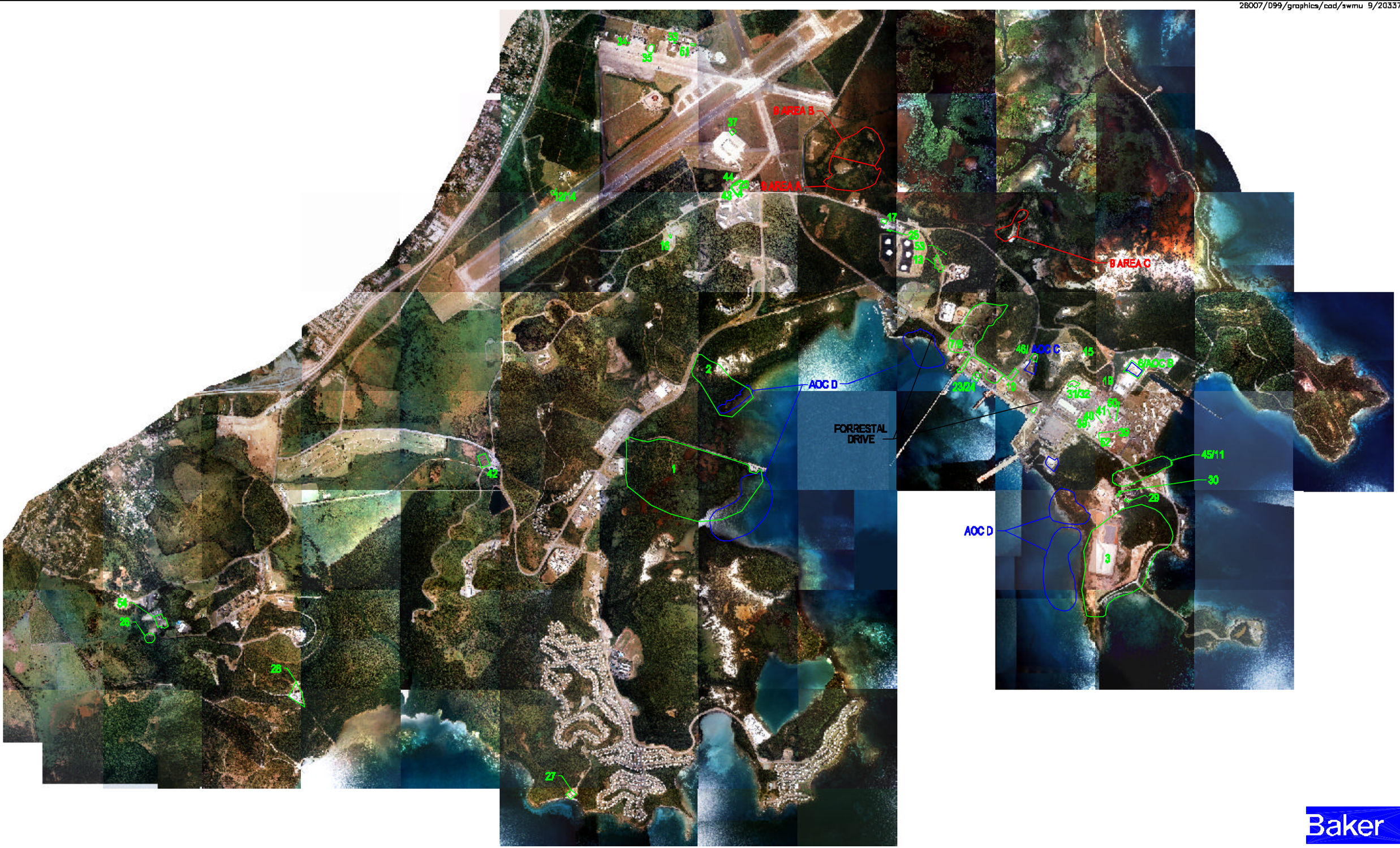
1 inch = 4 miles

Baker

FIGURE 1–1
REGIONAL LOCATION MAP

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

SOURCE: METRODATA, INC., 1999.



Baker

LEGEND

1 – SWMUs

9 – AREA OF WHICH THIS INVESTIGATION PERTAINS TO

AOC D – AOCs

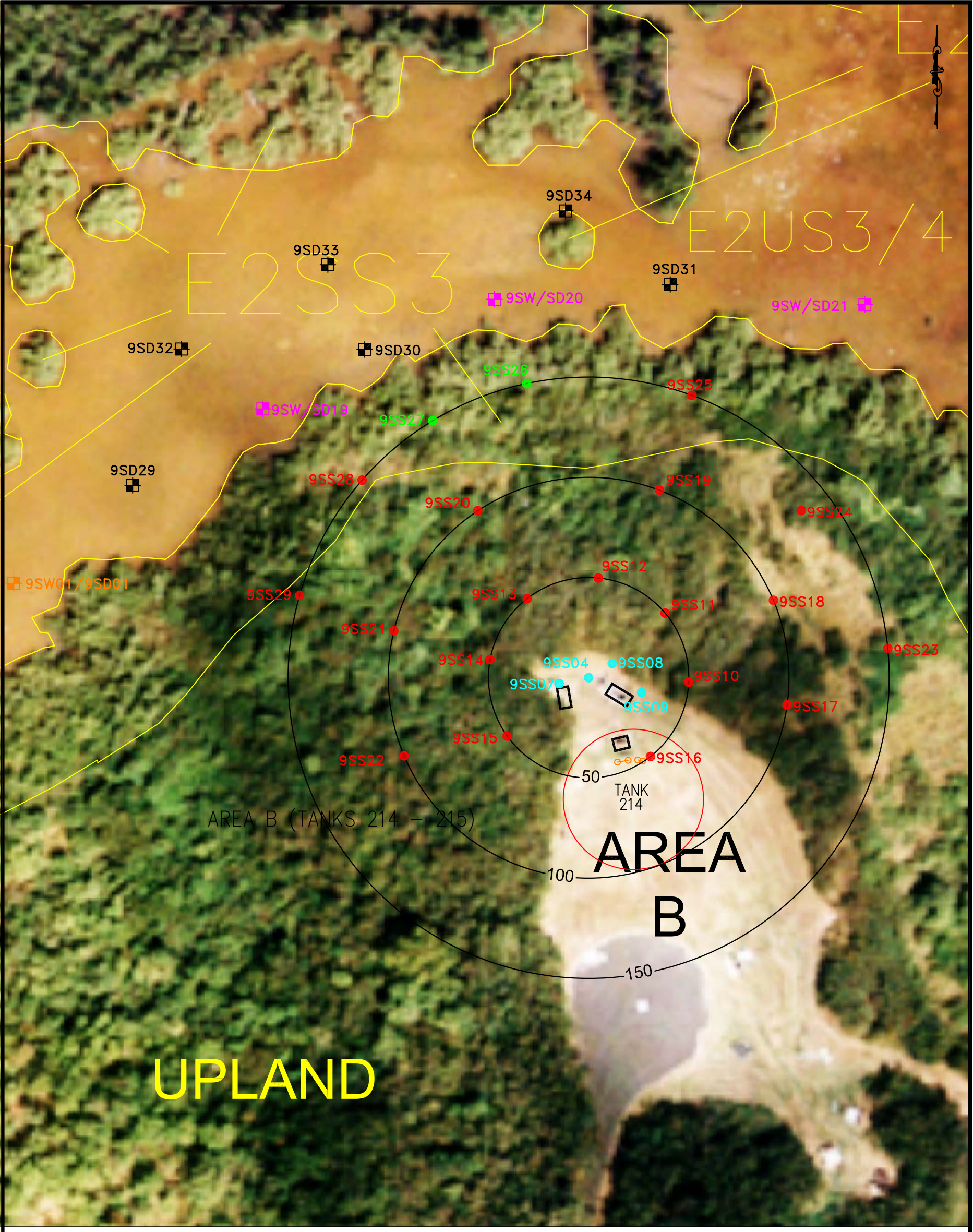
SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

2500 0 1250 2500

1 inch = 2500 ft.

FIGURE 1-2
SWMU/AOC LOCATION MAP

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



E2SS3 – ESTUARINE INTERTIDAL SCRUB–SHRUB BROAD–LEAVED EVERG.
E2US3/4 – ESTUARINE INTERTIDAL UNCONSOLIDATED SHORE ORGANIC/DEAD

50 0 25 50
1 inch = 50 ft.

Baker

26007/099/graphics/cad/swmu 9/2033706wp

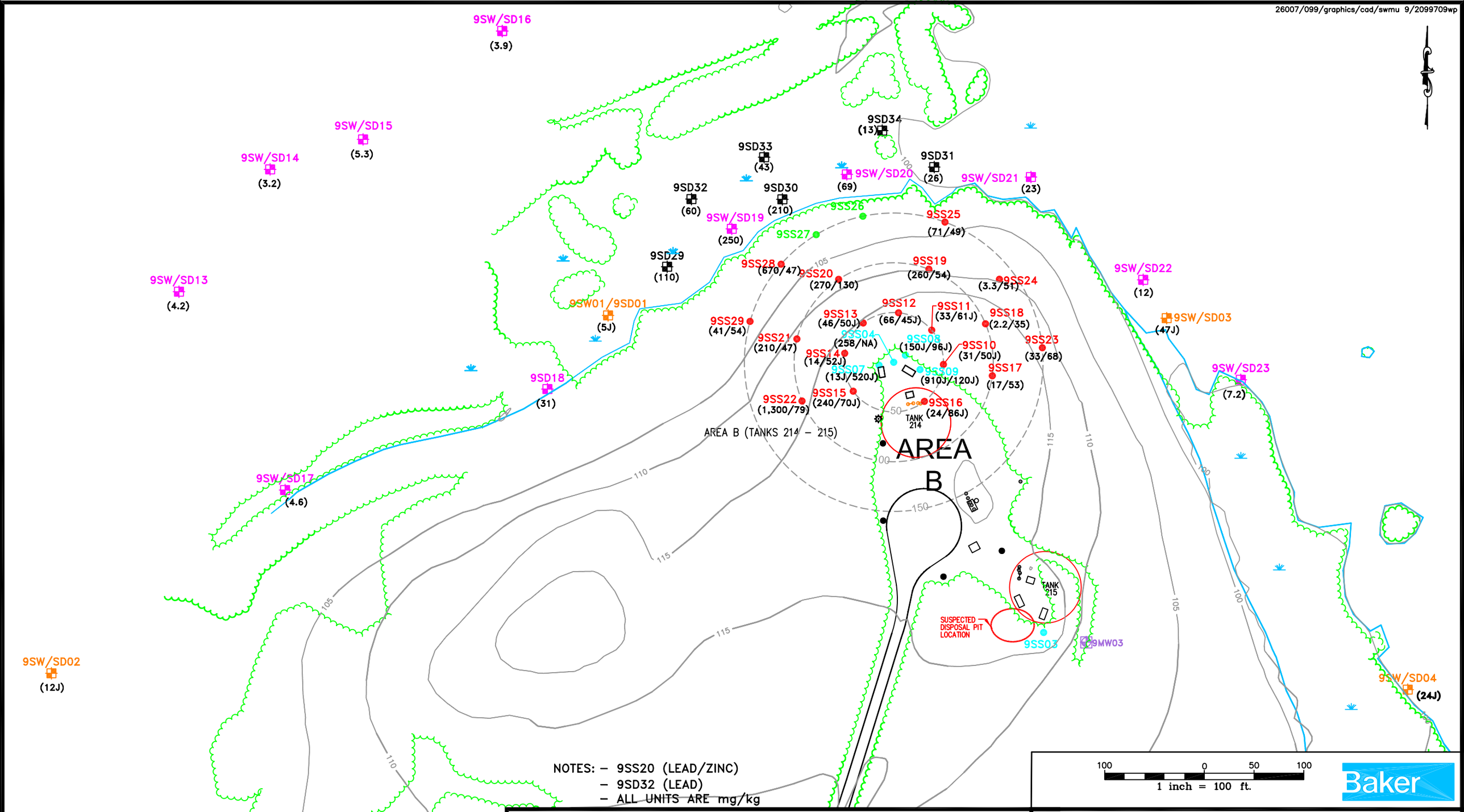
LEGEND

- SEDIMENT SAMPLE LOCATION (ADDITIONAL DATA COLLECTION–2003)
- SURFACE WATER/SEDIMENT SAMPLE LOCATION (CMS INVESTIGATION–2000)
- SURFACE WATER/SEDIMENT SAMPLE LOCATION (PHASE III RFI–1999)
- SURFACE SOIL SAMPLE LOCATION (PHASE I RFI AND CMS INV.–1996/2000)
- SURFACE SOIL SAMPLE (ADDITIONAL DATA COLLECTION–2003)
- PROPOSED SURFACE SOIL SAMPLE (ADDITIONAL DATA COLLECTION–2003) THAT WAS NOT COLLECTED DUE TO THE ESTUARINE WETLAND EXTENT.

E2SS3– THE COWARDIN WETLAND CLASSIFICATION SYSTEM

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

FIGURE 2–1
SURFACE SOIL AND SEDIMENT SAMPLING LOCATIONS
SWMU 9, AREAS A AND B
TANKS 212 – 215
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTES: – 9SS20 (LEAD/ZINC)
– 9SD32 (LEAD)
– ALL UNITS ARE mg/kg

LEGEND

- – MONITOR WELL LOCATION (PHASE I–1996)
- – SEDIMENT SAMPLE LOCATION (ADDITIONAL DATA COLLECTION–2003)
- – SURFACE WATER/SEDIMENT SAMPLE LOCATION (CMS INVESTIGATION–2000)
- – SURFACE WATER/SEDIMENT SAMPLE LOCATION (PHASE III RFI–1999)
- – SURFACE SOIL SAMPLE LOCATION (PHASE I RFI AND CMS INV.–1996/2000)
- – SURFACE SOIL SAMPLE (ADDITIONAL DATA COLLECTION–2003)
- – PROPOSED SURFACE SOIL SAMPLE (ADDITIONAL DATA COLLECTION–2003) THAT WAS NOT COLLECTED DUE TO THE ESTUARINE WETLAND EXTENT.
- – SUSPECTED LOCATION OF DISPOSAL PIT
- – TELEPHONE POLE

FIGURE 3–1
POSITIVE DECTIONS OF LEAD AND ZINC IN SURFACE SOIL AND SEDIMENT – SWMU 9 AREA B (TANKS 214–215)

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

APPENDIX A
CHAIN OF CUSTODY RECORDS

Serial Number 10442

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT **STL**

FEDEX AIRBILL # 834829767765

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

1-01

Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: SWMU 9	PROJECT NO.: CTO-033	PROJECT LOCATION (STATE): PR	PAGE 1 OF 4
STL (LAB) PROJECT MANAGER: ANGIE WEIMERSKIRK	P.O. NUMBER:	CONTRACT NO.: CLEAN II	STANDARD REPORT DELIVERY ●
CLIENT (SITE) PM: MARK KIMES	CLIENT PHONE: (787) 485-1097	CLIENT FAX: (412) 375-3995	DATE DUE: 28 DAY TAT
CLIENT NAME: BAKER	CLIENT E-MAIL: MKIMES@MBAKERCORP.COM		EXPEDITED REPORT DELIVERY (SURCHARGE) ○
CLIENT ADDRESS: 100 AIRSIDE DR. MOON TWP, PA 15108			DATE DUE:
COMPANY CONTRACTING THIS WORK (if applicable): CH2M HILL			NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT,...)	LEAD & ZINC (6010)									REMARKS
								PRESERVATIVE									
								NA									
								NUMBER OF CONTAINERS SUBMITTED									
7/14/03	1245	9SS10	G		X			1									
7/14/03	1245	9SS10D	G		X			1									
7/14/03	1245	9SS10 MS/MSD	G		X			1									
7/14/03	1250	9SS11	G		X			1									
7/14/03	1253	9SS12	G		X			1									
7/14/03	1257	9SS13	G		X			1									
7/14/03	1303	9SS14	G		X			1									
7/14/03	1313	9SS15	G		X			1									
7/14/03	1318	9SS16	G		X			1									
7/14/03	1357	9SS17	G		X			1									EXTRACT AND HOLD ANALYSIS
7/14/03	1408	9SS18	G		X			1									EXTRACT & HOLD ANALYSIS
7/14/03	1418	9SS19	G		X			1									EXTRACT & HOLD ANALYSIS

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY CONTAINERS			Mark E. K					
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
Mark E. K EMPTY CONTAINERS	7/14/03	0730						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: DATE TIME

CONDITION OF SAMPLE UPON RECEIPT

Coolers intact Custody seals intact

STL8240-680 (12/02)

Serial Number 10443

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT **STL**

STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404

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

9-01

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: SWMU 9	PROJECT NO.: CTO-033	PROJECT LOCATION (STATE): PR	PAGE 2 OF 4
STL (LAB) PROJECT MANAGER: ANGIE WEIMERSKIRK	P.O. NUMBER:	CONTRACT NO.: CLEAN II	STANDARD REPORT DELIVERY ●
CLIENT (SITE) PM: MARK KIMES	CLIENT PHONE: (787) 485-1097	CLIENT FAX: (412) 375-3995	DATE DUE: 28 DAY TAT
CLIENT NAME: BAKER	CLIENT E-MAIL: mkimes@mbakercorp.com		EXPEDITED REPORT DELIVERY (SURCHARGE) ○
CLIENT ADDRESS: 100 AIRSIDE DR. MOON TWP, PA 15108			DATE DUE:
COMPANY CONTRACTING THIS WORK (if applicable): CH2M HILL			NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: LEAD & ZINC (6010)

PRESERVATIVE: ZA

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT,...)	NUMBER OF CONTAINERS SUBMITTED	REMARKS
7/14/03	1554	95520	G		X			1	EXTRACT & HOLD ANALYSIS
7/14/03	1554	95520D	G		X			1	EXTRACT & HOLD ANALYSIS
7/14/03	1458	95521	G		X			1	EXTRACT & HOLD ANALYSIS
7/14/03	1445	95522	G		X			1	EXTRACT & HOLD ANALYSIS
7/15/03	0913	95523	G		X			1	EXTRACT & HOLD ANALYSIS
7/15/03	0927	95524	G		X			1	EXTRACT & HOLD ANALYSIS
7/15/03	0854	95525	G		X			1	EXTRACT & HOLD ANALYSIS
	~~0843~~	~~95526~~ MEK	~~G~~		~~X~~			~~1~~ MEK	EXTRACT & HOLD ANALYSIS
	~~0836~~	~~95527~~ MEK	~~G~~		~~X~~			~~1~~ MEK	EXTRACT & HOLD ANALYSIS
7/14/03	1533	95528	G		X			1	EXTRACT & HOLD ANALYSIS
7/14/03	1508	95529	G		X			1	EXTRACT & HOLD ANALYSIS

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY CONTAINERS			Mark E. Kimes					
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
~~EMPTY CONTAINERS~~ Mark E. Kimes	7/14/03	0730						

RECEIVED FOR LABORATORY BY: DATE: TIME:

LABORATORY COMMENTS:

STL8240-680 (12/02)

Serial Number 10456

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT **STL**

STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404

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

9-01

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
SWMU 9	CTO-033	PR
STL (LAB) PROJECT MANAGER: Angie Weimerskirk	P.O. NUMBER	CONTRACT NO.: CLEAN II
CLIENT (SITE) PM: Mark Kimes	CLIENT PHONE: (787) 485-1097	CLIENT FAX: (412) 375-3995
CLIENT NAME: Baker	CLIENT E-MAIL: mkimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr., Moon Twp., PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable): CH2M Hill		

PAGE 4 OF 4

STANDARD REPORT DELIVERY ●

DATE DUE 28 DAY TAT

EXPEDITED REPORT DELIVERY (SURCHARGE) ○

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS

PRESERVATIVE: HNO_3

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT,...)	Lead & Zinc (6010)	REMARKS
		9ER01	G	X				1	
		9FB01	G	X				1	

NUMBER OF CONTAINERS SUBMITTED

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY CONTAINERS			[signature]					
RECEIVED BY: (SIGNATURE) EMPTY CONTAINERS	DATE 7/14/03	TIME 0730	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

STL8240-680 (12/02)

Serial Number 10445

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT **STL**

STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404

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

1-01

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)	PAGE 3 OF 4
SWMU 9	CTO-033	PR	
STL (LAB) PROJECT MANAGER: ANGIE WEIMERSKIRK	P.O. NUMBER	CONTRACT NO.: CLEAN II	
CLIENT (SITE) PM: MARK KIMES	CLIENT PHONE: (787) 485-1097	CLIENT FAX: (412) 375-3995	
CLIENT NAME: BAKER	CLIENT E-MAIL: MKIMES@MBAKERCORP.COM		
CLIENT ADDRESS: 100 AIRSIDE DRIVE, MOON TWP, PA 15108			
COMPANY CONTRACTING THIS WORK (if applicable): CH2M HILL			

STANDARD REPORT DELIVERY ●
DATE DUE 28 DAY TAT
EXPEDITED REPORT DELIVERY (SURCHARGE) ○
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	MATRIX TYPE: COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT,...)	REQUIRED ANALYSIS: LEAD (6010)	NUMBER OF CONTAINERS SUBMITTED	REMARKS
								PRESERVATIVE	N/A	
7/15/03	0821	9SD29	G		X				1	
7/15/03	0821	9SD29D	G		X				1	
7/15/03	0821	9SD29 MS/MSD	G		X				1	
7/15/03	0808	9SD30	G		X				1	
7/15/03	0755	9SD31	G		X				1	
7/15/03		9SD32	G		X				1	
7/15/03	0813	9SD33	G		X				1	
7/15/03	0800	9SD34	G		X				1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY CONTAINERS			[signature]					
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
EMPTY CONTAINERS [signature]	7/14/03	0730						

STL8240-680 (12/02)

APPENDIX B
FIELD NOTES FROM THE ADDITIONAL DATA COLLECTION INVESTIGATION

APPENDIX B.1
FIELD NOTES FROM MARK KIMES – SITE MANAGER

14 JULY 2003 MONDAY

0630 ARRIVE @ PASS OFFICE. OBTAIN VEHICLE PASS.

0715 ARRIVE AT PWD ENVIRONMENTAL. PICK-UP COOLERS FROM LAB. STATION COOLERS @ RECYCLING BLDG.

0800 DEPART NSRR FOR LEASEWAY FATARDO TO PICK-UP BOX TRUCK.

0930 ARRIVE AT PASS & ID TO OBTAIN VEHICLE PASS FOR BOX TRUCK.

0945 PICK-UP REMAINING EQUIP & SUPPLIES FROM PWD ENV. RETURN TO RECYCLING BLDG AND TRANSFER ALL LAB COOLERS INTO BOX TRUCK.

1045 DEPART LANDFILL AREA FOR LUNCH.

1115 STOP UP TO ASK CHARLIE BROWN FOR ACCESS TO TANKS 212. CHARLIE INFORMED ME THEY NO LONGER MANAGE THE AREA. HE CALLED STEVE @ FUELS DISPATCH X-4075 TO UNLOCK THE GATE. WE WILL CALLS FUELS DISPATCH DIRECTLY THE REST OF THE WEEK.

1130 GAIN ACCESS TO SWMU 9. PREPARING TO INITIATE SAMPLING AT SWMU 9.

1245 COLLECTING 95510 DUP/MS/MSD FOR Pb/Zn. ORG.

1250 COLLECTING 95511 FOR Pb/Zn. ORG.

1253 COLLECTING 95512 FOR Pb/Zn. CLAY.

1257 COLLECTING 95513 FOR Pb/Zn. MOSTLY ORGANIC SOME CLAY.

1303 COLLECTED 95514 FOR Pb/Zn. MOSTLY ORGANIC SOME CLAY.

1308 COLLECTED 95515 FOR Pb/Zn. MOSTLY ORGANIC SOME CLAY

1318 COLLECTED 95516 FOR Pb/Zn. ORGANIC

1322 COMPLETED 50' RING SURF. SOIL SAMPLING. DEPARTING FOR MARINA TO OBTAIN DRINKS & ICE.

1345 RETURN TO SWMU 9. OBTAINING ADD'L SUPPLIES FOR 100' RING SURF. SOILS

1357 COLLECTING 95517 FOR Pb/Zn. ORGANIC

1408 COLLECTING 95518 FOR Pb/Zn. ORGANIC

1418 COLLECTING 95519 FOR Pb/Zn. ORGANIC.

1445 COLLECTING 95522 FOR Pb/Zn ORGANIC

1458 COLLECTED 95521 FOR Pb/Zn. ORGANIC.

1508 COLLECTED 95529 FOR Pb/Zn. ORGANIC.

1533 COLLECTING 95528 FOR Pb/Zn. ORGANIC 0-4" bgs CLAY 4"↓ bgs

1554 COLLECTING 95520 and 95520D - DUPLICATE FOR Pb/Zn. ORGANIC.

1625 RETURN TO TRUCK. PROCESS SAMPLES AND PACK-UP EQUIPMENT.

1800 DEPART NSRR.

1900 WRITING COC'S FOR TODAY'S SAMPLES.

2230 COMPLETED PAPERWORK (COC'S & SAMPLE LABELS)

MEK

0630 ARRIVE AT NSRR GATE 3.

0645 ARRIVE AT SWMU 9. GATE LOCKED CALLED FUELS DISPATCH TO GAIN ACCESS.

0712 CALLED DISPATCH AGAIN. STILL WAITING ON ACCESS TO SWMU 9.

0723 ~~AR~~ GAINED ACCESS TO SWMU 9.

0755 COLLECTING 95D31 FOR Pb. BLACK ORGANIC

0800 COLLECTING 95D34 FOR Pb. BLACK ORGANIC

0808 COLLECTING 95D30 FOR Pb. BLACK ORGANIC

0813 COLLECTING 95D33 FOR Pb. GRAY CLAY THIN BLACK

0816 COLLECTING 95D32 FOR Pb. THIN BLACK ORG GRAY CLAY

0821 COLLECTING 95D29, 95D29D, 95D29 MS/MSD FOR Pb. THIN BLACK ORG. ORG GRAY CLAY

0836 95527 IS IN THE MANGROVES/SEDIMENT. THE AVAILABLE SOILS ARE NEAR THE 100' RING. THEREFORE NO SAMPLE WILL BE COLLECTED FROM THIS LOCATION.

0843 95526 IS IN THE MANGROVES/SEDIMENT. THE AVAILABLE SOILS ARE NEAR THE 100' RING. THEREFORE NO SAMPLE WILL BE COLLECTED FROM THIS LOCATION.

0854 COLLECTING 95525 FOR Pb. 1Zn Organic. ROOT NO CLAY.

0913 COLLECTING 95523 FOR Pb/Zn. ALOT OF ROOT, ORG. MATERIAL.

MEK

0927 95524 COLLECTED FOR Pb & Zn. THIS LOCATION IS APPROXIMATELY 15' IN TOWARDS THE 100' RING. - ORGANIC

0935 RETURN TO TRUCK. UNLOADING SUPPLIES AND SAMPLES.

0947 DEPART SWMU 9 FOR DRINKS.

1130 LUNCH BREAK

1200 STOP IN TO SEE MARLENE.

1230 PICK-UP TRUCK @ SWMU 9. RELOCATE TO BLDG. 31. PROCESSING SAMPLES.

1340 COLLECT 9FB01 FIELD BLANK OF LAB GRADE DI H_2O.

1345 COLLECT 9ER01 EQUIP. RINSATE OF S.S. SPOON.

1405 FEDEX PICKED UP ALL SWMU 9 SAMPLES.
AIRBILL # 8348 2976 7765

1415 DEPART FOR ESTUARINE BACKGROUND LOCATION TO SCOPE OUT SAMPLING LOCATIONS.

1425 BEGIN SCOPING OUT SAMPLING LOCATION. LOCATIONS ARE ACCESSIBLE.

1508 RETURN TO TRUCK. BEGIN GATHERING SAMPLE CONTAINERS FOR EST. BACKGROUND

SAMPLING.

1615 DEPART EST. BACKGROUND TO PARK TRUCK OVER NITE AT BLDG. 31.

1625 DEPART BLDG. 31.

1700 ARRIVE AT DALMAS DEL MAR.

1730 BEGIN PROCESSING SAMPLE BOTTLES FOR TOMORROW'S SAMPLE COLLECTION AT ESTUARINE BACKGROUND.

2030 COMPLETED PREPING BOTTLES.

APPENDIX C
DATA VALIDATION REPORT NARRATIVES

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	PRNS61
Date:	August 16, 2003
Client Name:	Michael Baker Jr., Inc..
Project/Site Name:	Puerto Rico CTO-33
Date Sampled:	July 16, 2003
Number of Samples:	8 Non- Aqueous Sample(s) with 1 MS(s)/MSD(s) 2 Aqueous Sample(s) with 0 MS(s)/MSD(s)
Laboratory:	STL Savannah
Validation Guidance:	National Functional Guidelines for Inorganic Data Review, Region II
QA/QC Level:	DQO Level IV
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Lead Only

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

Paul B. Humburg, President

Date 8/18/03

4127 Plaza 94 South • St. Charles, MO 63304
(636) 936-1332 • Fax (636) 936-1335

SDG# PRNS61

Samples and Fractions Reviewed

Sample Identifications | Analytical Fractions

BAKER ID	MATRIX	Lead		Zinc	
9SS10	SOIL	X		X	
9SS10D	SOIL	X		X	
9SS11	SOIL	X		X	
9SS12	SOIL	X		X	
9SS13	SOIL	X		X	
9SS14	SOIL	X		X	
9SS15	SOIL	X		X	
9SS16	SOIL	X		X	
9SS10SD	SOIL	X		X	
9SS10MSD	SOIL	X		X	
9ER01	WATER	X		X	
9FB01	WATER	X		X	
Total Billable Samples (Water/Soil)		12	0	12	0

DATA ASSESSMENT NARRATIVE
LEAD

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW 846 methods for Metals and the Evaluation of Metals Data for the Contract Laboratory Program for Region II Jan 1992, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDGs # PRNS61

A validation was performed on the lead Data from SDG PRNS61. The data was evaluated based on the following parameters.

*	●	Data Completeness
*	●	Holding Times
*	●	Calibrations
*	●	Blanks
*	●	Interferences
*	●	Matrix Spike Recovery
*	●	Matrix Duplicates
*	●	Field Duplicates
*	●	Laboratory Control Samples
*	●	Serial Dilutions

* - All criteria were met for this parameter.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL	NUM

Data stands as reported without qualification.

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	PRNS62
Date:	August 16, 2003
Client Name:	Michael Baker Jr., Inc..
Project/Site Name:	Puerto Rico CTO-33
Date Sampled:	July 15, 2003
Number of Samples:	7 Non- Aqueous Sample(s) with 1 MS(s)/MSD(s)
Laboratory:	STL Savannah
Validation Guidance:	National Functional Guidelines for Inorganic Data Review, Region II
QA/QC Level:	DQO Level IV
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Lead Only

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

Paul B. Humburg, President

8/16/03
Date

4127 Plaza 94 South • St. Charles, MO 63304
(636) 936-1332 • Fax (636) 936-1335

SDG# PRNS62

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

BAKER ID	MATRIX	Lead	
9SD29	SOIL	X	
9SD29D	SOIL	X	
9SD30	SOIL	X	
9SD31	SOIL	X	
9SD32	SOIL	X	
9SD33	SOIL	X	
9SD34	SOIL	X	
9SD29MS	SOIL	X	
9SD29MSD	SOIL	X	
Total Billable Samples (Water/Soil)		9	0

DATA ASSESSMENT NARRATIVE
LEAD

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW 846 methods for Metals and the Evaluation of Metals Data for the Contract Laboratory Program for Region II Jan 1992, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDGs # PRNS62

A validation was performed on the lead Data from SDG PRNS62. The data was evaluated based on the following parameters.

*	●	Data Completeness
*	●	Holding Times
*	●	Calibrations
*	●	Blanks
*	●	Interferences
*	●	Matrix Spike Recovery
*	●	Matrix Duplicates
*	●	Field Duplicates
*	●	Laboratory Control Samples
*	●	Serial Dilutions

* - All criteria were met for this parameter.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL	NUM

Data stands as reported without qualification.

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	PRNS69
Date:	October 2, 2003
Client Name:	Michael Baker Jr. INC.
Project/Site Name:	PR CTO-271
Date Sampled:	July 24-26, 2003
Number of Samples:	12 Non-aqueous Sample(s) with (1) MS/MSD(s)
Laboratory:	Severn Trent Laboratories, Inc.
Validation Guidance:	National Functional Guidelines for Organic and Inorganic Data Review, Region II
QA/QC Level:	Level IV
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Lead and Zinc

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

Paul B. Humburg, President

10/2/03
Date

39 Windcastle Dr. • St. Charles, MO 63304
(636) 936-1332 • Fax (636) 936-1335

SDG# PRNS69

Samples and Fractions Reviewed

Sample Identifications Analytical Fractions

CH2M HILL ID	MATRIX	MET	
9SS17	WATER	X	
9SS17MS	WATER	X	
9SS17MSD	WATER	X	
9SS18	WATER	X	
9SS19	WATER	X	
9SS20	WATER	X	
9SS20D	WATER	X	
9SS21	WATER	X	
9SS22	WATER	X	
9SS23	WATER	X	
9SS24	WATER	X	
9SS25	WATER	X	
9SS28	WATER	X	
9SS29	WATER	X	
Total Billable Samples (Water/Soil)		14	0

MET= METALS

DATA ASSESSMENT NARRATIVE
METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW 846 methods: the Region II Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDGs # PRNS69

A validation was performed on the metals Data from SDG PRNS69. The data was evaluated based on the following parameters.

*	●	Data Completeness
*	●	Holding Times
*	●	Calibrations
*	●	Blanks
*	●	Interferences
*	●	Matrix Spike Recovery
*	●	Matrix Duplicates
*	●	Field Duplicates
*	●	Laboratory Control Samples
*	●	Serial Dilutions

* - All criteria were met for this parameter.

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B". Value is below the CRDL but greater than the IDL.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
all "B" results	all analytes	B	J