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Basis of Design
Corrective Measure Implementation Work Plan
For Soil Remediation
SWMU 53, Naval Station Roosevelt Roads
Ceiba, Puerto Rico

Prepared For

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Norfolk, Virginia

Under the
LANTDIV CLEAN Program

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LIST OF ACRONYMS AND ABBREVIATIONS

Baker	Baker Environmental, Inc.
CAO	Corrective Action Objective
CFR	Code of Federal Regulations
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	Contaminants of Concern
COPC	Contaminant of Potential Concern
CTO	Contract Task Order
cy	cubic yard
DDT	dichlordiphenyltrichlorethane
EPA	Environmental Protection Agency
ft	feet or foot
HTRW	hazardous, toxic, and radiological waste
LANTDIV	Atlantic Division, Naval Facilities Engineering Command
mg/kg	Milligrams per kilogram
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
NSRR	Naval Station Roosevelt Roads
NTR	Navy Technical Representative
PCB	polychlorinated biphenyl
ppb	parts per billion
PPE	personal protective equipment
RAC	Remedial Action Contractor
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCLP	Toxicity Characteristics Leachate Procedure
ug/kg	microgram per kilogram

1.0 INTRODUCTION

This document presents the Basis of Design for the Corrective Measure Implementation (CMI) of soil contaminated with pesticides and metals at Solid Waste Management Unit (SWMU) 53, Naval Station Roosevelt Roads (NSRR), Puerto Rico.

The location of SWMU 53 within NSRR is shown on Figure 1-1. A site plan depicting current site conditions is shown on Figure 1-2. Based on results of past investigations conducted at this location, contaminated soils pose a potentially unacceptable risk to human and ecological receptors at SWMU 53. As such, the removal of pesticide and metals contaminated soils will be performed.

This Basis of Design document has been prepared by Baker Environmental, Inc. (Baker) under Contract to the Naval Facilities Engineering Command, Atlantic Division (LANTDIV), Contract Number N62470-02-D-3052, Contract Task Order (CTO) Number 0040.

The Remedial Action Contracts Delivery Order Requirements Package Guide, Naval Energy and Environmental Support Activity (NEESA) 20.2-062, dated June 1992, was used as guidance.

As LANTDIV intends to use a Remedial Action Contractor (RAC) to implement the CMI, the terms "RAC" and "Contractor" are used interchangeably.

1.1 Purpose of the Basis of Design

The primary purposes of the Basis of Design are to present LANTDIV with background data on the project, describe the primary elements of the remedial design, recommend criteria, and present assumptions and any special requirements that may affect the design. This document is not intended to be part of the construction plans or technical specifications to be utilized by the RAC for execution of the removal action. Baker assumes no responsibility for the use of this report for any purpose other than the intended uses stated above.

2.0 BACKGROUND INFORMATION

This section provides a site description, site history, and summaries of pertinent environmental investigations and actions conducted at this site. Also included within this section are descriptions of site conditions, remediation levels, and extent of contamination at SWMU 53.

2.1 Site Description and History

SWMU 53 is located at NSRR as shown on Figure 1-2. The Malaria Control Building (Building 64) was built in 1942 and condemned in 1980. The building is presently unoccupied and lies on approximately 1/8 acre. The building structure itself is 15 feet by 20 feet in dimension, and occupies about 10 percent of the total SWMU 53 acreage. This SWMU is located on a gentle slope (approximately 5-7% grade) from southwest (down gradient) to the northeast (up gradient), approximately 200 feet away from Forrestal Drive. The building was utilized to store pesticides, such as aldrin and dichlorodiphenyltrichloroethane (DDT). It is not known if stocks of pesticides were maintained in the building for the entire duration. Although no direct evidence exists, it is assumed that mixing and other preparation for pesticide use was also performed at the building. No wastes are known to have been disposed of at the unit and there are no known releases related to this unit. No other use of the site was identified. The information gathered from the visual site inspection by Baker and environmental staff at NSRR revealed that there are no known wastes dumped at this facility, nor is there any evidence of source contamination (Baker, 2001a). Baker observed signs of possible past leakage of chemicals on the storage shelves inside the building, and identified migration pathways along the floor leading to the outside. With this information, along with the activities known to have taken place at this SWMU, a site characterization was performed to determine whether a release of hazardous waste including hazardous constituents has occurred, is likely to have occurred, or is likely to occur. A summary of the site characterization activities at the SWMU is presented in the following section.

2.2 Summary of Previous Environmental Investigations, Evaluations, and Activities

The following sections describe the investigations that have been performed at SWMU 53 along with current conditions. Numerous environmental investigations have been conducted at NSRR; however, this section deals only with those associated with SMWU 53.

2.2.1 Investigation History

2.2.1.1 Phase I Environmental Assessment

A Phase I Environmental Assessment Report was prepared by Baker for SWMU 53 and presented in the May 31, 2000 Resource Conservation and Recovery Act (RCRA) Quarterly Progress Report (Baker, 2000a). This report consisted of a description and characterization of the site, as well as a site history and a description of surrounding land uses. This report also documented if any sensitive receptors were present within the site area, and described any releases of hazardous materials if applicable.

2.2.1.2 Sampling and Analysis Investigation

A Draft Sampling and Analysis Plan was submitted for SWMUs 53 and 54 on August 4, 2000 (Baker, 2000b), and was approved by the U.S. Environmental Protection Agency (EPA) on October 10, 2000. The work proposed in this plan consisted of the collection of 15 surface soil samples, including three duplicate samples, and seven subsurface soil samples in the SWMU 53 vicinity, as well as four wipe samples within Building 64. The soil borings were advanced to depths ranging from two feet to ten feet below ground surface (bgs). The soil samples were analyzed for pesticides/polychlorinated biphenyls

(PCBs) and Appendix IX Metals, while the wipe samples were analyzed for pesticides/PCBs only. The purpose of this investigation was to determine whether a release of hazardous waste including hazardous constituents had occurred, was likely to have occurred, or is likely to occur. The associated field investigation was conducted in December 2000 in accordance with the EPA approved sampling and analysis plan.

The Draft Sampling and Analysis Report for SWMUs 53 and 54 was submitted on April 11, 2001. It was concluded in the report that it was likely that there was a release of contaminants to the surface soils in the vicinity of the Malaria Control Building. Results indicated the presence of pesticides, arsenic, and lead in the surface and subsurface soils at SWMU 53. Wipe samples also indicated the presence of pesticides on the concrete pad within Building 64. A RCRA Facility Investigation (RFI) was proposed at SWMU 53 to delineate the 4,4-DDT, lead, and arsenic contamination in the surface and subsurface soils. The EPA commented on this report on July 5, 2001, requesting that a RFI work plan be submitted to further delineate contamination found at SWMUs 53 and 54, as well as the submission of a Final Sampling and Analysis Report. The Final Sampling and Analysis Report was submitted on August 27, 2001 (Baker, 2001a).

2.2.1.3 RCRA Facility Investigation

A Final RFI Work Plan for SWMUs 53 and 54 was submitted on December 6, 2001 (Baker, 2001b), and was approved by the EPA on January 3, 2002. The work proposed in the RFI work plan consisted of the collection of 16 surface soil samples, inluding two duplicate samples, as well as 16 subsurface soil samples, including two duplicate samples, in the SWMU 53 vicinity. The soil borings were advanced to depths ranging from two to four feet bgs. The soil samples were all screened in the field for DDT and lead, with a select number of samples sent to the mainland laboratory for analysis of DDT and lead for confirmation purposes. All soil samples collected were sent to the mainland laboratory for arsenic analysis. The objective of this investigation was to assess the environmental impact of past operations at this site. The field investigation was conducted in February and March 2002 in accordance with the EPA approved RFI work plan.

The Draft RFI Report for SWMUs 53 and 54 was submitted on July 17, 2002 (Baker, 2002) and subsequently approved by the EPA on September 19, 2002 pending the performance of a Corrective Measures Study (CMS). It was concluded in the RFI report that three of the primary chemicals of potential concern (COPCs) identified in the Sampling and Analysis Report had been delineated. However, additional constituents were detected in samples collected on the outer edge of the investigative area during the 2002 RFI, and therefore, have not been delineated. It was proposed that an additional field investigation be conducted to delineate chlordane and heptachlor epoxide within the surface soil. Once this field investigation would be completed, a CMS would be conducted to develop remedial alternatives for the pesticides and metals that are present in the soils at SWMU 53.

2.2.1.4 Corrective Measures Study Investigation

A Final CMS Work Plan for SWMU 53 was submitted on March 7, 2003 (Baker, 2003a). This work plan incorporated the delineation of the chlordane, heptachlor epoxide, heptachlor, lead, copper, and zinc contamination in the surface soil. This work plan also presented those tasks required to evaluate lead, zinc, copper, arsenic, chlordane, 4,4'-DDT, and heptachlor epoxide as COPCs for soils at SWMU 53. The work proposed in the CMS work plan consisted of 26 surface soil samples, including three duplicate samples, in the SWMU 53 vicinity. Six surface soil samples, including one duplicate sample, were analyzed for chlordane, heptachlor, and heptachlor epoxide, while 15 surface soil samples, including two duplicate samples, were analyzed for lead, copper, and zinc. Four surface soil samples (53SS12, 53SS14, 53SS15, and 53SS16) were collected but not analyzed in the laboratory because delineation of the target constituents had already been achieved. Therefore, the analysis of these samples was not

necessary. The CMS investigation at SWMU 53 was conducted on March 23, 2003, after the Navy received verbal acceptance on the proposed sampling methods presented in the Final CMS Work Plan mentioned above.

It was concluded in the CMS Investigation Report (Baker, 2003b) that the concentrations of chlordane, heptachlor, and heptachlor epoxide were delineated during the CMS investigation. Although the lead, copper, and zinc results were all below the listed USEPA Industrial and Residential Risk Based Criteria (RBCs), their concentrations exceeded the NSRR Ecological Surface Soil Plant and/or Invertebrate values. There appears to be a potential risk to site plants and invertebrates as a result of the levels of the abovementioned three metals. It was proposed that a CMS report be completed to develop remedial alternatives for the abovementioned pesticides and metals that are present in the surface and subsurface soil at SWMU 53.

2.2.1.5 Corrective Measures Study

A Final CMS Report for SWMU 53 was submitted on November 24, 2003 (Baker, 2003c). This report was a streamlined CMS in which limited remedial options were considered. The proposed remedial action was excavation and disposal of the contaminated soil at SWMU 53. Corrective action objectives (CAOs) were established based on human health and ecological risk factors. Quantitative CAOs for the compounds of 4,4'-DDT, 4,4'-DDE, chlordane, heptachlor epoxide, kepone, lead, arsenic, zinc, and chromium were formulated. Both human health and ecological risk factors were compared, and the lowest CAO established for a particular compound was used. The EPA approved this document on December 22, 2003.

2.3 Current Site Conditions

The following subsections describe the current conditions at SWMU 53. Figure 2-1 shows the current extent of soil contamination above the CAOs (Baker, 2003c). Specific compounds are discussed below.

2.3.1 Organics

The organic compounds that have been determined to pose a risk to human health and/or ecological receptors at the site are 4,4'-DDT, 4,4'-DDE, chlordane, heptachlor epoxide, and kepone. The range of positive detections found at SWMU 53 of these compounds are as follows: 4,4'-DDT (0.98 – 5,100 micrograms per kilogram (ug/kg)); 4,4'-DDE (0.5 – 970 ug/kg); chlordane (19 – 2,700 ug/kg); heptachlor epoxide (0.43 – 160 ug/kg); and kepone (380 – 440 ug/kg).

2.3.2 Inorganics

Inorganic compounds that have been determined to pose a risk to human health and/or ecological receptors at SWMU 53 are lead, arsenic, zinc and chromium. The range of positive detections of these compounds are as follows: lead (2.6 – 3,900 milligrams/kilogram (mg/kg)); arsenic (0.65-5.6 mg/kg); zinc (48 – 5,800 mg/kg); and chromium (29 – 130 mg/kg).

2.4 Remediation Levels

The following sections discuss the remediation levels and extent of contamination at SWMU 53. The rationale for delineation/identification of removal extent is presented in Section 3.3. Based upon the potential of the site for residential use, remediation levels were selected for the most likely future potential human receptors, as well as the current ecological receptors present at the site. Table 2-1 presents the

proposed CAOs for SWMU 53. These CAOs are protective of any future property use scenario and no engineering controls or property use restrictions are necessary to protect human and ecological health. Human health CAOs were used for heptachlor epoxide (53 ug/kg) and arsenic (49.5 mg/kg). Ecological CAOs were uses as remediation levels for 4,4'-DDT, 4,4,'-DDE, chlordane, kepone, lead, zinc, and chromium.

2.5 Extent of Contamination

The scope of the CMI at SWMU 53 includes the removal of all contaminated soil above the remediation levels. This implementation is designed to ensure that all soil with contamination above the action levels is addressed. The estimated soil excavation depth is 1 foot. The extent is described below.

The area to be excavated is shown on Figure 2-2 and includes Building 64. The total quantity of soil to be removed is estimated as follows:

Depth of Removal (feet)	Area (square feet)	In Situ Volume (cubic yard [cy])
1	4200	156

Total In Situ Volume (cy) = 156

The above volume reflects the removal of contaminated soils above which the CAOs are exceeded. The materials of Building 64 are 4 foot by 8 foot corrugated metal sheeting attached to wooden studs. The volume of material from this demolition is estimated to be approximately 25 cubic yards. The volume of the concrete foundation of Building 64 was estimated to be 3.7 cubic yards based on a 15 foot by 20 foot area and a 4 inch thickness. Miscellaneous contents of the building will also be disposed of.

The estimated excavation quantity is based on the results of the various field investigations and may increase or decrease pending results of confirmation sampling conducted as part of the CMI.

3.0 FACTORS AFFECTING THE DESIGN OF THE CORRECTIVE MEASURES IMPLEMENTATION

The following sections describe factors affecting the design and implementation of the proposed CMI. Supporting information and referenced data are presented in the Appendices as follows.

- Appendix A - Construction Schedule
- Appendix B - Supporting Calculations

3.1 Scope and Goals of the Proposed Removal Actions

The proposed CMI for SWMU 53 will provide a cost-effective means of meeting the overall project goal that is the protection of human health and the environment. The CMI will provide protection by:

- Reducing the potential for human exposure to surface soil through direct contact.
- Reducing the potential for human exposure to inhalation of airborne particles.
- Reducing the potential for human exposure due to ingestion (via hand-to-mouth contact).
- Eliminating the future possibility of contaminants migrating to groundwater, surface water, and sediment.
- Reducing the potential for exposure to ecological receptors.

In terms of contaminant reduction, the scope of the CMI is as follows:

- Removal of surface soil with contamination at levels greater than the CAOs listed on Table 2-1.

3.2 Descriptions of the Proposed Removal Action

The major items associated with the proposed CMI for SWMU 53 include:

- mobilization of a small backhoe or gradeall, small front end loader, and roll-off boxes
- construction of a decontamination pad and equipment laydown area
- installation of erosion controls
- location by survey of excavation limits
- demolition of Building 64 and the removal of the concrete pad under the building
- excavation of one foot (1 ft) of soil from delineated areas, including the soil exposed after removal of the concrete pad
- confirmation sampling outside the outer edge of the excavation, in undisturbed soil, every 25 feet at a depth of 0-1 foot below the ground surface
- confirmation sampling of the bottom of the excavation in areas approximately 25 feet by 25 feet in extent, where possible. In addition, confirmation sampling will occur along the bottom of the excavation in known areas of uncertainty.
- transportation of the excavated soil to lined roll-off boxes. (The roll-off boxes will be placed so that they slope to drain to one corner of the box)
- transportation of the demolished building material and concrete pad to lined roll-off boxes. (The roll-off boxes will be placed so that they slope to drain to one corner of the box)
- collection and analysis of representative soil samples for toxicity characteristics in

accordance with 40 Code of Federal Regulations (CFR), Part 261.24.
- collection, analysis, and disposal of water from the roll-off boxes
- transportation and disposal of debris and soil to an approved disposal facility
- backfill existing excavated areas with clean fill to match existing grade.
- revegetation of any disturbed areas
- demobilization of all equipment, etc.
- removal of erosion and sediment control structures

The proposed construction schedule is presented in Appendix A. Following are a list of special requirements:

- Utility clearance must be done prior to excavation. Overhead utility lines are located next to the site and caution will be needed during demolition and excavation.
- The soil staging area and the equipment laydown area are located across the street at SWMU 13. There are two monitoring wells in the vicinity of these areas and care will be needed to ensure the integrity of the wells is not compromised and surface runoff does not flow from contaminated soil or decontamination areas toward the wells.
- The confirmation sampling will be conducted to ensure the CAOs for 4,4'-DDT, 4,4'-DDE, chlordane, heptachlor eposide, kepone, lead, arsenic, zinc, and chromium are met.

3.3 Preliminary Design Criteria and Rationale

The following criteria were used to develop the Basis of Design for the CMI:

Remediation Goals - The remediation goals for all contaminants of concern (COCs) are listed in Table 2-1.

Extent of Soil Removal - The extent of soil contamination at each site was defined via laboratory analysis conducted as part of previous investigations (i.e., Baker, 2003b). Excavation limits were defined based on available laboratory analytical results from past investigations.

Confirmatory sampling will verify removal of all contaminated soil. If further excavation with depth is found to be necessary based on confirmation sample results, removal of additional subsurface soil in the vicinity of the confirmation sampling will also be completed. Because several of the CAOs are ecologically derived, a statistical analysis of the confirmation sample results will determine if further excavation will be necessary. These special requirements will only be used for the ecologically derived CAOs. The requirements and rationale for this determination are described below in Section 4.2.

Following is a summary of the estimated volumes of soil removal for this site. Volume estimation calculations are presented in Appendix B.

- Inorganic and Organic contaminated soil--An estimated (in situ) volume of approximately 156 cubic yards of contaminated soil will be removed.

Sub-soil – Certified clean sub-soil will be placed and compacted in areas of contaminated soil removal up to a depth of 6 inches below grade at SWMU 53.

Top Soil - A 6-inch layer of top soil will be placed and compacted in the areas of contaminated soil removal at SWMU 53.

Slope Stability - The existing ground surface in the vicinity of the surface soils to be excavated at SWMU 53 are relatively flat-lying. There is no slope stability concern at this site.

Storage Area - All contaminated soil will be disposed of in lined roll-off boxes or other similar means as previously mentioned in this design plan.

3.4 General Operations and Maintenance Requirements

Minimal maintenance will be required subsequent to implementation of the removal action. Periodic visual inspections should be conducted at the excavation area to verify that the top soil cover is not eroding and that permanent vegetation has established.

4.0 CMI WORK BREAKDOWN STRUCTURE

The following sections of this Basis of Design describe the implementation by hazardous, toxic, and radiological waste (HTRW) account numbers, as defined by the work breakdown structure dictionary (http://www.efdlant.navfac.navy.mil/downl/Lantops_04/wbsdictionary.pdf).

4.1 7701- Mobilization and Preparatory Work

Mobilization involves the acquisition, delivery, and setup of equipment, material, and personnel at the work site, which are necessary to accomplish the scope of work outlined for the removal actions.

In addition, during the mobilization period, the Contractor shall prepare all necessary pre-construction submittals as described in Section 01115, "General Paragraphs" of the Technical Specifications. These specifications allow the Contractor up to twenty-one (21) days to prepare and submit the necessary pre-construction submittals. These submittals include:

- Erosion Control Plan
- Environmental Protection Plan
- Site Health and Safety Plan
- General Site Work Plan
- Construction Quality Control Plan
- Materials Handling/Transportation/Disposal Plan
- Sampling and Analysis Plan
- Shop Drawings
- Supplemental Specifications and Calculations
- Site Visit, Miscellaneous
- Complete Remedial Design Plans

The Contractor shall provide temporary facilities at each site, including (but not limited to) equipment decontamination/laydown areas, and soil stockpile/storage areas. The Contractor will also provide any temporary utilities required at the individual excavation locations necessary to complete the work.

The Contractor will be required to coordinate and obtain any necessary construction permits (such as temporary excavation permits) and clearances prior to the start of construction. The Contractor will also be responsible for coordinating all required inspections with LANTDIV or LANTDIV representatives.

If the contractor uses the area designated for equipment laydown and soil staging as shown in Figure 2-2, care shall be taken to ensure that contaminated soil and/or runoff, and equipment movement does not compromise the integrity of the two monitoring wells located in this area.

4.2 7702 & 7703 - Monitoring, Sampling, Testing, and Analysis

The RAC will be responsible for all health and safety monitoring at SWMU 53. Sampling, testing and analysis that will be conducted by the RAC will include characterization of materials that will be disposed or transported off site by the RAC, analysis of off-site borrow material, geotechnical classification, in place field density testing, etc.

The Contractor will be required to submit to LANTDIV for approval, a Sampling and Analysis Plan (SAP) describing the Contractor's sampling, analytical, and quality control procedures for the chemical data collected during the performance of work required by the specifications. The SAP will ensure that all chemical data generated are scientifically accurate and legally defensible. The SAP will describe the quantity, frequency, and media of samples to be collected and analyses to be performed.

The type and quantity of testing will be based on the requirements set forth in the specifications (and the Contractor's Health and Safety Plan and Air Monitoring Plan) and as required by disposal facilities which will be utilized. All required testing, documentation, and submittal of test results (for samples collected by the Contractor) will be the responsibility of the Contractor.

4.2.1 Soil Sampling

4.2.1.1 In-Situ Soil Sampling

The excavation will remain open while results of the laboratory confirmation testing are obtained. Laboratory analysis will be performed on a "quick turn" (24 hours maximum from laboratory receipt) basis to minimize this waiting period.

The contractor will collect soil samples for analysis of the Target Analyte List (TAL) of 4,4'-DDT, 4,4'-DDE, chlordane, heptachlor epoxide, kepone, lead, arsenic, zinc, and chromium in areas where these contaminants will be removed. All confirmation samples will be analyzed for all the above compounds.

Soil samples will be taken from the bottom of the excavation (where possible) at a frequency of one approximately every 625 square feet (25' by 25' grid area). In addition, one extra confirmation sample will be taken from the bottom of the excavation in each grid area located in the middle of the excavation area (i.e. those areas adjacent to or contiguous with the former Building 64), resulting in a maximum of four extra confirmation samples. This extra sampling will provide adequate vertical delineation in the center of the remedial area where previous investigations did not delineate all the COCs adequately with depth. It should be noted that bedrock is shallow at this site, and some excavation bottom sampling may or may not be possible due to this constraint. The total number of confirmation samples initially taken along the bottom of the excavation should not exceed thirteen.

Confirmation sampling along the sides of the excavation will occur in the undisturbed soil located a few inches outside the excavation and at a depth of 0-1 feet below the ground surface. The results of this sampling will be treated differently for the different chemical compounds on the TAL and is discussed in the following paragraphs.

Heptachlor epoxide and arsenic

CAOs established based on human health risk management levels for heptachlor epoxide and arsenic will be directly compared to the confirmation sample results for these two compounds. Soil with concentrations above these CAOs will be excavated further.

4,4'-DDT, 4,4'-DDE, chlordane, kepone, and lead

CAOs established based on ecological risk management levels for the following compounds: 4,4'-DDT, 4,4'-DDE, chlordane, kepone, and lead, will be compared to the mean concentration of the confirmation samples taken along the excavation perimeter combined with any remaining known concentrations outside of the excavation at the site. For a given chemical, if the mean concentration exceeds the CAO, soil with maximum concentrations (i.e., hot spots) will be excavated further until the mean concentration is less than the CAO. Although the use of mean concentrations may not be protective of individual ecological receptors, their use will be protective of ecological receptor populations. In all cases, individual confirmation sample analytical results above the human health CAO for these compounds as shown on Table 2-1 will result in further excavation.

Zinc and chromium

The CAOs established based on the maximum background concentrations for zinc and chromium will be compared to the confirmation sample results. To determine if additional excavation is necessary, analytical data for the confirmation samples will be statistically compared to background concentrations in accordance with Navy procedures (NFEC, 2002). For a given metal, if the statistical evaluation of the confirmation sample results demonstrates that the SWMU 53 data are statistically equivalent to background concentrations, no additional excavation will be performed. However, if the statistical evaluation shows that the SWMU 53 data are elevated above background concentrations, soil with maximum concentrations (hot spots) will be excavated further until statistical equivalence is established. The background database includes four basewide background surface soil samples and five SWMU 9 background surface soil samples. The summary of these background samples was given in the CMS (Baker, 2003c).

The total number of confirmation samples initially taken along the sides of the excavation should not exceed twelve.

4.2.1.2 Ex-Situ Soil Sampling

As outlined in the Specifications, any off-site borrow material to be used as backfill, will be sampled (by the Contractor) at a frequency of one sample for every 500 cubic yards of potentially clean/borrow material. Alternately, the Contractor may submit certification indicating that the soil is clean, with approval from the Navy Technical Representative (NTR). The Contractor will also be required to perform geotechnical testing of soils as outlined in the design drawings and specifications.

Characterization sampling for disposal will also be required as specified in Section 4.2.3 and design specifications.

4.2.2 Debris, Waste, and Recyclable Material Sampling

The Contractor will be responsible for collecting samples of materials that will be transported off site for disposal. These materials may include, but are not limited to the following:

- Erosion and sediment controls;
- Recyclable materials such as metal and rubber;
- Decontamination pad;
- Waste generated by the Contractor;
- Personal Protective Equipment (PPE)

4.2.3 Testing and Analysis

The Contractor shall adhere to USEPA chain-of-custody procedures during the collection, transport, and analyses of all samples. The materials to be sampled are discussed in Sections 4.2.1 and 4.2.2.

Confirmatory sampling in excavated areas will conform to Naval Facilities Engineering Service Center (NFESC) Level C Quality Assurance Requirements. Samples shall be analyzed as follows:

1. Confirmatory samples for excavation area-- analysis for soil samples taken from outside of the sides and bottom of the excavation area. All soil samples shall be analyzed for the following TAL: 4,4'-DDT, 4,4'-DDE, chlordane, heptachlor epoxide, kepone, lead, arsenic, zinc, and chromium.

The Contractor shall arrange laboratory analyses of the following samples to conform to NFESC Level C Quality Assurance Requirements. Samples shall be analyzed as follows:

1. Characterization sampling for disposal: One composite sample for every 25 cubic yards or fraction thereof. These shall be analyzed for Toxicity Characteristics Leachate Procedure (TCLP) Metals, TCLP Volatiles, TCLP Semi-Volatiles, Pesticides/PCBs, RCRA Characteristics.

2. Laboratory verification to verify the absence of contaminants in off-site borrow material. Sampling and analysis frequencies and methods will be outlined in the Contractor's SAP. Alternately, the Contractor may submit certification indicating that the soil is clean, with approval from the NTR.

3. Geotechnical testing (soil classification and compaction testing) of borrow soils and "clean" soils that will be placed as backfill. Test frequency and methodologies will be outlined in the Contractor's SAP.

4.3 17 - Site Preparation

Site preparation includes, but is not limited to, the following activities:

- Construction of a decontamination pad;
- Clearing and grubbing (and associated chipping, mulching, transportation of mulch);
- Installation of safety measures (such as safety fencing);
- Installation of erosion and sedimentation control facilities;
- Demolition of Building 64, including removal of miscellaneous contents, and concrete slab.
- Earthwork including excavation, fill placement, regrading;

4.4 770101 - Surface Water Collection and Control

The Contractor will be required to provide devices and facilities as necessary to prevent surface water from contacting contaminated materials (e.g., contaminated equipment, excavated soils, exposed debris/contaminated soils within the excavation) throughout the course of all construction activities. The Contractor shall be required to keep the excavated area dewatered during construction and to collect, sample, analyze, and dispose of any water accumulated in the excavation and staging areas. The liquid that accumulates within the excavated area, as well as the liquid collected following contact with contaminated materials and equipment shall not be allowed to flow outside of the limits of construction.

The evacuation of water from the excavation area can be accomplished via installation of sump pumps within the excavated area and pumping the accumulated water to a collection vessel (such as a Baker tank or tanker truck).

For costing purposes, it was assumed that 2,000 gallons of water would be collected.

4.5 170302 - Solids Collection and Containment

The excavation of contaminated soil will be performed with earth moving equipment such as excavators and front-end loaders.

The anticipated extent of excavation is depicted on the design drawings. The estimated in-place volume of contaminated soil that will be excavated is as follows:

- 156 cubic yards of contaminated soil. The anticipated depth of excavation will be 1 foot.
- Building 64 and its concrete slab will be demolished. The stacked volume of the building debris is approximately 25 cubic yards. The in-place volume of the slab is approximately 4 cubic yards. In addition, miscellaneous contents of the building will be disposed of. A total of 30 cubic yards is assumed for cost estimating.

These volumes do not include excavation associated with site work (e.g., grading, etc.)

The above volumes were calculated on the in situ soils and do not include bulking. The volumes are based on extent of contamination as defined via laboratory analyses that were conducted under previous investigations. The Contractor will establish baselines or reference points as necessary to ensure that the excavation is conducted in the proper location, and that the locations can be readily field verified. Excavation will not commence without approval from the Navy's on-site representative.

The Contractor will not excavate beyond the designated area or depth (as indicated on the design drawings) without approval from the Navy's on-site representative. If the confirmatory soil sampling indicates that the in situ soils underlying the excavated area exhibit contamination (above the established remediation goals), the Contractor will consult with the Navy's on-site representative to determine the additional areas/depths of soils to be excavated. Excavation (and confirmatory soil sampling) will proceed until the remediation goals are met.

The excavated soil will be placed in (pre-approved) temporary storage containers such as roll-off boxes located near the excavation area. Surveying will take place to determine extent of soil removal as well as post-construction site conditions.

4.6 770102 - Liquids Collection and Containment

The Contractor will provide a decontamination pad to collect liquids from the decontamination of personnel and construction equipment. The Contractor will collect ponded water that may collect in the excavation areas. The resulting fluids will be collected for analysis and proper disposal or treatment.

4.7 770201 - Decontamination and Decommissioning

Demolition of the existing structure, along with the concrete building slab will be performed. Drums, tanks, or spent personnel protective equipment (PPE), and other non-hazardous solid waste will be disposed of in accordance with USEPA Guidance (USEPA Publication 9345.3-05FS).

4.8 170302 - Disposal

The following materials will be containerized, manifested, and transported to an approved treatment or disposal facility off-base:

- Contractor-generated waste (e.g., liquids generated through decontamination procedures).
- Excavated soil, debris, and concrete.

4.9 170304 - Site Restoration

After confirmatory sampling results indicate that the contamination has been removed from a given site, the excavated area will be backfilled with soil from off-site borrow sources as coordinated through the NTR. The site will be restored as indicated on the design drawings and in the technical specifications.

4.10 770102 - Demobilization

All temporary facilities, equipment, and supplies acquired for this contract shall be decontaminated and removed from the site upon completion of the removal actions.

Post-construction submittals will include: 1) a punch list showing correction of all listed items; 2) a letter from the Contractor certifying completion of all contracted work in accordance with the contract conditions, applicable regulations, and standards of practice; 3) a completed project current condition with an as-built survey for the entire site; 4) submittal, in one collated document, of all quality control daily reports manifests, bills of lading, samples collected, results of the sample analyses, corrective actions taken to correct unacceptable deviations from required quality standards (if required) results of corrective actions; problems encountered and resolved, and lessons learned; and, 5) submittal in one collated document of all quality assurance samples, sample analyses results, and corrective actions taken to correct unacceptable deviations from required quality standards (if required).

The Contractor will submit a detailed report summarizing the CMI, lessons learned, and recommendations for inclusion in future similar contracts.

5.0 REFERENCES

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Baker, 2000a. *RCRA Final Permit Required Quarterly Progress Report Period February 1, 2000 – April 30, 2000*, RCRA/HSWA Permit No. PR2170027203, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. May 31, 2000.

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Naval Facilities Engineering Command (NFEC), 2002. *Guidance for Environmental Background Analysis, Volume I: Soil*. NFESC User's Guide UG-2049-ENV. April 2002.

United States Environmental Protection Agency (USEPA), 1991. *Management of Investigation-Derived Wastes During Site Inspections*. OSWER Publication Number 9345.3-05FS. May 1991.

TABLES

TABLE 2-1

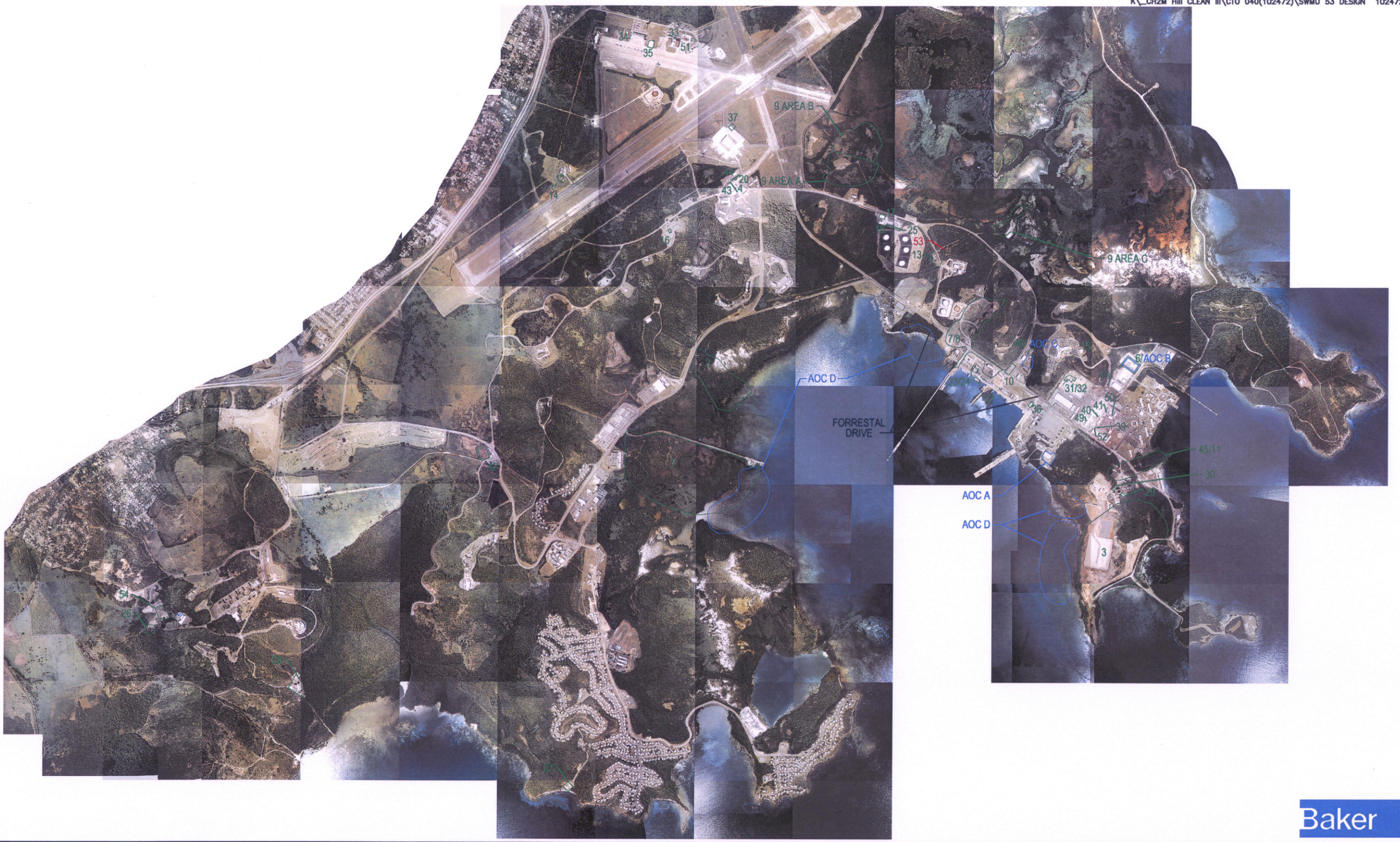
REMEDIATION GOALS
SWMU 53 - BUILDING 64 (MALARIA CONTROL BUILDING)
CORRECTIVE MEASURES IMPLEMENTATION
NAVAL STATION ROOSEVELT ROADS, CIEBA, PUERTO RICO

Contaminant of Concern	Ecological Risk Management Level	Rationale	Human Health Risk Management Level [(1)]	Rationale	Proposed Remediation Goal
Pesticides					
4,4'-DDT	396 ug/kg	Surface Soil Screening level	1,700 ug/kg	$1x10^{-6}$ ILCR	**396 ug/kg**
4,4'-DDE	106 ug/kg	Food web based screening for omnivorous bird	NA	NA	**106 ug/kg**
chlordane	99 ug/kg	Surface Soil Screening level	1,600 ug/kg	$1x10^{-6}$ ILCR	**99 ug/kg**
heptachlor epoxide	NA	NA	53 ug/kg	$1x10^{-6}$ ILCR	**53 ug/kg**
kepone	99 ug/kg	Surface Soil Screening level	NA	NA	**99 ug/kg**
Metals					
Lead	49.5 mg/kg	Surface Soil Screening level	400 mg/kg	Residential Screening Level	**49.5 mg/kg**
Arsenic	NA	NA	3.9 mg/kg	$1x10^{-5}$ ILCR	**3.9 mg/kg**
Zinc	106 mg/kg	Maximum detected background level for NSRR	NA	NA	**106 mg/kg**
Chromium	44.1 mg/kg	Maximum detected background level for NSRR	NA	NA	**44.1 mg/kg**

Notes:
ug/kg--micrograms per kilogram
mg/kg--milligrams per kilogram
NA-Not applicable
ILCR--incremental lifetime cancer risk
(1) - Based on a residential exposure scenario.

FIGURES

K_CH2M HILL CLEAN III\CTO 040(102472)\SWMU 53 DESIGN 102472F00



LEGEND

1 – SWMUs

AOC D – AOCs

– AREA OF WHICH THIS INVESTIGATION PERTAINS TO

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

2500 0 1250 2500

1 inch = 2500 ft.

FIGURE 1-1
SWMU/AOC LOCATION MAP
SWMU 53
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Baker

K:\CH2MHILL CLEAN III\CTO 040 (102472)\SWMU 53 DESIGN\102472F01

SWMU 53

BUILDING 64

DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)

18GW01

FORRESTAL DRIVE

13MW07

13MW06

18GW03

18GW02

40 0 20 40
1 inch = 40 ft.

Baker

LEGEND

BLDG. 64 – MALARIA CONTROL BUILDING

– SWMU 53

18GW01 – MONITOR WELL

– UTILITY POLE

– TREE LINE

20 – SURFACE CONTOUR

SOURCE: DEPT. OF THE NAVY, SEPEMBER 1999.

FIGURE 1–2
SWMU 53 SITE PLAN
CORRECTIVE MEASURES IMPLEMENTATION

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

K:\CH2MHILL CLEAN III\CTO 040 (102472)\SWMU 53 DESIGN\102472F02

DENSE FOLIAGE (SECONDARY GROWTH VEGETATION)

53SS15
53SS27
53SS11
53SS12
53SS10
53SS16
53SS28
53SS26
53SS13
53SS08
53SB01
53SB13
53SB14
53SS07
53SB12
53SS25
53SB11
53SS09
53SB02
53SS14
20
53SB07
53SB10
53SS02
53SB15
53SS29
53SS24
53WP01
53WP03
53SS01
53SS03
53SB05
53SS17
BUILDING 64
53SB03
53SS18
53SS23
53SB06
53SB09
53WP02
53WP04
53SS04
53SS06
53SB16
53SB08
53SS05
53SS19
53SB17
53SB20
53SB04
53SB18
53SS20
53SS22
53SB19
53SS21
28
DENSE FOLIAGE (SECONDARY GROWTH VEGETATION)

CORRECTIVE ACTION OBJECTIVES
CHROMIUM (44.1 mg/kg)
LEAD (49.5 mg/kg)
ARSENIC (3.9 mg/kg)
ZINC (106 mg/kg)
4-4'-DDT (396 ug/kg)
4,4'-DDE (106 ug/kg)
CHLORDANE (99 ug/kg)
KEPONE (99 ug/kg)
HEPTACHLOR EPOXIDE (53 ug/kg)

10 0 5 10
1 inch = 10 ft.

Baker

LEGEND
- (W) – WIPE SAMPLE LOCATION (SAMPLING AND ANALYSIS INVESTIGATION, 2000)
- – ADDITIONAL SURFACE SOIL SAMPLE LOCATION (CMS INVESTIGATION, 2003)
- – SURFACE SOIL SAMPLE LOCATION (SAMPLING AND ANALYSIS INVESTIGATION, 2000)
- – SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (SAMPLING AND ANALYSIS INVESTIGATION, 2000)
- – SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (RFI, 2002)
- – OVERHEAD ELECTRIC UTILITY POLE
- – BUILDING
- – APPROXIMATE EXTENT OF SOIL CONTAMINATION ABOVE CORRECTIVE ACTION OBJECTIVES
- – GROUND SURFACE CONTOUR LINE
- – TREE LINE

SOURCE: DEPT. OF THE NAVY, SEPEMBER 1999.

FIGURE 2–1
EXTENT OF SOIL CONTAMINATION ABOVE CORRECTIVE ACTION OBJECTIVES SWMU 53, BUILDING 64 (MALARIA CONTROL BUILDING) CORRECTIVE MEASURES IMPLEMENTATION
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

K:\CH2M HILL CLEAN III\CTO 040 (102472)\SWMU 53 DESIGN\ 10472F03

--DEMOLISH BUILDING 64 AND REMOVE
--DEMOLISH CONCRETE AND REMOVE
--CLEAR AND GRUB AS REQUIRED
--EXCAVATE TOP 1 FOOT OF SOIL

BUILDING 64

DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)

18GW01

SOIL STAGING
AREA, IF REQUIRED

FORRESTAL DRIVE

13MW07

13MW06

18GW03

18GW02

EQUIPMENT
LAYDOWN
AND DECONTAMINATION
AREA

40 0 20 40
1 inch = 40 ft.

Baker

LEGEND

- PROPOSED EXCAVATION BOUNDARY
- UTILITY POLE
- MONITORING WELL

SOURCE: DEPT. OF THE NAVY, SEPEMBER 1999.

FIGURE 2-2
SWMU 53 DESIGN PLAN
SWMU 53, BUILDING 64
(MALARIA CONTROL BUILDING)
CORRECTIVE MEASURES IMPLEMENTATION
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

APPENDIX A
CONSTRUCTION SCHEDULE

APPENDIX A
CONSTRUCTION SCHEDULE
CORRECTIVE MEASURES IMPLEMENTATION FOR SOIL REMEDIATION

SWMU 53, NAVAL STATION ROOSEVELT ROADS
CEIBA, PUERTO RICO

Task	Start[1]	Complete
Prepare and submit Draft Corrective Measure Implementation Design to EQB and EPA for review	6-Feb-2004	22-Mar-2004
Comment period for EQB and EPA	23-Mar-2004	22-Apr-2004
Response to Comments and submit Final Corrective Measures Implementation Design to EQB and EPA for concurrence	23-Apr-2004	24-May-2004
Perform Corrective Measure	TBD[2]	TBD[2]
Prepare and Submit Close-out Report	TBD[2]	TBD[2]

Notes:

[1] -- These dates are dependent upon available funding for the performance of this work and are subject to change.

[2]--To Be Determined based on availability of funding.

EPA--Environmental Protection Agency

EQB--Puerto Rico Environmental Quality Board

APPENDIX B
SUPPORTING CALCULATIONS

S.O. No. CLEAN III - CTO 040

Subject: SWMU 53 CMI

Sheet No. 1 of 1

Drawing No.

Computed by CLH Checked By Date 3/5/04

Baker

SOIL REMOVAL VOLUME

AREA (FROM CAD DRAWING) $\simeq$ 4200 ft^2

VOLUME = AREA * DEPTH

$= 4200\ ft^2 * 1\ ft$

$= 4200\ ft^3$

$= 4200\ ft^3 * \frac{yd^3}{27\ ft^3}$

$= 155.56\ yd^3$

CONCRETE VOLUME

AREA = $15\ ft * 20\ ft = 300\ ft^2$

VOLUME = AREA * THICKNESS

$= 300\ ft^2 * 0.33\ ft$ (assumed - 4 inches)

$= 100\ ft^3$

$= 100\ ft^3 * \frac{yd^3}{27\ ft^3}$

$= 3.7\ yd^3$

BUILDING VOLUME

ENGINEER'S ESTIMATE OF VOLUME OF BUILDING MATERIAL = $25\ yd^3$