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RECORD OF DECISION FOR SITE 1 INCINERATOR LANDFILL AND SITE 41 FORMER INCINERATOR MCRD PARRIS ISLAND SC

8/1/2006

TETRA TECH NUS

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Rev. 1
08/06

Record of Decision
Site/SWMU 1 – Incinerator Landfill and SWMU 41 – Former Incinerator

Marine Corps Recruit Depot
Parris Island, South Carolina

Contract Task Order 0020

August 2006

NAVFAC
Naval Facilities Engineering Command
Southeast
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

030204/P

RECORD OF DECISION
SITE/SWMU 1 – INCINERATOR LANDFILL AND SWMU 41 – FORMER INCINERATOR
FOR

MARINE CORPS RECRUIT DEPOT
PARRIS ISLAND, SOUTH CAROLINA
U.S. EPA IDENTIFICATION NUMBER SC6170022762

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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Naval Facilities Engineering Command
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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0020

AUGUST 2006

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/l	micrograms per liter
ARAR	Applicable or Relevant and Appropriate Requirements
B&R Environmental	Brown & Root Environmental
BAP	benzo(a)pyrene
bgs	below ground surface
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	centimeters per second
CMS	corrective measures study
COC	chemical of concern
COPC	chemical of potential concern
DON	Department of the Navy
ERA	ecological risk assessment
ER-L	effects range - low
ER-M	effects range - median
FDEP	Florida Department of Environmental Protection
FS	feasibility study
HHRA	human health risk assessment
HI	Hazard Index
HQ	Hazard Quotient
ILCR	incremental lifetime cancer risk
LOAEL	low-observed-adverse-effect level
LTM WP	long-term monitoring work plan
LUC	land-use control
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MCRD	Marine Corps Recruit Depot
mg/kg	milligrams per kilogram
MOA	Memorandum of Agreement
Navy	United States Navy
NCP	National Contingency Plan
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity

NEPA	National Environmental Policies Act
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effect level
NPL	National Priorities List
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PELs	probable effect level
PRG	preliminary remediation goal
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facilities investigation
RGO	remedial goal option
RI	remedial investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SMCLs	Secondary Maximum Contaminant Levels
SVOCs	semivolatile organic compounds
SWMU	solid waste management unit
TAL	Target Analyte List
TBC	to be considered (criteria)
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCL	target compound list
TEL	Threshold Effect Level
TEQ	toxicity equivalent concentration
TtNUS	Tetra Tech NUS, Inc.
U.S. EPA	United States Environmental Protection Agency
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service

1.0 DECLARATION FOR THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Site/Solid Waste Management Unit (SWMU) 1, Incinerator Landfill, and SWMU 41, Former Incinerator, are located in the northeastern tip of Horse Island in the northern section of the Marine Corps Recruit Depot (MCRD) Parris Island, South Carolina. SWMU 41, the Former Incinerator, consisted of a coal-fired brick chamber and, from 1921 to 1959, Site/SWMU 1 served as the disposal site for combustion residues from the incinerator. Although SWMU 41 ceased operation in 1959, Site/SWMU 1 continued to be used for disposal of combustible trash and noncombustible waste until 1965. Incinerated wastes at Site/SWMU 1 were initially piled on the land or placed in trenches into an adjacent marsh, extending the edge of the landfill farther into the marsh. Fill dirt was also used to build up the land at the edge of the marsh. The landfill progressively extended farther into the marsh as wastes were dumped on the edge of the fill. Site/SWMU 1 currently extends approximately 670 feet toward Archers Creek and is approximately 400 feet in width. Site/SWMU 1 is approximately 7 acres in size and was until recently covered with mature pine trees. In 2001, timber in the center of the site was harvested.

The Superfund site identification number for MCRD Parris Island is 04NY03488. The United States Environmental Protection Agency (U.S. EPA) identification number is SC6170022762.

For ease of reading and clarity, Site/SWMU 1 will be referred to as Site 1, for the remainder of this Record of Decision (ROD).

1.2 STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedy for Site 1 and SWMU 41 at the MCRD Parris Island, South Carolina. The remedial action was selected by the Navy and EPA in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource and Conservation Recovery Act (RCRA), as amended, and, to the extent practicable, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). The Navy and EPA select the remedy, with concurrence by the South Carolina Department of Health and Environmental Control (SCDHEC). The decision is based on information contained within the MCRD Administrative Record, which is located at the Beaufort County Public Library's Headquarters Location, 311 Scott Street, Beaufort, South Carolina, 29902. The State of South Carolina concurs with the selected remedy for Site 1 and SWMU 41

After the Proposed Plan was published and public comments received, negotiations between U.S. EPA and the Navy on post remedial action activities, in particular Land Use Controls, delayed the agencies' ability to finalize the Record of Decision (ROD). The agencies agreed, however, on the active component of the remedy and implemented the remedy as proposed. Therefore, although some language in the ROD may be in the present tense, many of the required actions have, in fact, been implemented.

1.3 ASSESSMENT OF THE SITE

A remedial investigation (RI)/Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) was conducted at Site 1. The RI/RFI was conducted in two phases (from May to September 1998 and in April 1999) [Tetra Tech, NUS, Inc. (TtNUS), 2001]. As further discussed in Section 2.6 (Summary of Site Risks), a human health risk assessment (HHRA) was conducted as part of the RI/RFI; it examined current risks associated with maintenance and construction workers possibly exposed to contaminated media. The HHRA also examined potential future risks to hypothetical on-site residents and adolescent and adult recreational users.

As also discussed in Section 2.6, an ecological risk assessment (ERA) completed for Site 1 and SWMU 41 considered potential impacts for benthic receptors, soil invertebrates, terrestrial and aquatic plants, terrestrial receptors, and aquatic receptors.

Based upon findings made in the Remedial Investigation/RCRA Facilities Investigation for Site/SWMU 1 – Incinerator Landfill and SWMU 41 – Former Incinerator human health risk assessment and ecological risk assessment, the response action selected in this ROD is necessary to protect the public health or welfare and the environment from actual or threatened releases of pollutants or contaminants from this site that may present an imminent and substantial endangerment to public health or welfare**.**

1.4 DESCRIPTION OF THE SELECTED REMEDY

Approximately 46 sites at MCRD Parris Island are being investigated under the Installation restoration (IR) Program. This Record of Decision addresses Site 1 and SWMU 41; the remaining 44 sites will be addressed separately.

Based upon the risk assessments undertaken during the study of Site 1 and SWMU 41, the soils of Site 1 and SWMU 41 and sediment and surface water of Site 1 were deemed to pose unacceptable risk to human health and the environment (see Table 2-7 and the Table in Section 2.6.2). As a result, a remedial action was selected for Site 1 and SWMU 41 to reduce these risks. Waste and sediment containing chemicals in excess of cleanup goals (see Table 2-9) for pesticides, PAHs, and inorganics has been excavated from the outside perimeter of the landfill and consolidated on site. A landfill cap was

constructed at Site 1 that reduces human and ecological contact with waste and contaminated soil and sediment. Waste and contaminated soil and sediment are no longer in direct contact with surface water, resulting in a reduced transport of contaminants to surface water.

The remedial action for Site 1 and SWMU 41 consists of the following actions.

- Sediment and Waste Excavation: Contaminated sediment was excavated and consolidated within the limits of a landfill cap system. This sediment consisted of sediment containing concentrations of inorganic chemicals (copper, mercury, and lead), PAHs, and pesticides above the cleanup goals for protection of ecological receptors. Additional testing was performed and successfully confirmed that no PAH-contaminated sediment remained.

  Sediment excavated did not include that sediment located north of the waste materials where arsenic was detected above its cleanup goal. Under current and future land-use scenarios that exclude residential development in the saltwater marsh, these arsenic concentrations were within acceptable human health risk ranges. Likewise, these arsenic concentrations were not determined to pose a significant threat to ecological receptors. Waste material (e.g., glass, ash) located outside the limits of the proposed cap system was also excavated and consolidated within the limits of the cap. However, at one single location, inorganic contamination (lead, copper, and mercury) did remain slightly in excess of its cleanup goal, and this will be addressed through long term monitoring.

- Low-Permeability Cap System Installation: A low-permeability cap system meeting or exceeding the requirements of the federal and state solid waste and hazardous waste landfill closure requirements was placed over approximately 5.0 acres of consolidated and graded waste and contaminated sediment materials. All excavated waste was consolidated over the mean high-tide level.

- Slope Stabilization and Erosion Control: Slope stabilization and erosion control measures were implemented along the toe and sideslopes of the landfill cap system to minimize the potential for failure of the sideslopes and to reduce the erosion rate of the cover due to surface water runoff, waves, and/or wind.

- Salt Marsh Restoration and Monitoring: Excavated areas were restored by filling in the excavation area with sand and then vegetating the area with local native vegetation (e.g., cordgrass). The sediment in the area was temporarily stabilized to minimize erosion and then the vegetation and sediment continue being re-evaluated to assess whether the response action remains sufficiently protective.

- Maintenance of the Cap System: Maintenance of the cap system and any existing or future monitoring and remediation system, including groundwater monitoring wells, is also part of the action. Maintenance of the cap includes routine mowing of grass and removal of trees or shrubs with root systems that could impact the liner system. The mowing of grass will occur in conjunction with lawn care across other parts of the Depot. Tree and shrub removal will occur at least annually, in conjunction with the cover inspection as part of a long term monitoring program. These cap maintenance activities are expected to be performed for at least 30 years.

- Land Use Controls: Land Use Controls (LUCs) consisting of both Engineering Controls (ECs) and Institutional Controls (ICs) will be implemented to preclude unacceptable future human health and/or ecological risks from exposure(s) to chemicals of concern (COCs) at the Site. The Land Use Controls will be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and unlimited exposure. Consistent with the RAOs developed during the RI/RFI, the specific performance objectives for the LUCs to be implemented at Site 1 are as follows:

    - To prohibit unauthorized excavation, construction or intrusive activities;
    - To prohibit residential development of the Site. Prohibited uses shall include, but are not limited to any form of housing, child-care facilities, pre-schools, elementary and secondary schools, or playgrounds; and
    - To prohibit the extraction or any use of the groundwater beneath the Site.

The following generally describes those LUCs which will be implemented at Site 1 in order to achieve the aforementioned LUC performance objectives:

Engineering Control:

- A sign will be posted on the landward side of Site 1 advising that any excavation, construction, or intrusive activity within the landfill is prohibited unless authorized in advance by the MCRD environmental department. The size, location and the language to appear on the sign will be agreed upon by MCRD, USEPA and SCDHEC as part of the LUC remedial design;

Institutional Controls:

- The Site 1 location and LUC boundaries, prohibitions against unauthorized excavation, construction or intrusive activities, residential development and groundwater extraction or

use, and the requirement for MCRD environmental department approval of any site excavation, construction, or intrusive activity will be annotated in the installation's Master Plan.

- The Site 1 location and LUC boundaries, prohibitions against unauthorized excavation, construction or intrusive activites, residential development and groundwater extraction or use, and the requirement for MCRD environmental department approval of any site excavation, construction or intrusive activity will be annotated in the installation's geographical information system, (GIS).

- The Site 1 location and LUC boundaries, prohibitions against unauthorized excavation, construction or intrusive activities, residential development or groundwater extraction or use, and the requirement for MCRD environmental department approval of any site excavation, construction or intrusive activity will be annotated in the installation's Environmental Management System. The environmental management system is a centralized tool for the dissemination of information critical to making appropriate decisions regarding the management of resources, compliance with environmental regulations and ensuring that site-specific use limitations are complied with.

- Site 1 LUCs will be included in a Depot Order currently under development governing ground disturbing activities across the facility.

The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. A LUC remedial design, as part of the Final Remedial Design or document memorializing Remedial Action Completion, (primary documents under the FFA), that addresses how these LUCs will be implemented, maintained, monitored (including periodic inspections), enforced and reported on, will be prepared and submitted by the Navy per the approved Site Management Plan (SMP) schedule to EPA and SC DHEC for review and approval. Once the Final Remedial Design or document memorializing Remedial Action Completion, (including the LUC remedial design) is approved by EPA, it shall supersede any Land Use Control Implementation Plan already developed for Site 1, as well as any conditions related to Site 1 LUCs in the LUC Memorandum of Agreement (also termed the Land Use Control Assurance Plan) executed between the Navy, U.S. EPA and SCDHEC.

- <u>Long-Term Monitoring:</u> Long term monitoring of groundwater and sediment will be conducted in

accordance with the Long Term Monitoring Work Plan (LTM WP) for Site 1 once finalized and approved. Monitoring results will be compared against appropriate criteria identified and agreed to in the LTM WP. A re-evaluation of the site will be performed every five years to determine whether changes to the LUCs implemented, site monitoring, and/or remedial action will be required.

1.5 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective. This action did not satisfy the statutory preference for remedies that employ treatment technologies that reduce toxicity, mobility, or volume as a principal element because treatment of the wastes found at the site was deemed to be impracticable. Instead, it was determined that a presumptive remedy approach providing for waste containment was more appropriate and adequately protective. The remedy will result in hazardous substances, pollutants, or contaminants on-site above levels that allow for unlimited use and unlimited exposure; therefore, in accordance with Section 121(c) of CERCLA and 40 CFR 300.430(f)(4)(ii), a statutory review will be conducted within 5 years of initiation of the selected remedial action, and every 5 years thereafter unless and until unlimited use and exposure may be allowed, to ensure that the remedy continues to be protective of human health and the environment.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for Site 1 and SWMU 41.

- Detected chemicals and their respective concentrations (Tables 2-1 through 2-5).
- Chemicals retained as human health COPCs (Table 2-6) and ecological COPCs (Table 2-8).
- Cleanup levels established for selected COCs and the basis for these levels (Table 2-9).
- Baseline human health risk represented by the COCs (Section 2.6).
- The manner in which source materials constituting principal threats are addressed (Section 2.8).
- Current and reasonably anticipated future land-use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Section 2.5.4).

- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section 2.5.4).

- Estimated capital, annual O&M, and total present-worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 2.7, and 2.9 and Appendix B).

- Key factors that led to selecting the remedy (Sections 2.9 and 2.10).

1.7 AUTHORIZING SIGNATURES

Signature Paul E. Lefebvre
Brigadier General
Commanding General
MCRD Parris Island

Date

Signature Beverly H. Banister
Acting Division Director
Waste Management Division
U.S. EPA Region 4

9/12/06
Date

By separate letter, the State of South Carolina will concur with this decision.

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

MCRD Parris Island is located along the southern coast of South Carolina, approximately 1 mile south of the city of Port Royal and 3 miles south of the city of Beaufort within Beaufort County. MCRD Parris Island covers approximately 8,047 acres that consist of dry land, salt marshes, saltwater creeks, and ponds, as shown in Figure 2-1. MCRD Parris Island is the reception and recruit training facility for the Marine Corps for enlisted men for all states east of the Mississippi River and for enlisted women nationwide. Site 1, the Incinerator Landfill, and SWMU 41, Former Incinerator, are located on the northeastern tip of Horse Island in the northern section of the MCRD Parris Island, as shown on Figure 2-1.

The Superfund site identification number for MCRD Parris Island is 04NY03488. The U.S. EPA identification number is SC6170022762.

The United States Navy (Navy) is the lead agency for this ROD. The U.S. EPA Region 4 is the lead oversight agency and SCHDEC is a support oversight agency. Representatives of National Oceanic and Atmospheric Administration (NOAA), South Carolina Department of Natural Resources (SCDNR), and U.S. Fish and Wildlife Service (USFWS) also serve as natural resource trustees.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Having been operated as a recruit training facility for the U.S. Marine Corps since 1915, MCRD Parris Island consists mainly of administrative office buildings, training facilities, recruit and family housing, building and vehicle maintenance shops, and community facilities. It is anticipated that future land uses at the facility will be substantially the same as historical land uses although Site 1 which is the subject of this ROD, will no longer be used as a landfill disposal site. The following paragraphs provide more specific historical use information for Site 1 and SWMU 41:

2.2.1 Site History

Site 1 – Incinerator Landfill

From 1921 to 1959, Site 1 (see Figure 2-2) served as the disposal site for combustion residues incinerated at SWMU 41. Wastes were initially piled on the land or placed in trenches into an adjacent marsh, extending the edge of the landfill farther into the marsh. Fill dirt was also used to build up the land

at the edge of the marsh. The landfill progressively extended farther into the marsh as wastes were dumped on the edge of the fill. The landfill currently extends approximately 670 feet toward Archers Creek and is approximately 400 feet in width. Site 1 occupies approximately 7 acres and was until recently covered with mature pine trees. In 2001, timber in the center of the site was harvested.

The majority of wastes disposed in the landfill were non-hazardous, combustible domestic wastes and other noncombustible wastes (e.g., cans, bottles, and construction debris). Additionally, hazardous wastes generated from the MCRD from 1921 to 1959 were reportedly treated in the incinerator and disposed in the landfill. Paint thinners (mineral spirits), diesel fuels, kerosene, and strippers (methylene chloride) were also reportedly poured onto the landfill and burned. No auxiliary fuels were used for open burning. Although incineration operations at SWMU 41 ceased in 1959, Site 1 continued to be used for disposal of waste until 1965. Approximately 56,000 cubic yards of soil, fill, and waste material were disposed at Site 1 from 1921 to 1965. Since 1965, no significant disposal or intrusive activity has taken place within the boundaries of Site 1. Site 1 is not and has never been a RCRA Subtitle C or D permitted landfill.

SWMU 41 – Former Incinerator

SWMU 41 consisted of a coal-fired brick chamber, that was approximately 43 feet long, 34 feet tall, and 20 feet wide. Emissions from the incinerator were vented through a hole in the top of the chamber. A ramp was situated along one of the unit's sides to provide access to the top of the incinerator. Trucks carried wastes up the ramp and discharged them into the hole and incinerated wastes were subsequently disposed at Site 1. SWMU 41 remained in operation until 1959. Historical records indicate that SWMU 41 was located in one of two possible locations. Based on the RI/RFI, the Navy determined that SWMU 41 was likely located within the area defined as Site 1 and that remediation of Site 1 would also address SWMU 41.

Environmental investigations at Site 1 and SWMU 41 began in 1986. The following reports describe the results of investigations to date at that site and are available in the MCRD Parris Island information repository:

- Initial Assessment Study of MCRD Parris Island, South Carolina [Naval and Energy Environmental Support Activity (NEESA), 1986].
- RI/RFI Work Plan for Sites/SWMUs 1, 2, 3, and 15 and SWMU 41 [Brown and Root Environmental (B&R Environmental), 1998a] and Work Plan Addendum (TtNUS, 1999).

- RI/RFI Report for Site/SWMU 1 – Incinerator Landfill and SWMU 41 – Former Incinerator (TtNUS, 2001).

- Feasibility Study (FS)/Corrective Measures Study (CMS) Report for Site/SWMU 1 – Incinerator Landfill and SWMU 41 – Former Incinerator (TtNUS, 2002a).

- Proposed Plan for Soil and Sediment Remedial Action at Site/SWMU 1 – Incinerator Landfill and SWMU 41 – Former Incinerator (TtNUS, 2002b).

2.2.2 Enforcement Activities

Although there is no history of cited violations under federal or State environmental laws or regulations in connection with MCRD's historical activities at Site 1 or SWMU 41, EPA has undertaken certain RCRA and CERCLA related compliance oversight activities at MCRD Parris Island. These include the following:

- An Interim RCRA Facility Assessment (RFA) of MCRD Parris Island in 1990 (A.T. Kearney, Inc.);

- A Hazard Ranking System (HRS II) scoring of MCRD Parris Island in May 1992. That effort yielded an initial score of 71.59. The installation was rescored by EPA in August 1994 yielding a score of 50.00.Ha

- Proposed inclusion of MCRD Parris Island on the National Priorities List in July 1994.

- Listing of MCRD Parris Island on the NPL in December 1994 with appropriate Federal Register Notice on January 17, 1995.

- Joint execution with the Navy, EPA, and SCDHEC of a Federal Facilities Agreement for MCRD Parris Island in January 2005. That agreement was made effective by EPA on March 31st, 2006.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

MCRD Parris Island has performed public participation activities in accordance with CERCLA and to the extent practicable the NCP throughout the CERCLA site clean-up process. On January 31, 2002, the Proposed Plan for Soil and Sediment Remedial Action at Site 1 and SWMU 41 was made available to the public in the Information Repository at the Beaufort County Public Library's Headquarters Location at 311 Scott Street, Beaufort, South Carolina 29902. This Proposed Plan recommended the following preferred remedy:

- Excavation of waste outside the limits of a landfill cap system.

- Excavation of sediment containing concentrations of inorganic chemicals (copper, mercury, and lead), PAHs, and pesticides above cleanup goals for protection of ecological receptors.

- Consolidation of excavated material within a landfill cap system.

- Installation of a low-permeability cap system over the consolidated and regraded contaminated material.

- Installation of slope stabilization and erosion control measures.

- Restoration and monitoring of the salt marsh area where excavation was performed.

- O&M of the landfill cap system.

- Long-term monitoring of groundwater and sediment.

- LUCs

The public notice of the Proposed Plan was published in the *Beaufort Gazette* on January 31 and February 3, 10, and 17, 2002. That notice solicited public comments on the PP. No adverse comments were received in response. Additionally, a public information session was held on February 19, 2002 to present the results of the RI/RFI and the FS/CMS, explain the preferred remedy, and solicit comments from the community. At this information session, representatives from Southern Division, Naval Facilities Engineering Command, MCRD Parris Island, U.S. EPA Region 4, and SCDHEC were available to discuss aspects of Site 1 and SWMU 41 and the response actions under consideration. The Community Relations Responsiveness Summary is included in Appendix A of this decision document.

2.4 SCOPE AND ROLE OF THE RESPONSE ACTION AT SITE 1 AND SWMU 41

Site 1 and SWMU 41 are two of approximately 45 sites being evaluated for potential contamination at the MCRD Parris Island. In 1996, the MCRD Parris Island partnering team was developed to facilitate the development, review, and approval of work plans, reports (RIs and FSs), and decision documents (Proposed Plans and RODs). The original members of the team consisted of the Southern Division of the Navy, Marine Corps - MCRD Parris Island, U.S. EPA, and SCDHEC. In 1997, representatives of NOAA, SCDNR, and USFWS joined the team as natural resource trustees.

As part of the overall site cleanup strategy for MCRD Parris Island, contaminated areas have been and continue to be assessed, organized into OUs, and addressed in relative risk order, starting with those sites with generally higher risk, followed by those of generally lower risk. The relative risk for Site 1 was high. EPA has designated Site 1 and SWMU 41 together as Operable Unit 1 for purposes of tracking within EPA's CERCLIS database. The FFA details MCRD Parris Island's RCRA/CERLA integration and overall Site remedial process.

This CERCLA action satisfies SCDHEC RCRA requirements for corrective action consistent with the FFA Section VI. RCRA/CERCLA Integration, as required by the FFA.

This ROD presents the remedy selected by the MCRD partnering team for Site 1 and SWMU 41. Under the selected remedy, waste materials, soils, and sediments that currently pose risks to human health and the environment were consolidated under a cap system. This action, coupled with LUCs, prevents direct human and ecological contact with contaminated media. Concentrations of chemicals in the remaining sediment (sediment that was not consolidated under the cap system) were within acceptable risk ranges to human receptors under current and future land uses that prohibit residential development in the saltwater marsh. Likewise, this remaining sediment was not determined to pose a significant threat to ecological receptors. However, at one single location, inorganic contamination (lead, copper, and mercury) did remain slightly in excess of Remediation levels, and this will be addressed through long term monitoring.

Surface water at the site has been impacted by site contaminants as summarized in Table 2-3. The selected remedy prevents future migration of contaminants from the consolidated media to surface water. Groundwater at this site has also been affected by site contaminants as summarized in Table 2-2. However site groundwater is not usable as a potable water supply due to high salinity and high dissolved solids content and groundwater exposure pathways do not currently exist. In addition, the low-permeability cap component of this remedy will reduce rainfall infiltration into the landfall, thereby reducing future migration of contaminants to groundwater.

2.5 SUMMARY OF SITE CHARACTERISTICS

This section summarizes the regional and site-specific geology, hydrogeology, and ecology in the vicinity of MCRD Parris Island. A more detailed presentation of this information is available in the RI/RFI Report for Site 1 and SWMU 41 (TtNUS, 2001).

2.5.1 Geology

Four geological units are present in the Beaufort-Jasper County area. These units from the oldest (Eocene age) to the youngest (Pleistocene age) are the Santee Limestone, Cooper Marl, Hawthorn Formation, and Pleistocene sands and clays. Soils at MCRD Parris Island have been mapped by the U.S. Soil Conservation Service as both individual soils and groupings of soils (units) (Stuck, 1980). The Depot has been mapped as having 15 individual soil types, but only eight types are present beneath MCRD Parris Island. Three soil units have been mapped for the Depot (the Wando-Seabrook-Seewee, Coosaw-Williman-Ridgeland, and Bohicket-Capers-Handsboro Soil Units).

Surface soil collected from the interior of the landfill during the 1998 field event consisted of fine to medium sands with varying amounts of silt and clay. Surface debris consisting of glass and metal was observed during the field event. This material was observed in several surface soil locations at depths of 1 foot or less.

The site-specific subsurface geology at the unit has been affected by human activities. Material was buried in pits in the landfill, creating topographic high and low areas within the landfill limits. In the soil boring locations along the edge of the landfill boundary, landfill debris consists of glass fragments and construction debris, which included concrete and brick fragments. Generally, the shallow subsurface geology of the study area consists of a heterogeneous mixture of tidal- and storm-deposited silt, clay, and sand; clays are prevalent to a depth of approximately 28 feet below ground surface (bgs). Beneath the tidal sands, silts, and clays, the sediment consists of fine to coarse sands with varying clay content to depths of 34 to 36 feet bgs.

Figures 2-3 through 2-7 show the cross-sectional transects, A-A' through E-E', that were developed from soil boring data collected during the RI/RFI. The locations of these cross-sections are shown on Figure 2-2.

2.5.2 Hydrogeology

Two primary aquifers are present within the Beaufort-Jasper County area: the surficial Pleistocene aquifer and the Floridan Aquifer. These aquifers are generally separated by the Hawthorn Formation and Cooper Marl, which act as confining units to the underlying Floridan Aquifer.

In the MCRD Parris Island area, the shallow unconfined aquifer generally consists of permeable, fine to medium Pleistocene age sands. Surface relief is relatively low. The area is drained by fresh and brackish water streams inland and by tidal streams along the coast. The water table in the MCRD Parris Island area usually ranges from 0 to 10 feet bgs and is most commonly found at a depth of 3 feet bgs.

Water-table fluctuations are a function of tidal influence, recharge, evaporation, and transpiration and have been observed to be as great as 6.5 feet at some locations (Glowacz, et al., 1980). The direction of groundwater flow in the upper portion of the shallow surficial aquifer is generally toward the nearest surface water body, such as a pond, river, tidal creek, or the ocean.

In the Beaufort-Jasper County area, the Floridan Aquifer system occurs near the land surface, and overlying confining beds vary from essentially 0 to more than 150 feet in thickness. Groundwater in the Floridan Aquifer occurs in solutionally enlarged openings or cavities in the limestone. In general, groundwater occurs in a series of broadly defined water-bearing (permeable) zones that serve as aquifers and are separated by less permeable rocks. Two hydrogeologic zones within the Floridan Aquifer lie beneath the MCRD Parris Island area: a 200-foot-thick upper hydrogeologic unit that contains an upper permeable zone and an 800-foot-thick lower hydrogeologic unit that has a somewhat lower permeability compared to the upper unit.

A surficial groundwater table exists at Site 1 and SWMU 41. At monitoring wells located around the perimeter of the landfill, the depth to groundwater was less than 2.5 feet bgs. Based on the depth of the confining unit (Hawthorn Formation), which was consistently identified at approximately 36 feet bgs at these monitoring well locations, the thickness of the surficial aquifer is 33.5 feet. Locally, shallow groundwater is expected to flow from the middle of the landfill facility toward the topographic low areas that serve as groundwater discharge points. The geometric average hydraulic conductivity for the six shallow surficial aquifer wells and the five deep surficial aquifer wells was calculated to be approximately 2.52 feet per day [8.89×10^{-4} centimeters per second (cm/sec)] and 4.51 feet per day (1.59×10^{-3} cm/sec), respectively. The values for the shallow and deep wells are within the typical range of hydraulic conductivity for the encountered material.

The surficial aquifer is generally divided from the lower Floridan Aquifer by the Hawthorn Formation, which acts as a confining unit. The Hawthorn Formation is a phosphatic sand and clay unit with a reported thickness of approximately 2 to 40 feet in the study area. The results of a falling head permeability test performed on an undisturbed sample (gray-green silty to clayey, fine sand) at a depth of 39 to 41 feet bgs indicate the material encountered has a vertical hydraulic conductivity of 8.4×10^{8} cm/sec. Based on the results of the falling head permeability test, the material likely acts as a confining unit. At soil boring PAI-01-SB-05, the confining unit is underlain to a depth of at least 50 feet bgs by fine to coarse sand that gets tighter and dryer with depth. Assuming this sand unit exists across site, the confining unit is approximately 6 feet thick.

2.5.3 Human Health Conceptual Site Model

As a general rule, once released from the source, contaminants may be transported in media such as soil, groundwater, surface water, sediment, or air. Potential human receptors may be exposed either directly or indirectly to contaminants in these media by a variety of exposure mechanisms. Consequently, air inhalation, direct contact with soil, groundwater, surface water, and sediment, and ingestion of fish were all potential human health exposure routes evaluated in the RI/RFI.

Because of the known presence of waste materials at Site 1, the potential existed for contamination to be released from the landfill by various mechanisms such as stormwater runoff and resulting erosion of surface soils; the leaching of COPCs from soil via infiltrating water to subsurface soil and subsequent migration through the subsurface soil to the water table; wind erosion of surface soil (fugitive dust); and the volatilization of chemicals from soil (volatile emissions).

Potential human receptors were identified by analyzing the interaction of current and hypothetical future land use practices and the identified sources of Site contamination. The receptors evaluated in the RI/RFI consisted of construction workers, maintenance workers, hypothetical future on-site residents, and future on-site recreational users.

2.5.4 Current and Potential Future Land and Resource Uses

The real property upon which Site 1 and SWMU 41 are situated is currently vacant land covered with nature grasses planted as part of the Navy's landfill cap establishment efforts. The reasonably anticipated land use is to leave this land vacant. No residential use is anticipated. Section 2.9 further identifies the LUC performance objectives for the selected remedy. Site 1 and SWMU 41 groundwater is not used as a potable water supply nor is it expected to be used as such in the future, based on the high dissolved solids content and high salinity of the groundwater. In any case, extraction of groundwater will be prohibited. Currently, no off-site residents are located hydraulically downgradient in the immediate vicinity of the sites that might use groundwater as a potable water supply. The surface water adjacent to Site 1 and SWMU 41 is not currently used as a potable water supply but is used for recreation (boating).

2.5.5 Ecology

Until 2001, the entire upland portion of Site 1 and SWMU 41 was mostly forested. In 2001, the central portion of the site was harvested for timber. The overstory is dominated by slash pine (*Pinus elliottii*), loblolly pine (*Pinus taeda*), live oak (*Quercus virginiana*), and laurel oak (*Quercus laurifolia*). Other

common trees include hackberry (*Celtis laevigata*) and black cherry (*Prunus serotina*). Common understory shrubs include Eastern baccharis (*Baccharis halimfolia*) and wax myrtle (*Myrica cerifera*). Saw palmetto (*Serenoa repens*), oleander (*Nerium oleander*), yaupon (*Ilex vomitoria*), and the exotic Chinese tallowtree (*Sapium sebiferum*) are also present. Common vine species include poison ivy (*Rhus radicans*), Virginia creeper (*Parthenocissus quinquefolia*), muscadine grape (*Vitis rotundifolia*), and greenbriar (*Smilax rotundifolia*). An extensive saltwater marsh is located along the northern, eastern, and western portions of the peninsula on which Site 1 and SWMU 41 are located. The marsh is dominated by cordgrass (*Spartina alterniflora*). Seashore saltgrass (*Distichlis spicata*) and glasswort (*Salicornia virginica*) are present in portions of the marsh/upland interface.

The peninsula is small in areal extent, but nevertheless a variety of wildlife species occurs there. White-tailed deer (*Odocoileus virginianus*) and raccoons *(Procyon lotor*) are known to forage in the area and gray squirrels (*Sciurus carolinensis*) are common. Other mammalian herbivores expected to occur in the upland portion of the peninsula include the cotton rat (*Sigmodon hispidus*) and the cotton mouse (*Peromyscus gossypinus*). Eastern moles (*Scalopus aquaticus*) exist in some portions of the area. The opossum (*Didelphis virginiana*) and short-tailed shrew (*Blarina carolinensis*) forage throughout the area. The marsh rabbit (*Sylvilagus palustris*) and rice rat (*Oryzomys palustris*) forage along the edge of the marsh. Mink (*Mustela vison*) and river otters (*Lutra canadensis*) have been observed near Site 1 and SWMU 41 and are assumed to forage on the sites. Other mammalian carnivores expected to occur, at least occasionally, at the sites include the red fox (*Vulpes vulpes*) and striped skunk (*Mephitus mephitus*). A variety of birds, reptiles, and amphibians utilize the sites.

The saltwater marsh provides habitat for a variety of fauna, particularly fish and crustaceans. Several species of animals prey upon these fish and crustaceans. These include mammals such as the raccoon, mink, and river otter and wading birds such as the tricolored heron (*Egretta tricolor*), great blue heron (*Ardea herodias*), green heron (*Butorides striatus)*, and snowy egret (*Egretta thula*). Various shorebirds and wintering waterfowl forage in the marsh.

The shallow marsh is alternately flooded and drained by changing tides, and therefore fish in the areas near the sites are largely limited to small schooling species such as mud minnows (*Umbra pygmaea*) and mummichogs (*Fundulus heteroclitus*). However, Archer's Creek is located approximately 50 feet north of the northernmost edge of the peninsula. Fish such as red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), whiting (*Menticirrhus americanus*), and striped mullet (*Mugil cephalus)* are known to occur in Archer's Creek. These and other species occur, at least occasionally, in portions of the marsh during high tides.

Threatened and endangered species that could occur at or near the sites consist of the bald eagle (*Haliaeetus leucocephalus*) and wood stork (*Mycteria americana*). An active bald eagle nest is located approximately 1 mile southeast of the sites, and bald eagles (state and federally listed as threatened) could potentially forage on fish in the tidal channel north of the sites. Wood storks (state and federally listed as endangered) forage in various areas throughout the Depot, and they could forage in the marsh surrounding the sites.

Although other endangered and threatened species occur in Beaufort County [Table 2-2 of Volume I, Master Work Plan (B&R Environmental, 1998b)], the sites provides poor habitats for these species. For example, the manatee (*Trichechus manatus*), shortnose sturgeon (*Acipenser brevirostrum*), and various sea turtles are occasionally observed in the Broad River, Beaufort River, and Port Royal Sound, and the Atlantic bottlenosed dolphin (Tursiops truncatus) is a year-round resident of these areas. (Although not threatened or endangered, dolphins are afforded protection under the federal Marine Mammal Act.) However, these species usually are not associated with shallow marshes and narrow tidal channels like those near Site 1 and SWMU 41. With the exception of the bald eagle and wood stork, the likelihood of endangered and threatened species in the vicinity of the sites is remote.

2.6 SUMMARY OF SITE RISKS

The Site 1 and SWMU 41 RI/RFI analytical data were evaluated to determine baseline risks to human health and the environment. The baseline risk assessment estimates the risks the site would pose if no action were taken. It provides the basis for taking action and identifies the contaminants and the exposure pathways that need to be addressed by the remedial action. Sections 2.6.1 and 2.6.2 summarize the results of the baseline risk assessment for this site. Summary statistics for 1998 surface soil, groundwater, and surface water analytical results and 1998 and 1999 sediment results are presented in Tables 2-1 though 2-5.

Surface soil was found to contain PAHs, PCBs, pesticides, and several metals including lead, arsenic, aluminum, iron, mercury, vanadium, and zinc at concentrations greater than background soils and in exceedance of the most stringent human health risk-based concentrations (RBCs) (residential) or the most stringent ecological screening values. The highest levels of metals were generally associated with areas with little or no cover soil. The observed pesticide concentrations in soil are consistent with surface application; consequently, pesticides may not be site related.

Arsenic, iron, lead, manganese, thallium, chloroform, and naphthalene were detected in the site groundwater at concentrations that exceed the most stringent human health criteria (drinking water standards). The presence of a saltwater marsh surrounding the site and the measured salinity in the groundwater limit the use of site groundwater as a potable water supply. Naphthalene, copper, lead,

mercury, and zinc were present in groundwater at concentrations that could exceed the most stringent ecological screening values for surface water if groundwater to surface water attenuation factors were not present.

Bis(2-ethylhexyl)phthalate, chrysene, pentachlorophenol, arsenic, iron, manganese, and mercury were detected in surface water at concentrations in excess of background and the most stringent human health RBCs. Pentachlorophenol, copper, lead, mercury, silver, and zinc were detected in surface water at concentrations in excess of background and the most stringent ecological screening values.

Sediment was found to contain PAHs, pesticides, arsenic, cadmium, copper, iron, lead, mercury, and silver at concentrations greater than background sediments and in exceedance of the most stringent human health RBCs (residential) or the most stringent ecological screening values. The observed pesticide concentrations in sediment are consistent with surface application; consequently, pesticides may not be site related.

TCDD and related isomers, measured as TCDD toxicity equivalent concentrations (TEQs), were found in both sediment and groundwater at the site but at concentrations below the most stringent risk-based human health and drinking water criteria. The detected TEQs at the site were at concentrations similar to the most stringent ecological criteria for mammals and significantly less than the most stringent criteria for fish and avian receptors. As a result, significant impact to site ecological receptors would not be expected. The concentration of TEQ in site sediments is also similar to that found in a background sample location. As a result, the presence of TEQ is likely to be present from a regional source and is not related to Site 1 waste disposal activities.

In addition to the risks posed to human health and the environment, the landfill did not possess a uniform soil cover, resulting in exposed waste materials at the surface of the landfill. Under such conditions, the waste material continued to erode into the surrounding surface water and sediment. As a result, the response action selected in this ROD was necessary to protect the public health or welfare and the environment from actual or threatened releases of pollutants or contaminants from this site that presented an imminent and substantial endangerment to public health or welfare. The uncontrolled exposure to the wastes/contaminated sediments in the landfill and contaminated groundwater beneath Site 1 would present an unacceptable risk to human health. Consequently, the remedy includes LUCs in the form of land use restrictions that will prohibit intrusive activities, as well as residential development of the site and any use of the groundwater to eliminate unacceptable human exposure.

2.6.1 Human Health Risk Assessment

A baseline HHRA was performed at Site 1 and SWMU 41 to characterize and quantify potential health risks in the absence of remedial action. The baseline HHRA for Site 1 and SWMU 41 was conducted using the most recent guidance from the U.S. EPA (U.S. EPA, 1989, 1992a, 1993, 1998a, 1998b, 1999a), including regional supplemental guidance (U.S. EPA Region 4, 1995a). Methodologies presented in the Master Workplan for MCRD, Parris Island, South Carolina (B&R Environmental, 1998b) were also used to develop the baseline risk assessment for these sites.

Maximum detected concentrations at Site 1 and SWMU 41 were compared to risk-based and health-based screening criteria. If the maximum concentration exceeded any one of the screening criteria, that chemical was retained as a human health COPC. COPCs are chemicals that need further evaluation to determine if, in fact, the concentrations found at the site pose a potential risk to human health and the environment. COPCs identified for Site 1 and SWMU 41 are presented in Table 2-6.

The HHRA then evaluated potential exposure pathways including direct contact and ingestion of soil, sediment, groundwater, surface water, and sediment, inhalation of soil dust and groundwater vapors, and consumption of fish living within the site. Potential receptors consisted of construction workers, maintenance workers, hypothetical future residents, and future recreational users. Recreational users are individuals who fish or wade within the waters adjacent to Site 1.

Risk estimates developed in the HHRA were divided into carcinogenic (cancer) and noncarcinogenic (noncancer) concerns. For carcinogenic risks, EPA considers risks lower than 1 in 1,000,000 to require no further remedial action, while a range of 1 in 10,000 (1.0E-04) to 1 in 1,000,000 (1.0E-06) incremental lifetime cancer risk (ILCR) is considered by the U.S. EPA to be able to be managed. For noncarcinogenic concerns, the U.S. EPA threshold value HI is 1.0. A summary of the ILCRs and HIs for human receptors evaluated in the HHRA is provided in Table 2-7.

An analysis of exposure to surface waters by the adolescent recreational user and hypothetical future resident resulted in estimated ILCRs that exceed U.S. EPA's acceptable range of 1.0E-04 to 1.0E-06. Bis(2-ethylhexyl) phthalate and pentachlorophenol are the main contributors of these risks.

Potential health effects associated with recreational harvesting and consumption of fish tissue were also estimated under several scenarios. Chemical concentrations in fish were estimated through theoretical equilibrium partitioning of surface water contamination to fish. This approach is expected to be very conservative for this site. Under site-specific conditions (weekly fish consumption over a 6-year period and use of average surface water concentrations), ILCRs are within the U.S. EPA acceptable risk range. Under more conservative assumptions (daily fish consumption over a 30-year period and/or use of

maximum surface water concentrations), ILCRs exceed the U.S. EPA acceptable range. Site chemicals contributing to these risks are pentachlorophenol and arsenic.

Under all fish consumption scenarios, HIs exceeded the acceptable limit of 1.0, indicating that noncarcinogenic effects are possible. Pentachlorophenol, dibenzofuran, arsenic, iron, and manganese were the main contributors to this noncarcinogenic risk.

The HHRA determined that ingestion of surface soil by the construction worker and hypothetical child and adult future resident would result in HIs greater than 1.0. Antimony and iron were the main contributors to this noncarcinogenic risk.

Under other exposure scenarios, ILCRs and HIs were within acceptable ranges.

The baseline HHRA reflects certain uncertainties regarding the true risks associated with Site 1 and SWMU 41. Although this conservative approach is consistent with EPA Presumptive Remedy Guidance, because waste material was not actually sampled the calculated risk could underestimate the actual site risk. The major uncertainty involved the estimation of exposure point concentrations. For some chemicals in surface soil, surface water, and sediment, the distribution of the chemical was not defined and the maximum detected concentration was used as the exposure point concentration. As a result, the estimation of risk, where the maximum concentrations were used as the exposure point concentration, is most likely to be overstated because it is unlikely that potential receptors would be exposed to the maximum concentration over the entire exposure period.

No fish tissue samples were collected during the field investigation; therefore, exposure point concentrations for fish tissue were estimated from surface water and sediment concentrations and bioconcentration factors. Bioconcentration factors only estimate the uptake for chemicals from surface water and sediment and do not consider what happens to the chemical after uptake by fish. Most aquatic animals are able to metabolize PAH, a category of SVOCs, and excrete them rapidly. Consequently, the use of bioconcentration factors to estimate PAHs concentration in fish tissue most likely overestimates the actual PAH concentration in fish tissue and subsequently would represent an overestimation of risk.

2.6.2 Ecological Risk Assessment

An ERA was performed to characterize the potential risks from site-related contaminants to ecological receptors. The ERA was performed using the general approach recommended in U.S. EPA guidance for performing ERAs (U.S. EPA, 1997; 2000a), which served as the basis for the ERA methodology. Furthermore, the ERA was conducted in accordance with Navy policy [Department of the Navy (DON), 1999] and other available guidance documents (Suter, 1993; Calabrese and Baldwin, 1993;

U.S EPA, 1995b; Wentsel et al., 1996; Ingersoll et al., 1997). The methods used in this ecological risk assessment and discussed below were summarized in the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998b). Revisions to the Master Work Plan have been discussed with the MCRD Parris Island partnering team.

For ecological receptors, potential impacts were considered for benthic receptors, soil invertebrates, terrestrial and aquatic plants, terrestrial receptors (short-tailed shrew, cotton mouse, red fox, American woodcock, American robin, and red-tailed hawk), and aquatic receptors (great blue heron, osprey, raccoon, mummichog, and red drum).

Initially, COPCs were determined by comparing the maximum concentrations of detected chemicals in Site 1 surface water, groundwater, and sediment and Site 1 and SWMU 41 surface soil to U.S. EPA Region 4 ecological screening levels. When the HQ (ratio of the maximum concentration to its respective screening level) exceeded 1.0, adverse impacts were considered possible, and the chemical was retained as an ecological COPC. An HQ greater than 1.0 is an indication that ecological receptors are potentially at risk. Additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, especially since most guidelines are conservatively derived.

The initial ecological risk screening determined that the maximum detected concentrations of SVOCs, pesticides, PAHs, PCBs, and several metals exceed U.S. EPA Region 4 screening values. Chemical concentrations greater than these screening values indicate that risks may be present to lower-level ecological receptors (e.g., plants and worms) via direct contact and ingestion of site media or uptake of site chemicals by plants. These chemicals were subsequently retained as ecological COPCs. In addition, several other chemicals were identified as ecological COPCs because of the lack of screening criteria. Table 2-8 presents the chemicals selected as ecological COPCs during this initial screening.

Modeling of contaminant exposure via the food chain was performed to investigate potential risks to representative receptors. All ecological COPCs identified in surface water, sediment, and surface soil were used in the food-chain modeling. Contaminant intake from the ingestion of food and water and incidental ingestion of soil or sediment were estimated, and the resulting intake value was divided by NOAELs and LOAELs to obtain food-chain HQs. The food-chain modeling evaluated 11 upper-food-chain representative receptors and determined that, under a worst-case scenario (organisms constantly exposed to maximum concentrations), three SVOCs, two PAHs, five pesticides, one PCB, and 13 inorganic analytes, of the initial ecological COPCs pose potential risks (chemicals where HQs for NOAELs exceed 1.0). The food-chain modeling found that, under more realistic conditions that consider mean chemical concentrations, the list of chemicals in which the HQs for NOAELs exceed 1.0 was reduced to three pesticides and 10 inorganic analytes. Per the agreed ecological risk assessment

methodology, this analysis produced the list of contaminants of concern (COC). See Table 2-9. See the RI for additional information on determining the COCs from the list of COPCs.

The results of the initial ecological COPC screening process and food chain modeling are detailed in the RI, and indicate that risks may be present to terrestrial (land-based) animals via direct contact with sediment, surface water, and soil and ingestion of soil, sediment, surface water, and prey. Additionally, risks may be present to aquatic (water-based) animals via direct contact with sediment and surface water and ingestion of sediment, surface water, and prey. Risks are also present to terrestrial and aquatic plants, soil invertebrates, and benthic receptors due to direct contact with sediment, prey, surface water, and soil; ingestion of sediment, prey, surface water, soil, and food; and uptake by plants.

Receptor	Hazard Quotients	Exposure Route
Terrestrial and aquatic plants, soil invertebrates, benthic receptors (ecological COPC initial screening).	U.S. EPA Region 4 screening values, HQs for surface water (max = 21.7), sediment (260), surface water (1,760), and groundwater (9.2).	Direct contact with sediment, prey, surface water, and soil; ingestion of sediment, prey, surface water, soil, and food; and uptake by plants.
Aquatic Food-Chain Receptors – Maximum Concentrations - Raccoon - Heron - Mummichog - Red Drum - Osprey	Food-Chain Modeling, Maximum HQs based on NOAELS: 2,601 - Aluminum 83.5 – 4,4'-DDE 4.9 - Mercury 1.7 - Mercury 50.4 - Iron	Direct contact with sediment and surface water; ingestion of sediment, prey, and surface water.
Terrestrial Food-Chain Receptors – Maximum Concentrations - Shrew - Robin - Hawk - Mouse - Fox - Woodcock	Food-Chain Modeling, Maximum HQs based on NOAELS: 352 - Antimony 1,102 - Lead 172 – 4,4'-DDE 816 - Iron 172 - Iron 1,959 - Lead	Direct contact with sediment, surface water, and soil; ingestion of sediment, prey, surface water, soil, and food.

Final COCs for sediment and surface soil are identified in Table 2-9. Table 2-9 is a combination of Tables 3-4 and 3-5 from the Feasibility Study. The FS concluded that groundwater would be addressed through the containment of the fill and waste, surface soil, and sediment, and the implementation of restrictions. The FS concluded that surface water would be similarly addressed. The FS used this rationale to justify development of final COC lists for soil and sediment only, with no COCs established for groundwater.

The Partnering Team used a 'weight of evidence' approach to determine which COPCs would be retained

for further evaluation in the ecological risk assessment. The weight of evidence approach considered such things as number of samples exceeding the ESV, the average HQ, whether compounds biomagnify in the food chain and the potential risk to aquatic and semi-aquatic receptors via the food chain, among other risk management considerations. This process is described in more detail in the RI/RFI.

2.7 RESPONSE ACTION

The response action selected in this ROD is necessary to protect the public health or welfare and the environment from actual or threatened releases of pollutants or contaminants from this site that may present an imminent and substantial endangerment to public health or welfare. In the development of the response action, remedial action objectives (RAOs) were initially generated. Next, remedial alternatives were derived for the purposes of determining how best to achieve those RAOs as well as all federal and state Applicable or Relevant and Appropriate Requirements (ARARs). Lastly, those remedial alternatives were evaluated and compared so that the most appropriate alternative could be selected. This process is discussed in the following sections.

2.7.1 Remedial Action Objectives

Based on the results of the RI/RFI, the following RAOs were developed for protection of human health and the environment at Site 1 and SWMU 41:

- Eliminate contact with landfill contents and impacted surface soils by human and ecological receptors.

- Significantly reduce if not eliminate the migration of COCs from the source material (impacted soil, waste, and fill) to downgradient media (i.e., sediment, surface water, and groundwater).

- Eliminate human exposure (i.e., direct exposure to maintenance worker, future construction worker, future recreational users, and hypothetical future resident) to COCs in sediment at concentrations in excess of remediation levels. Remediation levels take into consideration an ILCR of 1.0E-06 for individual COCs. Additionally, remediation levels take into consideration an HI of 1.0 where noncarcinogenic effects would be expected. Elimination of COCs in sediment will also address human health concerns identified from chemicals detected in surface water.

- Eliminate exposure of ecological receptors to COCs in sediment at concentrations greater than remediation levels. The sediment remediation levels take into account direct contact of COCs by macroinvertebrates and are expected to be protective of upper food-chain receptors. Remediation

levels address risks where only minor effects would be expected by ecological receptors and consider site background concentrations.

Media-specific remediation goals (i.e., cleanup or remediation levels) as required by 40 CFR 300.435(f)(5)(iii)(A) and described in 40 CFR 300.430(e)(2)(i) were established and monitored. The remediation levels are provided in Table 2-9. The remediation levels initially identified during the FS are considered final clean up levels for this action. Remediation goals were developed to account for background concentrations. Sediment and soil remediation goals for the protection of ecological receptors were selected from Region 4 ecological screening values (ESVs) and background concentrations. This approach was taken in lieu of doing a more detailed ecological risk assessment.

2.7.2 Description of Remedial Alternatives

Due to the potential for exposed waste and contaminated soil to migrate to the surface waters and sediment adjacent to the landfill, and based on the RAOs, remedial alternatives were developed and evaluated in the FS/CMS. Modified Alternative 2a is the Preferred Alternative and has been implemented. The following summarizes the remedial alternatives evaluated for selection at Site 1/SWMU 41::

Alternative 1 – No Action. This alternative would have maintained the site at current levels of impact and environmental condition. This alternative was used to provide a baseline for comparison to other alternatives and would not have addressed the wastes that are present or impacted surface soil and sediment. Consequently, there would have been no reduction in toxicity, mobility, or volume of the COCs at Site 1 and SWMU 41 other than that which would result from natural dispersion, dilution, or other attenuating factors.

Alternative 2a – Excavation and Consolidation of Pesticide-and Inorganic-Contaminated Sediment in Excess of Ecological Remediation Levels and Containment of Waste. Alternative 2a consisted of the following components:

- Excavation of sediment with concentrations of pesticides and inorganic chemicals (copper, mercury, and lead) above the remediation levels for ecological receptors and consolidation of the excavated sediment within the limits of a proposed cap system.

- Monitored natural recovery of PAHs for the protection of ecological and human receptors.

- Excavation of waste and sediment/waste materials outside the limits of the proposed cap system and consolidation of the waste within the limits of the proposed cap system.

- Installation and maintenance of a low permeability cap system over the consolidated and regraded waste and sediment.

- Use of slope stabilization and erosion controls.

- Restoration and monitoring of salt marsh area where excavation was performed.

- Implementation of LUCs for the proposed cap, groundwater, and areas of sediment contaminated with arsenic and PAHs.

- Long term monitoring of the groundwater and PAH-contaminated sediments.

Alternative 2a would not include excavation of the sediment located north of the waste material with arsenic concentrations in excess of the remediation levels; however, these arsenic concentrations are within acceptable human health risk ranges under current and future land-use scenarios that exclude residential development in the saltwater marsh. Likewise, these arsenic concentrations were found not to represent a significant threat to ecological receptors.

Capital Costs:	$6,166,000
O&M Costs:	$23,000 to $70,000 per year
30-year present worth:	$6,513,000

<u>Modified Alternative 2a – Excavation and Consolidation of PAH-, Pesticide-, and Inorganic-Contaminated Sediment in Excess of Ecological Remediation Levels and Containment of Waste.</u> Under this preferred alternative (described in detail in Section 1.4), Alternative 2a was modified to include excavation of sediment with PAH concentrations that exceed remediation levels for the protection of human and ecological receptors. Prior to any excavation, additional sediment testing would be performed to determine whether PAH concentrations have attenuated to levels below remediation levels. If the testing determines that PAH concentrations remain above remediation levels, the PAH-contaminated sediment would be excavated and consolidated under the proposed cap system, thereby eliminating the need for long-term sediment PAH monitoring.

Capital Costs:	$6,453,000
O&M Costs:	$21,000 to $70,000 per year

30-year present worth: $6,775,000

Alternative 2b – Excavation and Consolidation of All Contaminated Sediment and Containment of Waste. Alternative 2b included the excavation of all contaminated sediment including the sediment located north of the waste with arsenic concentrations in excess of remediation levels. Alternative 2b consists of the following components:

- Excavation of sediment with concentrations of inorganic chemicals (arsenic, copper, mercury, and lead), pesticides, and PAHs above the remediation levels for the protection of ecological and human receptors and consolidation of the excavated sediments within the limits of the proposed cap.

- Excavation of waste and sediment/waste materials outside the limits of the proposed cap system and consolidation of the waste within the limits of the proposed cap system.

- Installation and maintenance of a low permeability cap system over the consolidated and regraded waste and sediment.

- Use of slope stabilization and erosion controls.

- Restoration and monitoring of salt marsh area where excavation was performed.

- Implementation of LUCs for the proposed cap, groundwater, and areas of sediment contaminated with arsenic and PAHs.

- Long term monitoring of the groundwater and PAH-contaminated sediments.

Capital Costs: $7,069,000
O&M Costs: $21,000 to $70,000 per year
30-year present worth: $7,391,000

Alternative 3 – Excavation and Off-Site Disposal of Waste and Sediment. Alternative 3 would have allowed for the unrestricted use of the site after completion of the remedial actions. Alternative 3 consists of the following components:

- Excavation of all sediment with concentrations of inorganics (including arsenic), pesticides, and PAHs that have concentrations above the remediation levels for ecological and human receptors.

- Excavation of waste and sediment/waste materials associated with the landfill area.

- Transportation and disposal of sediment and waste materials to approved off-site disposal facilities.

- Restoration and monitoring of salt marsh and landfill areas.

Assuming that either 10 or 1 percent of the landfill contents would require hazardous disposal, Alternative 3 costs are estimated as:

Capital Costs	$14,737,000[1]	$13,422,000[2]
O&M Costs:	$0	$0
30-year present worth	$14,737,000[1]	$13,422,000[2]

1. Assumes that 10 percent of the landfill contents would require hazardous disposal.
2. Assumes that 1 percent of the landfill contents would require hazardous disposal.

2.7.3 Summary of Comparative Analysis of Remedial Alternatives

The remedial alternatives under consideration for Site 1 and SWMU 41 were evaluated against the following criteria, in accordance with U.S. EPA guidance (U.S. EPA, 1988):

1. Overall protection of human health and the environment. The purpose of this evaluation criterion is to assess whether each alternative provides adequate protection of human health and the environment. Evaluation of the overall protectiveness of an alternative focuses on whether a specific alternative achieves adequate protection and describes how site risks posed through each pathway being addressed by the FS/CMS are eliminated, reduced, or controlled.

2. Compliance with ARARs. The purpose of this criterion is to assess whether each alternative will meet any identified 'applicable' or 'relevant and appropriate' Federal or more stringent state environmental laws or regulations (i.e., ARARs) as required by CERCLA Section 121(d) or provides a basis for invoking a waiver under CERCLA Section 121(d)(4).

   Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those

state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

3. Long-term effectiveness and permanence. The purpose of this criterion is to ensure protection of human health and the environment in the future, as well as in the near term. In evaluating alternatives for their long-term effectiveness and the degree of permanence they afford, the analysis considers the degree of threat posed by treatment residuals, adequacy and reliability of any controls used to manage wastes remaining at the site, potential impacts on human health and the environment should the remedy fail, and whether the alternative would have the flexibility to address uncontrollable changes at the site.

4. Reductions in toxicity, mobility, or volume through treatment. This criterion addresses the statutory preference for remedies that employ treatment as a principal element by ensuring that the relative performance of the various treatment alternatives in reducing toxicity, mobility, or volume will be assessed. There may be some situations (e.g., large, municipal-type landfills) where achieving substantial reductions in toxicity, mobility, or volume may not be practical or desirable.

5. Short-term effectiveness. This purpose of this criterion is to examine the short-term impacts of the alternatives on the neighboring community, the on-site workers, or the surrounding environment, including the potential threat to human health and the environment associated with excavation, treatment, and transportation of hazardous substances. The time to achieve protection of human health and the environment is also evaluated.

6. Implementability. Implementability considerations include the technical and administrative feasibility of the alternatives, as well as the availability of the goods and services on which the viability of the alternative depends.

7. Cost. Cost encompasses all capital costs and O&M costs incurred over the life of the project. The focus during the detailed analysis is on the net present value of these costs.

8. State acceptance. This criterion, which is an ongoing concern throughout the remediation process, reflects the statutory requirement to provide for substantial and meaningful state involvement.

9. Community acceptance. This criterion refers to the community's comments on the remedial alternatives under consideration, where "community" is broadly defined to include all interested parties.

Overall Protection of Human Health and the Environment

Alternative 3 would provide the most overall protection compared to Alternatives 1, 2a, Modified 2a, and 2b. The complete removal of all sediment, sediment/waste, and waste from the site and its disposal at an appropriate off-site facility would be protective.

Alternatives 2a, Modified 2a, and 2b are equal to one another with respect to the long-term protection of human health and the environment; however, this protection would be achieved in a faster period under Modified Alternative 2a and Alternative 2b (1 year to achieve remediation levels) than Alternative 2a (10 to 20 years to achieve remediation levels). These containment alternatives rely on placing the most contaminated sediment, sediment/waste, and waste within a capped landfill, constructing and maintaining a cap system, and performing long-term O&M**.** LUCSs that prohibit intrusive activityies and inappropriate land uses will protect human health and the environment by preventing exposure to waste materials contained within the landfill and contaminated groundwater beneath the site. Additionally, the LUCs would protect human health by restricting human access to contaminated sediment left to attenuate through monitored natural recovery and by preventing human ingestion of groundwater.

Alternative 2a is somewhat less protective in the short-term than Modified Alternative 2a and Alternative 2b because PAHs in sediment (representing a potential threat to macroinvertebrates and humans) would remain at the site. Also, both Alternatives 2a and Modified 2a leave low levels of arsenic in the site sediment; however, under current and future land uses that exclude residential development of the saltwater marsh, human health risks are within acceptable ranges. Under Alternative 2a, natural attenuation factors, such as biodegradation and dispersion, may require between 10 and 30 years to achieve remediation levels.

Alternative 1 is not protective of human health and the environment. In addition, site risks may increase as waste material continues to erode.

Compliance with ARARs

Alternative 1 would not comply with chemical-specific ARARs.

Alternatives 2a, Modified 2a, and 2b would comply with all chemical-specific ARARs in the long term. With Alternatives 2a, Modified 2a, and 2b, containment would reduce the release of the landfill contents into the groundwater and surrounding sediment and surface water. Alternatives 2a and Modified 2a include partial sediment removal, and Alternative 2b removes all impacted sediment. Alternative 2a relies on monitored natural recovery for the reduction of PAHs within sediment and LUCs for arsenic within sediment. Therefore, Alternative 2b and Modified 2a would comply with the chemical-specific ARARs for organic COCs in a shorter and more effective manner than Alternative 2a.

Alternative 3 would comply with all chemical-specific ARARs.

Alternatives 1, 2a, Modified 2a, 2b, and 3 would comply with all location-specific ARARs; however, the extent to which coastal wetlands would be restored to beneficial use differs under these alternatives. Alternative 1 would not include any coastal wetlands restoration, but would also not include any further intrusion. For alternative 2a, modified alternative 2a, and alternative 2b, the area of wetlands restoration would increase from less to more, respectively. The area of wetlands restoration for alternative 3 would be approximately equal to alternative 2b.

Alternatives 2a, Modified 2a, 2b, and 3 would comply with all action-specific ARARs. Action-specific ARARs are not applicable to Alternative 1.

Long-Term Effectiveness

No controls would be in place to determine whether Alternative 1 would be reliable and effective in the long term.

Alternatives 2a, Modified 2a, and 2b would be equally effective in the long term; however, this protection would be achieved in a faster period under Modified Alternative 2a and Alternative 2b (1 year to achieve remediation levels) than Alternative 2a (10 to 30 years to achieve remediation levels). Under Alternative 2a, potential residual risks would result from human and ecological exposure to sediment containing PAHs; however, monitored natural recovery would reduce the concentrations of these PAHs over the long term (within 10 to 30 years). Alternatives 2a, Modified 2a, and 2b rely on the long-term effectiveness of the cap system. LUCs would be effective in preventing human exposure to remaining contaminants in sediment by preventing residential development. Also, LUCs would effectively prevent human ingestion of groundwater and human contact with waste contained within the landfill. The remaining COCs in

sediment either do not represent significant threat to ecological receptors (e.g., arsenic) or will degrade naturally over time (e.g., PAHs). Approximately 1.5, 1.8, and 3.1 acres of wetlands would be created or restored under Alternatives 2a, Modified 2a, or 2b, respectively.

Alternative 3 provides the most effective long-term remediation option. All impacted sediment, sediment/waste, and waste would be removed from the site. The complete removal would eliminate monitoring and related long-term issues. Approximately 11.4 acres of wetlands would be created or restored under Alternative 3.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternatives 1, Modified 2a, 2b, and 3 would not include treatment technologies. Alternative 2a would include the use of monitored natural recovery for the reduction of PAHs in sediments. These alternatives would not reduce the toxicity or volume of the waste material or sediment COCs other than that which would result from natural dispersion, dilution, or other attenuating factors. Approximately 58,100, 59,000, and 62,100 cubic yards of landfill material and sediment would be contained within the cap systems in Alternatives 2a, Modified 2a, and 2b, respectively. Alternative 3 does not involve any on-site treatment (although an off-site disposal facility may opt to treat this material prior to disposal). Under Alternative 3, approximately 68,100 cubic yards of waste material and sediment would be excavated and disposed at an appropriate off-site facility. Although a statutory preference for treatment exists for CERCLA remedial actions, U.S. EPA's Presumptive Remedy for CERCLA Municipal Landfill Sites is for waste containment because the volume and types of wastes in landfills like Site 1 generally makes treatment impracticable (U.S. EPA, 1993b).

Short-Term Effectiveness

Alternative 1 is ineffective in addressing site concerns over the short term.

Alternatives 2a, Modified 2a, 2b, and 3 would not pose environmentally significant short-term effects to the neighboring off-base community. Under Alternative 3, there would be short-term impacts to traffic conditions because of the 6,000 truckloads of waste material that would be transported off site under this alternative.

Under Alternatives 2a, Modified 2a, 2b, and 3, 2 to 5 acres of wetlands in the vicinity of landfill would be affected but then returned to natural conditions. Additionally, aquatic receptors that inhabit the area of impacted sediment would be subject to short-term effects resulting from excavation or covering; however, these areas would be expected to re-establish to natural conditions after implementation.

The RAOs would be achieved in approximately 1 year under Alternatives Modified 2a, 2b, and 3. RAOs may take 10 to 30 years to be achieved under Alternative 2a.

Health and safety training and proper use of personal protection equipment would minimize any effects to site workers during implementation of these alternatives.

Implementability

The implementation of Alternatives 2a, Modified 2a, 2b, and 3 is technically and administratively feasible. MCRD Parris Island is an active military installation; therefore, LUCs at Site 1 and SWMU 41 are easily implementable and enforceable. This evaluation criterion is not applicable to Alternative 1.

Cost

The costs of the alternatives (including LUCs) are shown in the following table.

Alternative	Capital ($)	O&M ($/year)	30-Year Present Worth ($)(1)
1	0	0	0
2a	6,166,000	23,000 to 70,000	6,513,000
Modified 2a	6,453,000	21,000 to 70,000	6,775,000
2b	7,069,000	21,000 to 70,000	7,391,000
3(2)	14,737,000	0	14,737,000
3(3)	13,422,000	0	13,422,000

1 Calculated using a 7 percent discount rate.
2 Assumes 10 percent of the landfill's contents are hazardous.
3 Assumes 1 percent of the landfill's contents are hazardous.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an explanation of significant differences, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost.

A detailed breakdown of costs of the preferred alternative is provided in Appendix B.

State and Community Acceptance

The U.S. EPA guidance also requires that the remedial alternatives be evaluated for regulatory acceptance and public acceptance. These evaluations were addressed through the release of the Site 1

and SWMU 41 Proposed Plan on January 31, 2002 and the 60-day public comment period, which ended on April 2, 2002. A summary of the comments received is included in the Responsiveness Summary, Appendix A.

2.8 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that the treatment will be used to address the principal threats posed by a site wherever practicable [40 CFR 300.430(a)(1)(iii)(A)]. The source materials constituting principal threats at the site are the incinerated wastes that were disposed at the site from 1921 to 1959 and the non-combusted wastes disposed at the site from 1959 to 1965. However, the selected remedy does not satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element because treatment of wastes found at the site was deemed to be impractical. Instead, it was determined that a presumptive remedy approach providing for waste containment was more appropriate and adequately protective.

2.9 SELECTED REMEDY

Summary of the Rationale for the Selected Remedy

The selected remedy is Modified Alternative 2a. Illustrations of the selected remedy are presented in Figures 2-8 and 2-9. This alternative was selected because it satisfies the NCP's threshold criteria for overall protection of human health and the environment and for compliance with all ARARs. It satisfies four of the five NCP's primary balancing criteria including those for short and long term effectiveness, implementability and cost reasonableness. Although it will not satisfy the NCP's primary balancing criteria for the reduction of toxicity, mobility or volume through treatment, it is consistent with EPA's presumptive remedy guidance for municipal landfills which contemplates the leaving of wastes in place with appropriate oversight. It also satisfies the NCP's modifying criteria for State and community acceptance of the remedy. The most significant trade-off associated with the selection of Modified Alternative 2a is that long term monitoring and LUCs will be required along with their associated costs and resulting limitations on potential future land use(s). The physical construction of the remedy is complete, however the LUC remedial design must still be developed. See the LUC section below for LUC design information, The specific components of the selected remedy are as follows:

Description of the Selected Remedy

<u>Sediment and Waste Excavation</u>: Contaminated sediment has been excavated and consolidated within the limits of a proposed landfill cap system. Areas excavated are shown on Figure 2-8. This sediment

consisted of sediment containing concentrations of inorganic chemicals (copper, mercury, and lead), PAHs, and pesticides above the cleanup goals, or remediation levels, for protection of human health and ecological receptors. Additional testing was performed and confirmed that no PAH-contaminated sediment remained

Sediment excavated did not include the arsenic concentrations in sediment north of the waste materials that were detected above remediation levels. Under current and future land-use scenarios that exclude residential development in the saltwater marsh, the arsenic concentrations are within acceptable risk ranges. Likewise, the arsenic concentrations were not determined to pose a significant threat to ecological receptors. Waste material (e.g., glass, ash) located outside the limits of the proposed cap system was also excavated and consolidated within the limits of the cap. However, at one single location, inorganic contamination (lead, copper, and mercury) did remain slightly in excess of remediation levels, and this will be addressed through long term monitoring.

Low-Permeability Cap System Installation: A low-permeability cap system that meets or exceeds the requirements of the federal and state solid waste and hazardous waste landfill closure requirements was placed above approximately 6.3 acres of consolidated and graded waste and contaminated sediment materials. All excavated waste was consolidated above the mean high tide level.

Slope Stabilization and Erosion Control: Slope stabilization and erosion control measures was implemented along the toe and sideslopes of the landfill cap system to minimize the potential for failure of the sideslopes and to reduce the erosion rate of the cover due to surface water runoff, waves, and/or wind.

Salt Marsh Restoration and Monitoring: Excavated areas were restored by filling in the excavation area with sand and then vegetating the area with local native vegetation (e.g., cordgrass). The sediment in the area was temporarily stabilized to minimize erosion and then the vegetation and sediment continue being re-evaluated to assess whether the response action remains sufficiently protective.

Maintenance of the Cap System: Maintenance of the cap system and any existing or future monitoring and remediation system, including groundwater monitoring wells, is also part of the action. Maintenance of the cap includes routine mowing of grass and removal of trees or shrubs with root systems that could impact the liner system. The mowing of grass will occur in conjunction with lawn care across other parts of the Depot. Tree and shrub removal will occur at least annually, in conjunction with the cover inspection as part of a long term monitoring program. These cap maintenance activities are expected to be performed for at least 30 years.

Land Use Controls: Land Use Controls (LUCs) consisting of both Engineering Controls (ECs) and Institutional Controls (ICs) will be implemented to preclude unacceptable future human health and/or ecological risks from exposure(s) to chemicals of concern (COCs) at the Site. The Land Use Controls will be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and unlimited exposure. Consistent with the RAOs developed during the RI/RFI, the specific performance objectives for the LUCs to be implemented at Site 1 are as follows:

- To prohibit unauthorized excavation, construction or intrusive activities;
- To prohibit residential development of the Site. Prohibited uses shall include, but are not limited to any form of housing, child-care facilities, pre-schools, elementary and secondary schools, or playgrounds; and
- To prohibit the extraction or any use of the groundwater beneath at the Site.

The following generally describes those LUCs which will be implemented at Site 1 in order to achieve the aforementioned LUC performance objectives:

Engineering Control:

- A sign will be posted on the landward side of Site 1 advising that any excavation, construction, or intrusive activity within the landfill is prohibited unless authorized in advance by the MCRD environmental department. The size, location and the language to appear on the sign will be agreed upon by MCRD, USEPA and SCDHEC as part of the LUC remedial design;

Institutional Controls:

- The Site 1 location and LUC boundaries, prohibitions against unauthorized excavation, construction or intrusive activities, residential development and groundwater extraction or use, and the requirement for MCRD environmental department approval of any site excavation, construction, or intrusive activity will be annotated in the installation's Master Plan.

- The Site 1 location and LUC boundaries, prohibitions against unauthorized excavation, construction or intrusive activities, residential development and groundwater extraction or use, and the requirement for MCRD environmental department approval of any site excavation, construction or intrusive activity will be annotated in the installation's geographical information system, (GIS).

- The Site 1 location and LUC boundaries, prohibitions against unauthorized excavation, construction or intrusive activities, residential development or groundwater extraction or use, and the requirement for MCRD environmental department approval of any site excavation, construction or intrusive activity will be annotated in the installation's Environmental Management System. The environmental management system is a centralized tool for the dissemination of information critical to making appropriate decisions regarding the management of resources, compliance with environmental regulations and ensuring that site-specific use limitations are complied with.

- Site 1 LUCs will be included in a Depot Order currently under development governing ground disturbing activities across the facility.

The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. A LUC remedial design, as part of the Final Remedial Design or document memorializing Remedial Action Completion, (primary documents under the FFA), that addresses how these LUCs will be implemented, maintained, monitored (including periodic inspections), enforced and reported on, will be prepared and submitted by the Navy per the approved Site Management Plan (SMP) schedule to EPA and SC DHEC for review and approval. Once the Final Remedial Design or document memorializing Remedial Action Completion, (including the LUC remedial design) is approved by EPA, it shall supersede any Land Use Control Implementation Plan already developed for Site 1, as well as any conditions related to Site 1 LUCs in the LUC Memorandum of Agreement (also termed the Land Use Control Assurance Plan) executed between the Navy, U.S. EPA and SCDHEC.

Long-Term Monitoring: Long term monitoring of groundwater and sediment will be conducted in accordance with the Long Term Monitoring Work Plan for Site 1 once finalized and approved. Monitoring results will be compared against appropriate criteria identified and agreed to in the LTM WP. A re-evaluation of the site will be performed every five years to determine whether changes to the LUCs implemented, site monitoring, and/or remedial action will be required.

Summary of Estimated Remedy Costs

The capital cost for the selected remedy is approximately six and one half million dollars ($6.5M). The annual O&M cost is anticipated to range from twenty one thousand to seventy thousand dollars ($21,000 - $70,000). Total 30-year net present worth is approximately six million seven hundred seventy five

thousand dollars ($6.775M), assuming a discount rate of seven percent. Changes in this cost estimate occurred as a result of data collected during the engineering and construction of the remedial alternative. A detailed breakdown of estimated costs is provided in Appendix B. The cost estimate is expected to be within +50% to -30% of the actual project cost.

Expected Outcomes of the Selected Remedy

The anticipated future land use is undeveloped property. There is also no anticipated future groundwater use, due to high levels of dissolved solids and salinity.

The expected outcome of the selected remedial action, which has now been completed, is that remedial action objectives will be achieved because:

- Contact with landfill contents and impacted surface soils by human and ecological receptors is effectively eliminated.
- Migration of COCs from the source material to downgradient material is reduced.
- Human exposure to COCs in sediment concentrations in excess of remediation goals is effectively eliminated.
- Exposure of ecological receptors to COCs in sediment concentrations in excess of remediation goals is effectively eliminated.

Currently, wetlands restoration remains in progress as an initial restoration effort was unsuccessful, potentially due to inadequate revegetation establishment. Robust landfill O&M provisions are being set in place to ensure long-term protectiveness.

The final cleanup levels for sediment and soil are identified in Table 2-9.

The quality of the coastal marsh adjacent to the landfill is anticipated to improve immediately upon revegetation based on the habitat improvement fostered by removal of visible trash and debris.

Expected Outcomes for the Selected Remedy	
Site Scenario	Exposure controlled through excavation and consolidation beneath a low permeability cap, and institutional controls to ensure long-term protectiveness.
Expected Outcomes	**Land:** Contact with landfill contents and impacted surface soils by human and ecological receptors is effectively eliminated. Land will be unavailable for reuse in order to protect the landfill cap. **Marsh:** Human exposure to COCs in sediment concentrations in excess of remediation goals is effectively eliminated. Exposure of ecological receptors to COCs in sediment concentrations in excess of remediation goals is effectively eliminated. The marsh is available for reuse (as a marsh) following the excavation of debris and revegetation. **Groundwater:** Groundwater will remain unsuitable for use because of elevated salinity and dissolved solids levels unrelated to contamination. **Anticipated Socio-economic and Community Revitalization Impacts:** No socio-economic or community revitalization impacts are anticipated. The site will remain as it was, undeveloped land on an otherwise active military facility. **Anticipated Environmental and Ecological Benefits:** 1.8 acres of marshland is restored.

2.10 STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP, the lead agency (Navy) and EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

Protection of Human Health and the Environment: This remedial action is protective of human health and the environment because

- Human and ecological contact with waste and contaminated soil is effectively eliminated through consolidation of this material under the landfill cap.

- The migration of COCs contained in media consolidated under the cap is effectively reduced if not eliminated.

- Human exposure to COCs in sediment is effectively eliminated via consolidation of media under the cap and implementation of LUCs.

- Exposure of ecological receptors to sediment with concentrations of pesticides, PAHs, and inorganics above remediation levels is effectively eliminated via the consolidation of this material under the landfill cap.

Compliance with ARARS: This action also complies with those federal and state requirements that are applicable or relevant and appropriate for this remedial action. See Table 2-10 and Table 2-11. Of note, the SCDHEC solid waste landfill closure requirements and coastal zone management requirements were significant.

CERCLA Section 121(d), specifies in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs) to the hazardous substances or particular circumstances at a site or obtain a waiver [see also 40 *Code of Federal Regulations (CFR)* 300.430(f)(1)(ii)(B)]. Applicable or relevant and appropriate requirement (ARARs) include only federal and state environmental or facility siting laws/regulations and do not include occupational safety or worker protection requirements. In addition, per 40 *CFR* 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (so-called To-Be-Considered [TBC] guidance category).

In accordance with 40 *CFR* 300.400(g), the Navy, SCDHEC, and EPA have identified the specific ARARs and TBC for the selected remedy. The selected remedy complies with all ARARs/TBCs directly related to implementing the selected actions. Tables 2-10 and 2-11 list the Chemical-specific, Location-specific, and Action-specific ARARs, as well as the TBC, for the selected remedy.

Cost Effectiveness: In the lead agency's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: 'A remedy shall be cost-effective if its costs are proportional to its overall effectiveness.' (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant).

Utilization of Permanent Solutions and Alternative Treatment Technologies: This action does not satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element because treatment of wastes found at the site was deemed to be impractical. Instead, it was determined that a presumptive remedy approach providing for waste containment was more appropriate and adequately protective.

Preference for Treatment as a Principal Element: This action does not satisfy the statutory preference for remedies that employ treatment as a principal element because treatment of wastes found at the site was deemed to be impractical. Instead, it was determined that a presumptive remedy approach providing for waste containment was more appropriate and adequately protective.

Although not a remedy component, but because this remedy resulted in wastes remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review (CERCLA Five Year Review) was conducted in September 2005, and will be repeated every five years to ensure that the remedy is, or will be, protective of human health and the environment.

2.11 EXPLANATION OF SIGNIFICANT CHANGES

CERCLA Section 117(b) requires an explanation for any significant changes to the selected remedy presented in the Proposed Plan that was published for public comment. In this ROD there are no significant changes to the selected remedy reflected in the Proposed Plan.

TABLE 2-1

SUMMARY STATISTICS - SURFACE SOIL
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average of Positive Detects	Average All	Background Level	Maximum Level Exceed Background
Volatile Organics (mg/kg)								
Toluene	1/10	0.003	0.006 - 0.009	PAI-01-SS-05-01	0.003	0.0035	NA	NA
Semivolatile Organics (mg/kg)								
1,2,4-Trichlorobenzene	1/10	0.14	0.34 - 0.53	PAI-01-SS-07-01	0.14	0.19	NA	NA
2-Methylnaphthalene	1/10	0.13	0.34 - 0.53	PAI-01-SS-07-01	0.13	0.19	NA	NA
Anthracene	5/10	0.012 - 0.035	0.0085 - 0.088	PAI-01-SS-09-01	0.022	0.015	NA	NA
Benzo(a)anthracene	10/10	0.011 - 0.28	NA(1)	PAI-01-SS-07-01	0.099	0.091	NA	NA
Benzo(a)pyrene	10/10	0.02 - 0.31	NA(1)	PAI-01-SS-07-01	0.12	0.11	NA	NA
Benzo(b)fluoranthene	10/10	0.02 - 0.51	NA(1)	PAI-01-SS-07-01	0.14	0.13	NA	NA
Benzo(g,h,i)perylene	7/10	0.038 - 0.21	0.034 - 0.081	PAI-01-SS-07-01	0.12	0.077	NA	NA
Benzo(k)fluoranthene	10/10	0.011 - 0.16	NA(1)	PAI-01-SS-07-01	0.054	0.046	NA	NA
Bis(2-Ethylhexyl)phthalate	4/10	0.06 - 5.6	0.36 - 0.53	PAI-01-SS-12-01	1.45	0.71	NA	NA
Butylbenzyl Phthalate	1/10	2	0.34 - 0.53	PAI-01-SS-12-01	2	0.38	NA	NA
Carbazole	5/10	0.26 - 0.49	0.36 - 0.4	PAI-01-SS-14-01-AVG	0.40	0.30	NA	NA
Chrysene	10/10	0.019 - 0.33	NA(1)	PAI-01-SS-07-01	0.12	0.11	NA	NA
Di-n-butyl phthalate	1/10	0.072	0.34 - 0.53	PAI-01-SS-12-01	0.072	0.18	NA	NA
Di-n-octyl phthalate	1/10	6.4	0.34 - 0.53	PAI-01-SS-12-01	6.4	0.82	NA	NA
Dibenzofuran	3/10	0.17 - 0.2	0.34 - 0.53	PAI-01-SS-14-01-AVG	0.18	0.20	NA	NA
Fluoranthene	10/10	0.033 - 0.63	NA(1)	PAI-01-SS-07-01	0.20	0.18	NA	NA
Fluorene	1/10	0.095	0.042 - 0.44	PAI-01-SS-05-01	0.095	0.054	NA	NA
Indeno(1,2,3-cd)pyrene	8/10	0.18 - 0.23	0.025 - 0.047	PAI-01-SS-07-01	0.092	0.079	NA	NA
Phenanthrene	9/10	0.021 - 0.18	0.037	PAI-01-SS-06-01	0.10	0.089	NA	NA
Pyrene	9/10	0.030 - 0.51	0.094	PAI-01-SS-07-01	0.17	0.14	NA	NA
Pesticides/PCBs (mg/kg)								
4,4'-DDD	8/10	0.0021 - 0.18	0.0094 - 0.01	PAI-01-SS-07-01	0.043	0.030	NA	NA
4,4'-DDE	10/10	0.0038 - 4.2	NA(1)	PAI-01-SS-07-01	0.45	0.45	NA	NA
4,4'-DDT	10/10	0.0021 - 4.4	NA(1)	PAI-01-SS-07-01	0.44	0.44	NA	NA
Alpha-Chlordane	2/10	0.0095 - 0.018	0.0009 - 0.005	PAI-01-SS-07-01	0.014	0.004	NA	NA
Aroclor-1260	3/10	0.021 - 0.08	0.0094 - 0.088	PAI-01-SS-09-01	0.046	0.023	NA	NA
Endrin Ketone	1/10	0.012	0.0017 - 0.01	PAI-01-SS-07-01	0.012	0.0033	NA	NA
Gamma-Chlordane	1/10	0.006	0.0009 - 0.005	PAI-01-SS-09-01	0.007	0.0021	NA	NA
alpha-BHC	2/10	0.0037 - 0.042	0.0009 - 0.005	PAI-01-SS-07-01	0.023	0.0048	NA	NA
beta-BHC	2/9	0.0089 - 0.033	0.0009 - 0.005	PAI-01-SS-07-01	0.021	0.0049	NA	NA
delta-BHC	1/10	0.045	0.0009 - 0.005	PAI-01-SS-07-01	0.045	0.0049	NA	NA
gamma-BHC (Lindane)	1/10	0.075	0.0009 - 0.005	PAI-01-SS-07-01	0.075	0.0074	NA	NA

TABLE 2-1

SUMMARY STATISTICS - SURFACE SOIL
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average of Positive Detects	Average All	Background Level	Maximum Level Exceed Background
Inorganics (mg/kg)								
Aluminum	10/10	3880 - 8610	NA(1)	PAI-01-SS-08-01	6085.5	6085.5	7270	Yes
Antimony	9/10	0.1875 - 90.6	0.15	PAI-01-SS-09-01	10.84	9.76	ND	Yes
Arsenic	10/10	0.58 - 24.9	NA(1)	PAI-01-SS-09-01	5.237	5.24	1.4	Yes
Barium	10/10	15.2 - 178	NA(1)	PAI-01-SS-08-01	74.45	74.45	24	Yes
Cadmium	10/10	0.1 - 5.4	NA(1)	PAI-01-SS-08-01	1.13	1.13	ND	Yes
Calcium	10/10	420 - 13100	NA(1)	PAI-01-SS-05-01	3440.65	3440.65	766	Yes
Chromium	10/10	7 - 53.2	NA(1)	PAI-01-SS-08-01	16.57	16.57	6.2	Yes
Cobalt	10/10	0.33 - 13.7	NA(1)	PAI-01-SS-08-01	2.86	2.86	0.36	Yes
Copper	10/10	6.5 - 131	NA(1)	PAI-01-SS-08-01	48.26	48.26	1.5	Yes
Cyanide	2/10	0.73 - 0.86	0.42 - 0.61	PAI-01-SS-08-01	0.795	0.36	ND	Yes
Iron	10/10	2560 - 147000	NA(1)	PAI-01-SS-08-01	24992.5	24992.50	3920	Yes
Lead	10/10	58.4 - 8380	NA(1)	PAI-01-SS-09-01	1129.9	1129.90	12.5	Yes
Magnesium	10/10	233 - 1280	NA(1)	PAI-01-SS-06-01	695.5	695.50	515	Yes
Manganese	10/10	17.4 - 752	NA(1)	PAI-01-SS-08-01	149.95	149.95	129	Yes
Mercury	10/10	0.04 - 1.1	NA(1)	PAI-01-SS-07-01	0.25	0.25	0.11	Yes
Nickel	10/10	1.8 - 47.8	NA(1)	PAI-01-SS-08-01	9.63	9.63	1.8	Yes
Potassium	10/10	190 - 692	NA(1)	PAI-01-SS-05-01	473.45	473.45	313	Yes
Selenium	5/10	0.18 - 0.73	0.17 - 0.2	PAI-01-SS-05-01	0.36	0.22	0.29	Yes
Silver	5/10	0.48 - 2.4	0.06 - 0.44	PAI-01-SS-09-01	1.39	0.74	ND	Yes
Sodium	10/10	68 - 3530	NA(1)	PAI-01-SS-06-01	1288.4	1288.40	241	Yes
Vanadium	10/10	5.7 - 47.4	NA(1)	PAI-01-SS-09-01	14.25	14.25	9.5	Yes
Zinc	10/10	45.65 - 497	NA(1)	PAI-01-SS-08-01	220.17	220.17	9.7	Yes
Miscellaneous Parameters (mg/kg)								
Ph	5/5	6.3 - 7.7	NA(1)	PAI-01-SB-05-04	7.16	7.16	NA	NA
Total Organic Carbon (%)	5/5	0.98 - 2.5	NA(1)	-01-SB-05-04/PAI-01-SB-03	1.90	1.90	NA	NA

NA = Not Applicable
ND = Not Detected
1 A range of non detect values was not determined for chemicals in which the chemical was detected in all samples tested.

TABLE 2-2

SUMMARY STATISTICS - GROUNDWATER
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Detect	Average of Positive Detects	Average All
Volatile Organics (ug/L)						
2-Butanone	1/1	3.4	0	PAI-01-GW-10-01	3.4	3.4
Acetone	4/4	1.4 - 13	0	PAI-01-GW-14-01	6.5	6.5
Carbon Disulfide	6/11	0.7 - 16	1	PAI-01-GW-14-01	5.9	3.5
Chloroform	3/11	0.3 - 0.9	1	PAI-01-GW-14-01	0.53	0.51
Ethylbenzene	1/11	0.2	1	PAI-01-GW-10-01	0.20	0.47
Toluene	3/11	0.5 - 2	1	PAI-01-GW-07-01	1	0.64
Xylenes, Total	2/11	1.4 - 2	1	PAI-01-GW-09-01	1.7	0.72
Semivolatile Organics (ug/L)						
1,2-Dichlorobenzene	1/11	3	5 - 6	PAI-01-GW-05-01	3	2.6
2,4-Dimethylphenol	2/11	2 - 5	5 - 6	PAI-01-GW-09-01	3.5	2.8
2-Methylnaphthalene	1/11	7	5 - 6	PAI-01-GW-10-01	7	3.0
2-Methylphenol	1/11	1	5 - 6	PAI-01-GW-10-01	1	2.5
Acenaphthene	2/11	1 - 7	5 - 6	PAI-01-GW-10-01	4	2.9
Anthracene	2/11	1	5 - 6	PAI-01-GW-10-01/PAI-01-GW-13-01	1	2.4
Bis(2-Ethylhexyl)phthalate	3/11	1	5 - 10	PAI-01-GW-08-01/PAI-01-GW-10-01/GW-07-01	1	2.5
Carbazole	1/10	2	5 - 6	PAI-01-GW-13-01	2	2.6
Di-n-butyl phthalate	7/11	1	5 - 6	PAI-01-GW-12-01/12-01/10-01/09-01/-06-01/11-01-AVG/07-01	1	1.6
Di-n-octyl phthalate	1/11	7	5 - 6	PAI1-GW4-01	7	3.0
Dibenzofuran	2/11	1 - 3	5 - 6	PAI-01-GW-10-01	2	2.5
Diethyl Phthalate	4/11	1	5 - 6	PAI-01-GW-10-01/06-01/-08-01/-09-01	1	2.0
Fluoranthene	2/11	1	5 - 6	PAI-01-GW-13-01/-10-01	1	2.4
Fluorene	2/11	1 - 6	5 - 6	PAI-01-GW-10-01	3.5	2.8
Naphthalene	4/11	1 - 57	5 - 6	PAI-01-GW-10-01	16	7.6
Phenanthrene	4/11	1 - 8	5 - 6	PAI-01-GW-10-01	2.8	2.7
Pyrene	2/11	1	5 - 6	PAI-01-GW-10-01/-13-01	1	2.4
Inorganics (ug/L)						
Aluminum	5/10	23.3 - 3970	22 - 27	PAI1-GW4-01	850	431
Arsenic	6/11	1.15 - 4.4	1.1 - 2.2	PAI-01-GW-09-01	2.3	1.7
Barium	11/11	16.2 - 1030	NA	PAI-01-GW-07-01	424	424
Beryllium	5/11	0.2 - 0.7	0.2 - 0.7	PAI-01-GW-09-01	0.36	0.25
Calcium	10/10	67200 - 494000	NA	PAI-01-GW-09-01	239430	239430
Chromium	9/11	6.4 - 18.4	6.4	PAI-01-GW-09-01	13	11
Copper	4/11	2.55 - 7.8	2.1 - 3.7	PAI-01-GW-05-01	4.8	2.6
Iron	7/10	259 - 12700	8.6 - 84.6	PAI-01-GW-06-01	4311	3023
Lead	10/11	0.5 - 34.7	0.9	PAI-01-GW-09-01	13	11
Magnesium	10/10	9650 - 1180000	NA	PAI-01-GW-09-01	627615	627615
Manganese	7/10	40.3 - 1320	13.7 - 96.6	PAI-01-GW-05-01	306	224
Potassium	10/10	6980 - 477000	NA	PAI-01-GW-09-01	242198	242198

TABLE 2-2

SUMMARY STATISTICS - GROUNDWATER
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Detect	Average of Positive Detects	Average All
Sodium	10/10	19400 - 10100000	NA	PAI-01-GW-09-01	5476940	5476940
Vanadium	8/11	3.1 - 32.6	6.3 - 8.8	PAI-01-GW-09-01	9.6	8.0
Zinc	10/11	4.6 - 16.9	4.3	PAI-01-GW-05-01	9.8	9.1
Inorganics, Filtered (ug/L)						
Aluminum, Filtered	1/11	44.4	22 - 27	PAI1-GW4-01-F	44	15
Arsenic, Filtered	4/11	1.3 - 4	1.1 - 2.2	PAI-01-GW-09-01-F	2.6	1.4
Barium, Filtered	11/11	252 - 1230	NA	PAI-01-GW-10-01-F	630	630
Beryllium, Filtered	6/11	0.15 - 0.3	0.2 - 0.5	PAI-01-GW-05-01-F	0.21	0.19
Cadmium, Filtered	4/11	1.7 - 2.7	1.4 - 2	PAI-01-GW-12-01-F	2.2	1.4
Calcium, Filtered	11/11	62400 - 462000	NA	PAI-01-GW-09-01-F	240373	240373
Chromium, Filtered	8/11	7.1 - 26.9	6.4	PAI-01-GW-09-01-F	15	11
Copper, Filtered	4/11	3.05 - 4.6	2.1 - 2.6	PAI-01-GW-09-01-F	3.5	2.0
Iron, Filtered	7/11	114 - 13300	10.7 - 112	PAI-01-GW-06-01-F	3677	2348
Lead, Filtered	10/11	0.9 - 36.4	0.9	PAI-01-GW-09-01-F	12	11
Magnesium, Filtered	11/11	9430 - 1140000	NA	PAI-01-GW-09-01-F	638312	638312
Manganese, Filtered	9/11	14 - 1300	72.7 - 89.4	PAI-01-GW-05-01-F	247	210
Mercury, Filtered	1/11	0.23	0.2	PAI-01-GW-05-01-F	0.23	0.11
Potassium, Filtered	11/11	6740 - 440000	NA	PAI-01-GW-09-01-F	238613	238613
Sodium, Filtered	11/11	23000 - 9940000	NA	PAI-01-GW-09-01-F	5459818	5459818
Thallium, Filtered	1/11	3.1	2 - 20	PAI-01-GW-08-01-F	3.1	4.6
Vanadium, Filtered	7/11	2.8 - 27.8	2.6 - 9.8	PAI-01-GW-09-01-F	9.4	7.2
Zinc, Filtered	11/11	16.7 - 112	NA	PAI-01-GW-06-01-F	55	55
Miscellaneous Parameters (mg/L)						
Chloride	11/11	28 - 20000	NA	PAI-01-GW-09-01	10493	10493
Fluoride	5/11	11 - 155	2 - 20	PAI-01-GW-11-01-AVG	47.2	26
Hardness As Caco3	10/10	200 - 6300	NA	PAI-01-GW-09-01	3444	3444
Nitrate/nitrite, As Nitrogen	8/11	0.01 - 0.06	0.01 - 0.03	PAI1-GW4-01	0.033	0.027
Sulfate	11/11	24 - 1500	NA	PAI-01-GW-06-01	728	728
Sulfide	1/1	16	NA	PAI-01-GW-10-01	16	16
Total Dissolved Solids	11/11	290 - 35000	NA	PAI-01-GW-09-01	17908	17908
Total Organic Carbon	11/11	4 - 45	NA	PAI-01-GW-09-01	15	15
Total Suspended Solids	11/11	17 - 270	NA	PAI-01-GW-10-01	79	79
Miscellaneous Parameters (pg/L)						
2,3,7,8 TCDD Equivalents	1/1	0.0105	NA	PAI-01-GW-09(S)-02	0.0105	0.0105

NA = Not Applicable

TABLE 2-3

SUMMARY STATISTICS - SURFACE WATER
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Detect	Average of Positive	Average All	Background	Maximum Level Exceed Background
Volatile Organics (ug/L)								
Acetone	1/2	7	2	PAI-01-SW-09-00	7	4	NA	NA
Semivolatile Organics (ug/L)								
2-Methylnaphthalene	1/8	10	10 - 11.5	PAI-01-SW-03-00	10	5.8	NA	NA
Bis(2-Ethylhexyl)phthalate	3/8	14 - 56	10 - 11.5	PAI-01-SW-03-00	31	15	45	Yes
Chrysene	1/8	0.1	0.12 - 0.24	PAI-01-SW-10-00	0.1	0.075	NA	NA
Dibenzofuran	1/8	10	10 - 11.5	PAI-01-SW-03-00	10	5.8	NA	NA
Fluoranthene	1/8	0.082	0.12 - 0.27	PAI-01-SW-04-00	0.082	0.082	NA	NA
Pentachlorophenol	1/8	110	48 - 57	PAI-01-SW-03-00	110	36	NA	NA
Phenol	1/8	3	10 - 11.5	PAI-01-SW-11-00	3	4.9	NA	NA
Inorganics (ug/L)								
Aluminum	6/8	434 - 13435	262 - 309	PAI-01-SW-01-00-AVG	5062	3832	3113	Yes
Arsenic	1/8	13.9	2 - 8.3	PAI-01-SW-10-00	14	3.0	5.1	Yes
Barium	8/8	12.6 - 37.15	0	PAI-01-SW-01-00-AVG	20	20	38	No
Cadmium	2/8	0.305 - 0.42	0.3	PAI-01-SW-01-00-AVG	0.36	0.20	ND	Yes
Calcium	8/8	228000 - 290000	0	PAI-01-SW-12-00	257438	257438	637000	No
Chromium	2/8	14.1 - 19.2	0.7 - 0.8	PAI-01-SW-10-00	17	4.4	23	No
Cobalt	2/8	1.755 - 2.9	0.4 - 0.6	PAI-01-SW-10-00	2.3	1	ND	Yes
Copper	2/8	13.6 - 62.95	1.4 - 9	PAI-01-SW-01-00-AVG	38	11	7.0	Yes
Iron	8/8	175 - 15600	0	PAI-01-SW-10-00	3405	3405	2091	Yes
Lead	2/8	20.9 - 77.5	1 - 17	PAI-01-SW-01-00-AVG	49	15	ND	Yes
Magnesium	8/8	693000 - 883000	0	PAI-01-SW-12-00	783438	783438	1918667	No
Manganese	8/8	21.65 - 124	0	PAI-01-SW-10-00	58	58	53	Yes
Mercury	2/8	0.09 - 0.12	0.1 - 0.12	PAI-01-SW-10-00	0.11	0.065	ND	Yes
Nickel	2/8	3.85 - 5	0.6 - 1	PAI-01-SW-10-00	4.4	1.4	ND	Yes
Potassium	8/8	342500 - 492000	0	PAI-01-SW-12-00	435438	435438	831333	No
Silver	1/8	0.89	0.6 - 0.7	PAI-01-SW-11-00	0.89	0.39	ND	Yes
Sodium	8/8	5710000 - 7440000	0	PAI-01-SW-01-00-AVG	6541250	6541250	16226667	No
Vanadium	2/8	24.2 - 36.1	0.5 - 4.1	PAI-01-SW-10-00	30	8.1	18	Yes
Zinc	4/8	7.3 - 51.025	5 - 28.25	PAI-01-SW-01-00-AVG	29	18	11	Yes

TABLE 2-3

SUMMARY STATISTICS - SURFACE WATER
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Detect	Average of Positive	Average All	Background	Maximum Level Exceed Background
Inorganics, Filtered (ug/L)								
Antimony, Filtered	1/8	2.075	1.7 - 2.2	PAI-01-SW-01-00-F-AVG	2.1	1.1	ND	Yes
Barium, Filtered	8/8	34.9 - 263	0	PAI-01-SW-12-00-F	189	189	256	Yes
Calcium, Filtered	8/8	225000 - 287000	0	PAI-01-SW-12-00-F	252563	252563	650,000	No
Magnesium, Filtered	8/8	702500 - 873000	0	PAI-01-SW-12-00-F	769063	769063	1,900,000	No
Manganese, Filtered	7/8	11 - 43.8	14.05	PAI-01-SW-01-00-F-AVG	33	30	18	Yes
Potassium, Filtered	8/8	333000 - 487000	0	PAI-01-SW-03-00-F	441875	441875	890,000	No
Sodium, Filtered	8/8	5860000 - 7595000	0	PAI-01-SW-01-00-F-AVG	6503750	6503750	15,900,000	No
Zinc, Filtered	6/8	51.4 - 96.4	14.45 - 36.7	PAI-01-SW-12-00-F	66	53	66	Yes
Miscellaneous Parameters (mg/L)								
Hardness As Caco3	8/8	3430- 4360	0	PAI-01-SW-12-00	3870	3870	NA	NA
pH	8/8	7.2 - 8.3	0	PAI-01-SW-10-00	7.7	7.7	NA	NA
Salinity	8/8	18.7 - 23.4	0	PAI-01-SW-11-00	21	21	NA	NA
Total Organic Carbon	8/8	2.55 - 9.1	0	PAI-01-SW-04-00	4.5	4.5	NA	NA

NA = Not Applicable
ND = Not Detected

TABLE 2-4

SUMMARY STATISTICS - SEDIMENT
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Detect	Average of Positive Detects	Average All	Background Level	Maximum Level Exceed Background
Volatile Organics (mg/kg)								
Acetone	3/3	0.016 - 0.063	NA	PAI-01-SD-09-01	0.037	0.037	NA	NA
Carbon Disulfide	6/9	0.002 - 0.024	0.008 - 1.2	PAI-01-SD-01	0.013	0.077	NA	NA
Toluene	6/9	0.003 - 0.007	0.019 - 1.2	PAI-01-SD-09-01	0.0051	0.073	NA	NA
Semivolatile Organics (mg/kg)								
Acenaphthylene	1/14	0.38	0.071 - 3.6	PAI-01-SD-02-01	0.38	0.35	NA	NA
Anthracene	6/14	0.011 - 0.77	0.0028 - 0.85	PAI-01-SD-01	0.26	0.14	NA	NA
Benzo(a)anthracene	8/14	0.03 - 2.2	0.0071 - 0.85	PAI-01-SD017	0.56	0.35	NA	NA
Benzo(a)pyrene	9/14	0.0078 - 1.7	0.0071 - 0.85	PAI-01-SD-17	0.45	0.32	NA	NA
Benzo(b)fluoranthene	10/14	0.0081 - 1.8	0.0028 - 0.85	PAI-01-SD-17	0.40	0.32	NA	NA
Benzo(g,h,i)perylene	7/14	0.03 - 0.99	0.011 - 0.85	PAI-01-SD-17	0.32	0.20	NA	NA
Benzo(k)fluoranthene	9/14	0.0031 - 0.85	0.0028 - 0.85	PAI-01-SD-17	0.18	0.15	NA	NA
Carbazole	3/9	0.086 - 0.58	0.47 - 1.2	PAI-01-SD-02-01	0.31	0.38	NA	NA
Chrysene	9/14	0.013 - 2.3	0.0071 - 0.85	PAI-01-SD-17	0.56	0.39	NA	NA
Dibenzo(a,h)anthracene	1/14	1.6	0.011 - 0.85	PAI-01-SD-17	1.60	0.22	NA	NA
Fluoranthene	9/14	0.025 - 6.6	0.0071 - 0.85	PAI-01-SD-17	1.36	0.90	NA	NA
Fluorene	1/14	0.16	0.014 - 0.85	PAI-01-SD-03-01-AVG	0.16	0.11	NA	NA
Indeno(1,2,3-cd)pyrene	8/14	0.03 - 1.1	0.0071 - 0.85	PAI-01-SD-17	0.33	0.22	NA	NA
Phenanthrene	8/14	0.025 - 2.6	0.0057 - 0.85	PAI-01-SD-01	0.66	0.41	NA	NA
Pyrene	7/14	0.064 - 5.4	0.014 - 0.85	PAI-01-SD-17	1.46	0.77	NA	NA
Pesticides/PCBs (mg/kg)								
4,4'-DDD	4/14	0.0036 - 0.26	0.0057 - 0.032	PAI-01-SD-09-01	0.073	0.026	NA	NA
4,4'-DDE	6/14	0.0055 - 0.12	0.0057 - 0.032	PAI-01-SD-09-01	0.033	0.018	NA	NA
4,4'-DDT	4/13	0.0032 - 0.27	0.0046 - 0.032	PAI-01-SD-09-01	0.073	0.026	NA	NA
Alpha-Chlordane	1/8	0.052	0.0023 - 0.0074	PAI-01-SD-09-01	0.052	0.0083	NA	NA
Gamma-Chlordane	1/14	0.13	0.0023 - 0.0155	PAI-01-SD-09-01	0.13	0.012	NA	NA
alpha-BHC	1/14	0.0027	0.0023 - 0.0155	PAI-01-SD-02-01	0.0027	0.0030	NA	NA
beta-BHC	1/14	0.0054	0.0023 - 0.0155	PAI-01-SD-02-01	0.0054	0.0032	NA	NA
delta-BHC	1/14	0.0027	0.0023 - 0.0155	PAI-01-SD-02-01	0.0027	0.0030	NA	NA
gamma-BHC (Lindane)	1/14	0.0021	0.0023 - 0.0155	PAI-01-SD-02-01	0.0021	0.0029	NA	NA
Inorganics (mg/kg)								
Aluminum	14/14	2110 - 23400	NA	PAI-01-SD-02-02	10179	10179	24200	No
Antimony	4/14	0.55 - 1.3	0.39 - 6	PAI-01-SD-001	0.8	0.70	ND	Yes
Arsenic	13/14	1.2 - 15.6	0.27	PAI-01-SD-10-01	6.7	6.2	12	Yes
Barium	14/14	5.7 - 88.5	NA	PAI-01-SD-09-01	24	24	28	Yes

TABLE 2-4

SUMMARY STATISTICS - SEDIMENT
SITE 1 - INCINERATOR LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Detect	Average of Positive Detects	Average All	Background Level	Maximum Level Exceed Background
Beryllium	3/14	0.7075 - 1.2	0.17 - 0.95	PAI-01-SD-10-01	1.00	0.39	0.97	Yes
Cadmium	1/14	0.79	0.04 - 0.09	PAI-01-SD-02-02	0.79	0.08	0.28	Yes
Calcium	14/14	387 - 14500	NA	PAI-01-SD-09-01	2640	2640	4000	Yes
Chromium	14/14	7.1 - 34.4	NA	PAI-01-SD-10-01	21	21	35.2	No
Cobalt	13/14	0.19 - 3.9	5.7	PAI-01-SD-10-01	1.9	2.0	2.6	Yes
Copper	13/14	5.5 - 95.3	3.3	PAI-01-SD-01	29	27	10	Yes
Iron	14/14	1930 - 24000	NA	PAI-01-SD-02-02	13221	13221	21450	Yes
Lead	14/14	6.6 - 194	NA	PAI-01-SD-09-01	48	48	21	Yes
Magnesium	14/14	597 - 7355	NA	PAI-01-SD-13-AVG	3698	3698	6400	Yes
Manganese	14/14	12.3 - 190	NA	PAI-01-SD-13-AVG	93	93	186	Yes
Mercury	2/14	0.16 - 0.67	0.07 - 0.28	PAI-01-SD-09-01	0.42	0.13	0.09	Yes
Nickel	12/14	1.4 - 7.9	0.75 - 11.3	PAI-01-SD-001	4.6	4.4	6	Yes
Potassium	14/14	331 - 4475	NA	PAI-01-SD-013-AVG	2201	2201	3200	Yes
Silver	2/14	0.36 - 2.4	0.06 - 1.1	PAI-01-SD-09-01	1.4	0.29	ND	Yes
Sodium	14/14	2620 - 25550	NA	PAI-01-SD-13-AVG	12686	12686	19000	Yes
Thallium	1/14	0.925	0.38 - 1.1	PAI-01-SD-13-AVG	0.93	0.35	0.41	Yes
Vanadium	14/14	4.3 - 50.65	NA	PAI-01-SD-13-AVG	27	27	50	Yes
Zinc	14/14	10.5 - 124	NA	PAI-01-SD-09-01	45	45	45	Yes
Miscellaneous Parameters (mg/kg)								
Acid Volatile Sulfide	1/1	5.7	NA	PAI-01-SD-02-02	5.7	5.7	NA	NA
Lead Avs/sem	1/1	0.014	NA	PAI-01-SD-02-02	0.014	0.014	NA	NA
Nickel Avs/sem	1/1	0.008	NA	PAI-01-SD-02-02	0.008	0.008	NA	NA
Ph	9/9	7 - 8.3	NA	PAI-01-SD-02-02	7.5	7.5	NA	NA
Total Organic Carbon	1/1	29400	NA	PAI-01-SD-01	29400	29400	NA	NA
Total Organic Carbon (%)	8/8	1.4 - 4.2	NA	PAI-01-SD-10-01	2.5	2.5	NA	NA
Zinc Avs/sem	1/1	0.75	NA	PAI-01-SD-02-02	0.75	0.75	NA	NA
Miscellaneous Parameters (pg/g)								
TCDD Equivalents[(1)]	2/2	1.7-2	NA	PAI-01-SD-02A-02	1.8	1.8	NA	NA

NA = Not Applicable
ND = Not Detected
1 Minimum and maximum concentrations are toxic equivalent (TEQ) concentrations for mammalian wildlife calculated using methods recommended by the World Health Organization (Van den Berg et al, 1998) and U.S. EPA's Interim Report on Data Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks. TEQs are based on positive detections of polychlorinated dibenzo-p-dioxins. Mammal TEQ concentrations were greater than fish and avian wildlife TEQ concentrations and thus, the mammal TEQ concentration represents the most conservative of the three values.

TABLE 2-5

SUMMARY STATISTICS - SURFACE SOIL
SITE 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Detect	Average of Positive Detects	Average All	Background Level
Volatile Organics (mg/kg)							
Acetone	1/1	0.73	NA	PAI-41-SS-02-01	0.73	0.73	NA
Semivolatile Organics (mg/kg)							
Benzo(a)anthracene	2/4	0.024 - 0.063	0.021 - 0.022	PAI-41-SS-03-01	0.044	0.027	NA
Benzo(a)pyrene	2/4	0.032 - 0.037	0.021 - 0.022	PAI-41-SS-03-01	0.035	0.023	NA
Benzo(b)fluoranthene	4/4	0.01 - 0.068	NA	PAI-41-SS-03-01	0.034	0.034	NA
Benzo(g,h,i)perylene	1/4	0.07	0.034 - 0.07	PAI-41-SS-03-01	0.070	0.035	NA
Benzo(k)fluoranthene	1/4	0.019	0.0086 - 0.018	PAI-41-SS-01-01	0.019	0.009	NA
Chrysene	1/4	0.012	0.022 - 0.044	PAI-41-SS-04-01	0.012	0.017	NA
Fluoranthene	4/4	0.026 - 0.2	NA	PAI-41-SS-03-01	0.079	0.079	NA
Fluorene	1/4	0.028	0.043 - 0.087	PAI-41-SS-03-01	0.028	0.029	NA
Indeno(1,2,3-cd)pyrene	1/4	0.026	0.021 - 0.044	PAI-41-SS-01-01	0.026	0.017	NA
Phenanthrene	4/4	0.03 - 0.19	NA	PAI-41-SS-03-01	0.080	0.080	NA
Pyrene	1/4	0.12	0.043 - 0.087	PAI-41-SS-03-01	0.12	0.052	NA
Pesticides/PCBs (mg/kg)							
4,4'-DDE	2/4	0.034 - 0.043	0.085 - 0.18	PAI-41-SS-01-01	0.039	0.052	NA
4,4'-DDT	2/4	0.012 - 0.065	0.085 - 0.18	PAI-41-SS-01-01	0.039	0.052	NA
Inorganics (mg/kg)							
Aluminum	4/4	3130 - 6290	NA	PAI-41-SS-04-01	4623	4623	7270
Arsenic	4/4	0.48 - 6.3	NA	PAI-41-SS-03-01	2.1	2.1	1.4
Barium	4/4	20.7 - 151	NA	PAI-41-SS-03-01	61	61	24
Beryllium	3/4	0.05 - 0.51	0.14	PAI-41-SS-03-01	0.23	0.19	0.095
Cadmium	3/4	0.11 - 1.1	0.13	PAI-41-SS-03-01	0.51	0.40	NA
Calcium	4/4	384 - 1830	NA	PAI-41-SS-03-01	1369	1369	766
Chromium	4/4	4.8 - 13.4	NA	PAI-41-SS-03-01	8.2	8.2	6.2
Cobalt	4/4	0.36 - 4.3	NA	PAI-41-SS-03-01	1.4	1.4	0.36
Copper	4/4	4.8 - 114	NA	PAI-41-SS-03-01	35	35	1.5
Iron	4/4	2150 - 15500	NA	PAI-41-SS-03-01	5970	5970	3920
Lead	4/4	26.4 - 161	NA	PAI-41-SS-01-01	94	94	12.5
Magnesium	4/4	187 - 604	NA	PAI-41-SS-03-01	341	341	515
Manganese	4/4	28.3 - 95.7	NA	PAI-41-SS-03-01	57	57	129
Mercury	4/4	0.04 - 0.18	NA	PAI-41-SS-03-01	0.11	0.11	0.11
Nickel	4/4	1.1 - 13.9	NA	PAI-41-SS-03-01	4.8	4.8	1.8
Potassium	4/4	148 - 1170	NA	PAI-41-SS-03-01	443	443	313
Selenium	4/4	0.22 - 1.1	NA	PAI-41-SS-03-01	0.45	0.45	0.29
Silver	2/4	0.18 - 0.89	0.05 - 0.25	PAI-41-SS-03-01	0.54	0.31	NA
Sodium	4/4	263 - 425	NA	PAI-41-SS-03-01	364	364	241
Vanadium	4/4	4.8 - 11	NA	PAI-41-SS-03-01	7.0	7.0	9.5
Zinc	4/4	27.8 - 158	NA	PAI-41-SS-03-01	70	70	9.70

NA = Not Applicable

TABLE 2-6

CHEMICALS RETAINED AS HUMAN HEALTH COPCs
SITE 1 - INCINERATOR LANDFILL AND SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Surface Soil	Groundwater	Surface Water	Sediment	Soil to Air	Soil to Groundwater	Fish
Volatile Organics							
Chloroform		X					
Semivolatile Organics							
Benzo(a)anthracene				X			
Benzo(a)pyrene	X			X			
Benzo(b)fluoranthene				X			
Bis(2-ethylhexyl)phthalate			X				X
Chrysene			X				
Dibenzo(a,h)anthracene				X			
Dibenzofuran		X	X				X
Indeno(1,2,3-cd)pyrene				X			
Naphthalene		X					
Pentachlorophenol			X				X
Phenanthrene		X					
Pesticides/PCBs							
4,4'-DDE	X						
4,4'-DDT	X						
alpha-BHC						X	
beta-BHC						X	
gamma-BHC (Lindane)						X	
Inorganics							
Aluminum	X	X	X				X
Antimony	X					X	
Arsenic	X	X	X	X			X
Barium		X					
Cadmium	X						
Chromium						X	
Iron	X	X	X	X			X
Lead	X	X	X				X
Manganese	X	X	X	X			X
Mercury			X				
Thallium				X			
Vanadium		X	X				

Notes
X - Indicates chemical was retained as a COPC.

TABLE 2-7

SUMMARY OF CANCER RISKS AND HAZARD INDICES
SITE 1 - INCINERATOR LANDFILL AND SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5}	Chemicals with Cancer Risks >10^{-6}	Cumulative HI	Chemicals with HI > 1
Construction Worker	Soil	Ingestion	7.6E-07	--	--	--	**1.9**	Iron
		Dermal Contact	3.7E-07	--	--	--	0.2	--
		Total	1.1E-06	--	--	--	**2.1**	Iron
	Groundwater	Dermal Contact	2.4E-09	--	--	--	0.06	--
	Sediment	Ingestion	2.3E-07	--	--	--	0.05	--
		Dermal Contact	3E-07	--	--	--	0.005	--
		Total	5.3E-07	--	--	--	0.05	--
	Surface Water	Ingestion	6.5E-08	--	--	--	0.009	--
		Dermal Contact	3.8E-06	--	--	BEHP, Pentachlorophenol	0.009	--
		Total	3.9E-06	--	--	BEHP, Pentachlorophenol	0.02	--
		Total All Media	4.8E-06				**2.2**	
Maintenance Worker	Soil	Ingestion	1.6E-06	--	--	Arsenic	0.2	--
		Dermal Contact	1.5E-06	--	--	--	0.04	--
		Total	3E-06	--	--	Arsenic	0.2	--
	Sediment	Ingestion	1.4E-06	--	--	--	0.01	--
		Dermal Contact	3.6E-06	--	--	cPAHs	0.002	--
		Total	5E-06	--	--	cPAHs	0.01	--
		Total All Media	8.1E-06				0.2	
Adolescent Recreational Users	Soil	Ingestion	8.8E-07	--	--	--	0.2	--
		Dermal Contact	7.7E-07	--	--	--	0.05	--
		Total	1.7E-06	--	--	Arsenic	0.3	--
	Sediment	Ingestion	1.6E-06	--	--	cPAHs	0.03	--
		Dermal Contact	3.8E-06	--	--	cPAHs	0.006	--
		Total	5.4E-06	--	--	cPAHs	0.04	--
	Surface Water	Ingestion	3.5E-07	--	--	--	0.009	--
		Dermal Contact	**1.1E-04**	--	BEHP, Pentachlorophenol	--	0.009	--
		Total	**1.1E-04**	--	BEHP, Pentachlorophenol	--	0.02	--
		Total All Media	**1.2E-04**				0.3	
Adult Recreational Users	Soil	Ingestion	3.4E-07	--	--	--	0.1	--
		Dermal Contact	4.4E-07	--	--	--	0.05	--
		Total	7.8E-07	--	--	--	0.2	--
	Sediment	Ingestion	6.1E-07	--	--	--	0.02	--
		Dermal Contact	2.2E-06	--	--	cPAHs	0.006	--
		Total	2.8E-06	--	--	cPAHs	0.03	--
	Surface Water	Ingestion	1.4E-07	--	--	--	0.006	--
		Dermal Contact	6.3E-05	--	BEHP, Pentachlorophenol	--	0.006	--
		Total	6.4E-05	--	BEHP, Pentachlorophenol	--	0.01	--
		Total All Media	6.7E-05				0.2	
	Fish (Maximum concentration in surface water)	Conservative	**2.0E-03**	Pentachlorophenol, Arsenic	BEHP	--	**23.8**	Dibenzofuran, Pentachlorophenol, Arsenic, Iron, Manganese
		Site-Specific	**1.4E-04**	Pentachlorophenol	Arsenic	BEHP	**8.2**	Iron
	Fish (Average concentration in surface water)	Conservative	**6.0E-04**	Pentachlorophenol	Arsenic	BEHP	**6.5**	Iron
		Site-Specific	4.1E-05	--	Pentachlorophenol	Arsenic	**2.2**	Iron

TABLE 2-7

SUMMARY OF CANCER RISKS AND HAZARD INDICES
SITE 1 - INCINERATOR LANDFILL AND SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5}	Chemicals with Cancer Risks >10^{-6}	Cumulative HI	Chemicals with HI > 1
Child Resident	Soil	Ingestion	2.5E-05	--	Arsenic	cPAHs, 4,4'-DDT	**10.1**	Antimony, Iron
		Dermal Contact	5.6E-06	--	--	cPAHs, Arsenic	0.6	--
		Total	3.0E-05	--	Arsenic	cPAHs, 4,4'-DDT	**10.7**	Antimony, Iron
	Sediment	Ingestion	5.7E-06	--	--	cPAHs, Arsenic	0.2	--
		Dermal Contact	3.1E-06	--	--	cPAHs	0.008	--
		Total	8.8E-06	--	--	cPAHs, Arsenic	0.2	--
	Surface Water	Ingestion	6.4E-07	--	--	--	0.03	--
		Dermal Contact	**1.0E-04**	--	BEHP, Pentachlorophenol	--	0.03	--
		Total	**1.0E-04**	--	BEHP, Pentachlorophenol	--	0.06	--
		Total All Media	**1.4E-04**				**11.0**	
Adult Resident	Soil	Ingestion	1.1E-05	--	--	cPAHs, Arsenic	**1.1**	--
		Dermal Contact	4.8E-06	--	--	Arsenic	0.1	--
		Total	1.5E-05	--	Arsenic	cPAHs	**1.2**	--
	Sediment	Ingestion	2.5E-06	--	--	cPAHs	0.02	--
		Dermal Contact	3.0E-06	--	--	cPAHs	0.002	--
		Total	5.5E-06	--	--	cPAHs	0.02	--
	Surface Water	Ingestion	5.5E-07	--	--	--	0.006	--
		Dermal Contact	**2.5E-04**	Pentachlorophenol	BEHP	--	0.006	--
		Total	**2.5E-04**	Pentachlorophenol	BEHP	--	0.01	--
		Total All Media	**2.8E-04**				**1.3**	
Lifelong Resident	Soil	Ingestion	3.5E-05	--	Arsenic	cPAHs, 4,4'-DDE, 4,4'-DDT	NA	--
		Dermal Contact	1.0E-05	--	--	Arsenic	NA	--
		Total	4.6E-05	--	Arsenic	cPAHs, 4,4'-DDE, 4,4'-DDT	NA	--
	Sediment	Ingestion	8.2E-06	--	--	cPAHs, Arsenic	NA	
		Dermal Contact	6.1E-06	--	--	cPAHs	NA	
		Total	1.4E-05	--	cPAHs	Arsenic	NA	--
	Surface Water	Ingestion	1.2E-06	--	--	--	NA	--
		Dermal Contact	**3.6E-04**	BEHP, Pentachlorophenol	--	--	NA	--
		Total	**3.6E-04**	BEHP, Pentachlorophenol	--	--	NA	--
		Total All Media	**4.2E-04**				NA	

Note: Shading indicates an exceedance of the U.S. EPA target risk range (1.0E-04 to 1.0E-06) for cancer risks or the acceptable limit of 1.0 for hazard indices.
BEHP = Bis(2-ethylhexyl)phthalate

TABLE 2-8

CHEMICALS RETAINED AS ERA STEP 2 ECOLOGICAL COPCS
SITE 1 - FORMER INCINERATOR AND SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Surface Water	Sediment	Surface Soil Site 1	Surface Soil Site 41	Groundwater
Volatile Organics					
2-Butane					X
Acetone	X	X		X	X
Carbon Disulfide		X			X
Toluene		X			
Xylenes, Total					X
Semivolatile Organics					
1,2,4-Trichlorobenzene			X		
2,4-Dimethylphel					X
2-Methylnaphthalene	X		X		X
2-Methylphel					X
Acenaphthylene		X			
Anthracene		X			
Benz(a)anthracene		X	X		
Benzo(a)pyrene		X	X		
Benzo(b)fluoranthene		X	X		
Benzo(g,h,i)perylene		X	X		
Benzo(k)fluoranthene		X	X		
Bis(2-ethylhexyl) phthalate	X		X		X
Butylbenzyl phthalate			X		
Carbazole		X	X		X
Chrysene	X	X	X		
Dibenzo(a,h)anthracene		X			
Dibenzofuran	X		X		X
Di-n-octyl phthalate			X		X
Fluoranthene		X	X	X	
Fluorene		X			
Inde(1,2,3-cd)pyrene		X	X		
Naphthalene					X
Pentachlorophel	X				
Phenanthrene		X	X	X	
Pyrene		X	X	X	X
Total PAHs		X			

TABLE 2-8

CHEMICALS RETAINED AS ERA STEP 2 ECOLOGICAL COPCS
SITE 1 - FORMER INCINERATOR AND SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Surface Water	Sediment	Surface Soil Site 1	Surface Soil Site 41	Groundwater
Pesticides/PCBs					
4,4'-DDD		X	X	X	
4,4'-DDE		X	X		
4,4'-DDT		X	X	X	
Alpha-Chlordane		X	X		
Aroclor 1260			X		
Endrin Ketone			X		
Gamma-Chlordane		X	X		
alpha-BHC		X	X		
beta-BHC		X	X		
delta-BHC		X	X		
gamma-BHC (Lindane)		X	X		
Inorganics					
Aluminum	X	X	X	X	X
Antimony	X		X		
Arsenic		X	X		
Barium	X	X	X		X
Beryllium		X			X
Cadmium		X	X		
Chromium			X	X	
Cobalt	X	X			
Copper	X	X	X	X	X
Iron	X	X	X	X	X
Lead	X	X	X	X	X
Manganese	X	X	X		X
Mercury	X	X	X	X	X
Nickel			X		
Selenium				X	
Silver	X	X	X		
Thallium		X			
Vanadium	X	X	X	X	X
Zinc	X	X	X	X	X

TABLE 2-9

SELECTION OF SURFACE SOIL AND SEDIMENT REMEDIATION LEVELS FOR THE PROTECTION OF HUMAN AND ECOLOGICAL RECEPTORS SITE 1 - INCINERATOR LANDFILL AND SWMU 41 - FORMER INCINERATOR MCRD PARRIS ISLAND, SOUTH CAROLINA

Sediment COCs	Maximum Concentration	Background/ Typical Facility Sediment Concentration (1)	Region 9 Residential Soil PRG (2)	Selected Human Health Rem. Level	Region 4 ESV (3)	Selected Ecological Rem. Level
PAHs (ug/kg)						
B(a)P Equivalents (4)	3,821	NA	434(9)	434(9)	NA	NA
Total PAHs (5)	29,455	NR	NA	NR	1,684	1,684
PESTICIDES (ug/kg)						
4,4'-DDD	260	33.6	2,400	NR	3.3	33.6 (1)
4,4'-DDE	120	31.6	1,700	NR	3.3	31.6 (1)
4,4'-DDT	270	34.5	1,700	NR	3.3	34.5 (1)
DDTR (6)	650	99.8	5,800	NR	9.9	99.8
Alpha Chlordane	52	13.9	1,600 (10)	NR	1.7 (10)	13.9
Gamma Chlordane	130	13.2	1,600 (10)	NR	1.7 (10)	13.2
INORGANICs (mg/kg)						
Arsenic	18.8	12	0.39	12.4 (8)	7.24	NA
Copper	95.3	10	2,900	NR	18.7	18.7
Lead	238	21	400 (7)	NR	30.2	30.2
Mercury	0.67	0.09	23	NR	0.13	0.13
Surface Soil COCs						
PAHs (ug/kg)						
B(a)P Equivalents (4)	854	NA	434(9)	434(9)	NA	NA
Total PAHs (5)	7,464	NA	NA	NA	1,000	1,000
PESTICIDES/PCBs (ug/kg)						
Alpha-BHC	42	NA	90	NR	2.5	2.5
Beta-BHC	33	NA	320	NR	1	1
Gamma-BHC (Lindane)	75	NA	440	NR	0.05	0.05
4,4'-DDD	180	33.6	2,400	1,700	2.5	33.6 (1)
4,4'-DDE	4,200	31.6	1,700	NR	2.5	31.6 (1)
4,4'-DDT	4,400	34.5	1,700	1,700	2.5	34.5 (1)
DDTR (6)	8,780	99.8	5,800	5,800	9.9	99.8
Aroclor-1260	80	NA	220	NR	20	20
INORGANICs (mg/kg)						
Aluminum	8,610	7,270	76,000	NR	50	7,270 (1)
Antimony	90.6	ND	31	31	3.5	3.5
Arsenic	24.9	1.44	0.39	1.83 (8)	10	10
Barium	178	24	5,400	NR	165	165
Cadmium	5.4	ND	37	NR	1.6	1.6
Chromium	53.2	6.2	210	NR	0.4	6.2 (1)
Copper	131	1.5	2,900	NR	40	40
Iron	147,000	3,920	23,000	26,920 (8)	200	3,920 (1)
Lead	8,380	12.5	400	412.5 (8)	50	50
Manganese	752	129	1,800	NR	100	129 (1)
Mercury	1.1	0.11	23	NR	0.1	0.110 (1)
Nickel	47.8	1.8	1,600	NR	30	30
Selenium	1.1	0.29	390	NR	0.81	0.81
Silver	2.4	ND	390	NR	2	2
Vanadium	47.4	9.5	550	NR	2	9.5 (1)
Zinc	497	9.7	23,000	NR	50	50

(1) Background/typical facility sediment concentrations taken from Site 1 RI/RFI (TtNUS, 2001). Pesticide values are typical facility concentrations.
(2) U.S. EPA Region 9 PRG Residential Soil Table (U.S. EPA, 2000b).
(3) U.S. EPA Region 4 Ecological Screening Values (U.S. EPA, 2000a).
(4) BAP equivalents = benzo(a)anthracene(0.1) + benzo(a)pyrene(1.0) + benzo(b)fluoranthene(0.1) + benzo(k)fluoranthene(0.01) + chyrsene(0.001) + dibenzo(a,h)anthracene(1.0) + indeno(1,2,3-cd)pyrene (0.1).
(5) Total PAHs = low molecular weight PAHs + high molecular weight PAHs.
* Low molecular weight = 2-methylnaphthalene + acenaphthene + acenaphthylene + anthracene + fluorene + naphthalene + phenanthrene.
* High molecular weight PAHs = benzo(a)anthracene + benzo(a)pyrene + chyrsene + dibenzo(a,h)anthracene + fluoranthene + pyrene.
* One-half the detection limit is used for nondetected PAHs to calculate total PAHs and BAP equivalents.
(6) DDTR = DDD + DDE + DDT.
(7) OSWER Soil Screening Level for Residential Landuse (U.S. EPA, 1994).
(8) Remediation Levels are PRG + Background per U.S. EPA guidance.
(9) Calculated as 7 x benzo(a)pyrene Region 9 PRG.
(10) Based on total chlordane.

ND = Nondetect.
NA = Not available.
NR = Not relevant. Maximum concentration is below RGO.

TABLE 2-10

FEDERAL ARARs/MEDIA CLEAN-UP STANDARDS AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Chemical-Specific ARARs			
Safe Drinking Water Act MCLs, MCLGs, and SMCLs	40 CFR 140-143	Not applicable	Would be used as protective levels for groundwater that are current or potential drinking water sources; however, groundwater is saline to brackish and is not a viable drinking water source.
Ambient Water Quality Criteria	Section 304 of the Clean Water Act	Relevant and appropriate	Criteria for assessing the need for surface water remedial action/corrective measures.
RCRA Subtitle C – Hazardous Waste Identifications and Listing Regulations	40 CFR 261	Potentially applicable	Would be used to identify a material as a hazardous waste and thus determine the applicability and relevance of RCRA C Hazardous Waste Rules.
U.S. EPA Health Advisories	U.S. EPA, 1996a	To be considered criteria (TBC)	Benchmark values for assessing the need for groundwater remedial action/corrective measures.
Preliminary Remediation Goals (PRGs)	U.S. EPA Region 9, 2000b	TBC	Benchmark values for assessing the need for soil, groundwater, and air remedial action/corrective measures.
Generic Soil Screening Levels	U.S. EPA, 1996b	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Dutch Soil Clean-Up Act Ecological Screening Values	Beyer, 1990	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Dutch Ministry of Housing Intervention Values and Target Values – Soil Quality Standards	MHSPE, 1994	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Oak Ridge National Laboratory Toxicity Benchmarks for Soil	Efroymson, 1997a and 1997b	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Canadian Council of Ministers of the Environment Soil Quality Guidelines	CCME, 1997	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Ecological Risk Assessment at Military Bases	U.S. EPA, 2000a	TBC	Memorandum consists of benchmark values for assessing the need for surface soils, sediment, and surface water remedial action/corrective measures.
ER-L and ER-M Levels	Long et al., 1995	TBC	Benchmark values for assessing the need for sediment remedial action/corrective measures.
PELs and TELs	FDEP, 1994	TBC	Benchmark values for assessing the need for sediment remedial action/corrective measures.

TABLE 2-10

FEDERAL ARARs/MEDIA CLEAN-UP STANDARDS AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Location-Specific ARARs			
U.S. EPA's Groundwater Protection Strategy	U.S. EPA, 1984	TBC	Surficial groundwater at Site 1 is likely designated Class IIIA.
CWA Section 404 River and Harbors Act, Section 10	40 CFR 230, 33 CFR 320-330	Applicable	Prohibits the unauthorized obstruction or alteration of any navigable waters of the United States. The waters within the vicinity of Site 1, most notably Archers Creek, are classified as navigable waters and, therefore, the Act is applicable.
Floodplain Management	Executive Order 11988	Applicable	Site 1 is located within the 100-year floodplain.
Protection of Wetlands	Executive Order 11990	Applicable	Site 1 is located within a wetlands area.
Endangered Species Act	16 U.S.C. 1531 et seq.	Applicable	A bald eagle is known to nest in the vicinity of Site 1. Wood storks and alligators are sometimes observed in the vicinity.
Fish and Wildlife Coordination Act	16 U.S.C. 661 et seq., 40 CFR Part 122.49	Applicable	Ensures that remedial action/corrective measures protect nearby wetlands and protected habitats.
Coastal Zone Management Act	16 U.S.C. 1451 et seq.	Applicable	Ensures that remedial action/corrective measures protect coastal resources.
Historic Sites, Buildings, and Antiquities Act of 1935	16 U.S.C. 461 et seq.	Potentially applicable	This Act would be applicable if information is found to classify Site 1 as a historic or prehistoric property of national significance.
Archaeological and Historic Preservation Act of 1974	16 U.S.C. 469 et seq.	Potentially applicable	This Act would be applicable if historic and archaeological artifacts were to be affected by remedial activities. No such artifacts are known to exist within the boundaries of Site 1 and none are expected because the landfill consists primarily of incinerator ash and fill used to expand the edge of the landfill into the marsh.
Archaeological Resources Protection Act of 1979	16 U.S.C. 479(aa) et seq.	Potentially applicable	This Act would be applicable if archaeological artifacts were discovered during remedial activities. No such artifacts are known to exist within the boundaries of Site 1 and none are expected because the landfill consists primarily of fill dirt used to expand the edge of the landfill into the marsh.
Native American Grave Protection and Repatriation Act of 1990	25 U.S.C. 3001 et seq.	Potentially applicable	This Act would be applicable if human remains were discovered during remedial activities.
Bald Eagle Protection Act of 1940, as Amended	16 U.S.C. 688 et seq.	Potentially applicable	This Act includes provisions for prohibiting the disturbance of bald eagles. Because a bald eagle is known to nest within 1,000 feet of Site 1, remedial activities would need to be conducted to minimize the disturbance to this species.

TABLE 2-10

FEDERAL ARARs/MEDIA CLEAN-UP STANDARDS AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Conservation Programs on Military Reservations (Sikes Act) of 1960, as Amended	16 U.S.C. 670(a) et seq.	Applicable	This act requires that military installations manage natural resources for multipurpose uses and public access appropriate for those uses consistent with the military department's mission.
Marine Mammal Protection Act of 1972 as Amended	16 U.S.C. 1361 et seq.	Not applicable	Marine mammals are not known to inhabit Archers Creek.
Action-Specific ARARs			
Solid Waste Disposal Act (SWDA)/ RCRA Subtitle C	42 U.S.C 6905, 6912a, 6924-6925	–	–
• Standards for Hazardous Waste Generators	40 CFR 262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.
• Standards for Hazardous Waste	40 CFR 263	Potentially applicable	Applicable for site wastes determined to be hazardous that are transported off site.
• Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	40 CFR 264	Potentially applicable	These regulations would be applicable to waste removed from the site, including both on-site and off-site management.
• Interim status standards for owners and operators of hazardous waste TSD facilities	40 CFR 265	Relevant and appropriate	Establishes design and operating criteria for hazardous landfills. Because the type of waste disposed in the Site 1 landfill was primarily nonhazardous in nature, these requirements are not applicable; however, certain aspects are relevant and appropriate.
• RCRA Land Disposal Restrictions (LDR) Requirements	40 CFR 268	Potentially applicable	If off-site treatment or disposal of contaminated media and/or disposal of treatment residuals that may be considered hazardous waste is necessary, it would be subject to land disposal restrictions.
Hazardous and Solid Waste Amendments of 1984	42 U.S.C. 6926	Potentially applicable	Establishes a corrective actions program requiring four basic elements (assessment, investigation, CMS, implementation).
RCRA Subtitle D	40 U.S.C 6901	Relevant and appropriate	Establishes design and operating criteria for solid waste (nonhazardous) landfills; however, disposal activities ceased prior to the effective date of the regulation.
The Clean Water Act (CWA) National Pollution Discharge Elimination System	40 CFR 122	Potentially applicable	These requirements are applicable for all alternatives that include a surface water discharge.

TABLE 2-10

FEDERAL ARARs/MEDIA CLEAN-UP STANDARDS AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Toxic Substances Control Act	40 CFR 761	Not an ARAR	Remedial action/corrective measures may be driven by reducing PCB concentrations in affected media to meet published levels.
Clean Air Act National Ambient Air Quality Standards (NAAQs)	42 U.S.C §7401- 7642, 40 CFR Part 50	Potentially applicable	Remedial action/corrective measures involving treatment of media could result in emissions to the atmosphere.
U.S. EPA Clean Air Act New Source Performance Standards (NSPS)	40 CFR 60	Potentially applicable	Remedial action/corrective measures involving treatment of media could result in emissions to the atmosphere.
Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR 60	Potentially applicable	Remedial action/corrective measures involving treatment of media could result in emissions to the atmosphere.
DOT Hazardous Materials Transportation	49 CFR	Potentially applicable	These rules are considered potentially applicable depending on whether wastes are shipped off site for laboratory analysis, treatment, or disposal.
OSHA Standards	29 CFR 1910.120	Applicable	On-site activities are required to follow OSHA requirements.
National Environmental Policies Act	42 U.S.C 4321 et seq.	Relevant and appropriate	Remedial action/corrective measures could constitute significant activities, thereby making NEPA requirements ARARs; however, activities conducted in accordance with the NCP are considered to meet the substantive NEPA requirements.
Soil Conservation Act	U.S.C. 5901 et seq.	Applicable	During remedial activities, implementation of soil conservation practices would be required.
Presumptive Remedy for CERCLA Municipal Landfill Sites	U.S. EPA, 1993	TBC	Through this directive, U.S. EPA has identified containment as the presumptive remedy for such landfill sites.
Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills	U.S. EPA, 1996c	TBC	Provides the framework for determining the applicability of the containment presumptive remedy to military landfills.
Policy on Land Use Controls Associated with Environmental Restoration Activities	DOD, 2001	TBC	Requires that feasibility studies that consider a remedy requiring a land use restriction shall include the costs of implementing and maintaining the LUC, as well as an evaluation of an “unrestricted use” alternative.

TABLE 2-11

STATE OF SOUTH CAROLINA ARARs/MEDIA CLEAN-UP STANDARDS AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Chemical-Specific ARARs			
State Primary Drinking Water Regulations Groundwater Sources and Treatment Surface Water Sources and Treatment MCL in Drinking Water Control of Lead and Copper	R.61-58 to R.61-58.11 R.61-58.2 R.61-58.3 R.61-58.5 R.61-58.11	Applicable	Although it is unlikely that site groundwater could be used as a drinking water source, it would be used as protective levels for groundwaters that are current or potential drinking water sources.
South Carolina Hazardous Waste Management Act Hazardous Waste Management Regulations	§44-56-30 R.61-79	Potentially applicable	Would be used to identify a material as a hazardous waste and thus determine the applicability and relevance of Hazardous Waste Management Regulations.
Location-Specific ARARs			
Water Classifications and Standards Classified Water	R.61-68 R.61-69	Applicable	Surficial groundwater is not an underground source of drinking water due to salinity and TDS levels. The surface water at Site 1 is classified as SA (tidal saltwaters).
Coastal Zone Management Act	§48-39-10	Applicable	Ensures that remedial action/corrective measures protect coastal resources.
Groundwater Mixing Zone Application Guidance	SCDHEC, 1997b	TBC	Guidance for completing an application to obtain groundwater waiver for non-attainment of MCLs.
Action-Specific ARARs			
Well Standards	R.61-71	Applicable	Applicable if remedial action/corrective measures involve the installation or abandonment of monitoring wells.
Hazardous Waste Management Act	§44-56-30	-	-
• Standards for Hazardous Waste Generators	R.61-79.262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.
• Standards for Hazardous Waste Transporters	R.61-79.263	Potentially applicable	Applicable for removed site wastes determined to be hazardous that are transported off site.
• Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal (TSD) Facilities	R.61-79.264	Potentially applicable	These regulations would be applicable to waste removed from the site including both on-site and off-site management.

TABLE 2-11

STATE OF SOUTH CAROLINA ARARs/MEDIA CLEAN-UP STANDARDS AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
• Interim status standards for owners and operators of hazardous waste TSD facilities	R.61-79.265	Relevant and appropriate	Establishes design and operating criteria for hazardous landfills. Because the type of waste disposed in the landfill was primarily nonhazardous in nature, these requirements are not applicable; however, certain aspects are relevant and appropriate.
• Land Disposal Restrictions (LDR) Requirements	R.61-79.268	Potentially applicable	If off-site treatment or disposal of contaminated media and/or disposal of treatment residuals that may be considered hazardous waste is necessary, it would be subject to land disposal restrictions. Consolidation activities at Site 1 would be conducted so as to not trigger LDRs.
Air Pollution Control Regulations and Standards	R.61-62	Applicable	Remedial action/corrective measures involving treatment of media could result in emissions to the atmosphere.
Solid Waste Management: Collection, Temporary Storage, and Transportation of Solid Waste	R.61-107.5	Potentially applicable	Applicable if solid waste is generated during remedial action/corrective measures.
Solid Waste Management: Construction, Demolition, and Land Clearing Debris Landfills	R.61-107.11	Relevant and appropriate	Construction, demolition, and land-clearing debris is co-mingled with other wastes.
Solid Waste Management: Municipal Solid Waste Landfills	R.61-107.258	Relevant and appropriate	Contains design and construction requirements for municipal landfills; however, disposal activities ceased prior to the effective date of the regulation.
Sanitary Landfill Design, Construction, and Operation	R.61-70	Relevant and appropriate	Contains design and construction requirements for sanitary landfills; however, disposal activities ceased prior to the effective date of the regulation.
Standards for Stormwater Management and Sediment Reduction	R.72-300 and R.72-405	Potentially applicable	Applicable if remedial action/corrective measures involve land-disturbance activities.
General Objectives and Components of Contamination Assessments and Remedial Actions	SCDHEC, 1994	TBC	Provides guidance for conducting remedial action activities.
Soil/Groundwater Remediation Guidance Document	SCDHEC, 1992	TBC	Provides guidance for conducting groundwater and soil remediation.
Stormwater and Management and Sediment Control Handbook for Land Disturbance Activities	SCDHEC, 1997a	TBC	Guidance document to be following if remedial action/corrective measures involve land-disturbance activities.

SOURCE: USGS 7.5 MINUTE PARRIS ISLAND QUADRANGLE, 1956. PHOTOREVISED 1979.

DRAWN BY D. PERRY	DATE 16-MAR-99	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7394 / OWNER NO. —
CHECKED BY CAR	DATE 5/16/01	DEPOT LOCATION MAP MCRD, PARRIS ISLAND, SOUTH CAROLINA	APPROVED BY — / DATE —
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. Figure 2-1 / REV 0

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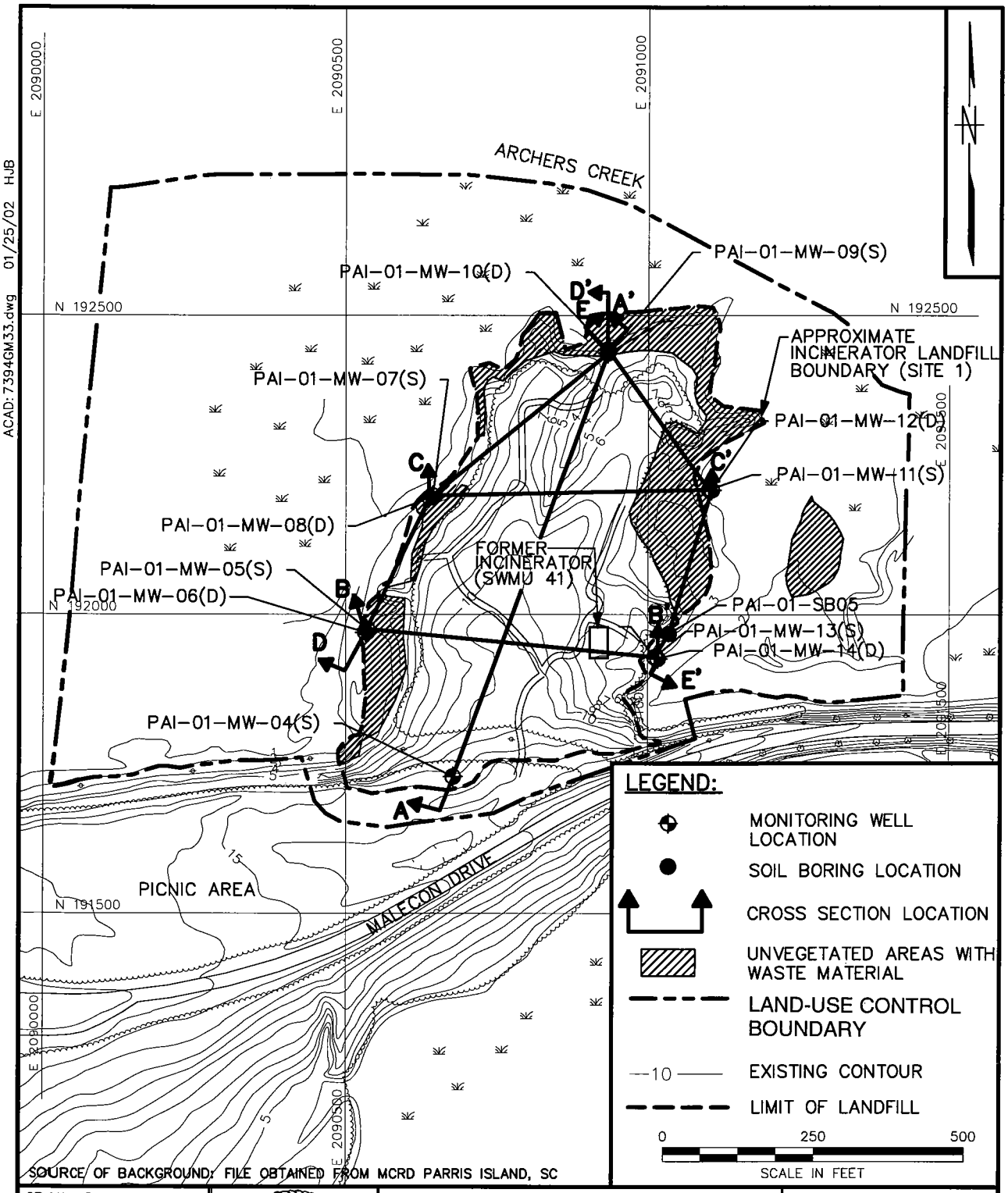

SOURCE OF BACKGROUND: FILE OBTAINED FROM MCRD PARRIS ISLAND, SC

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CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-2 REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98

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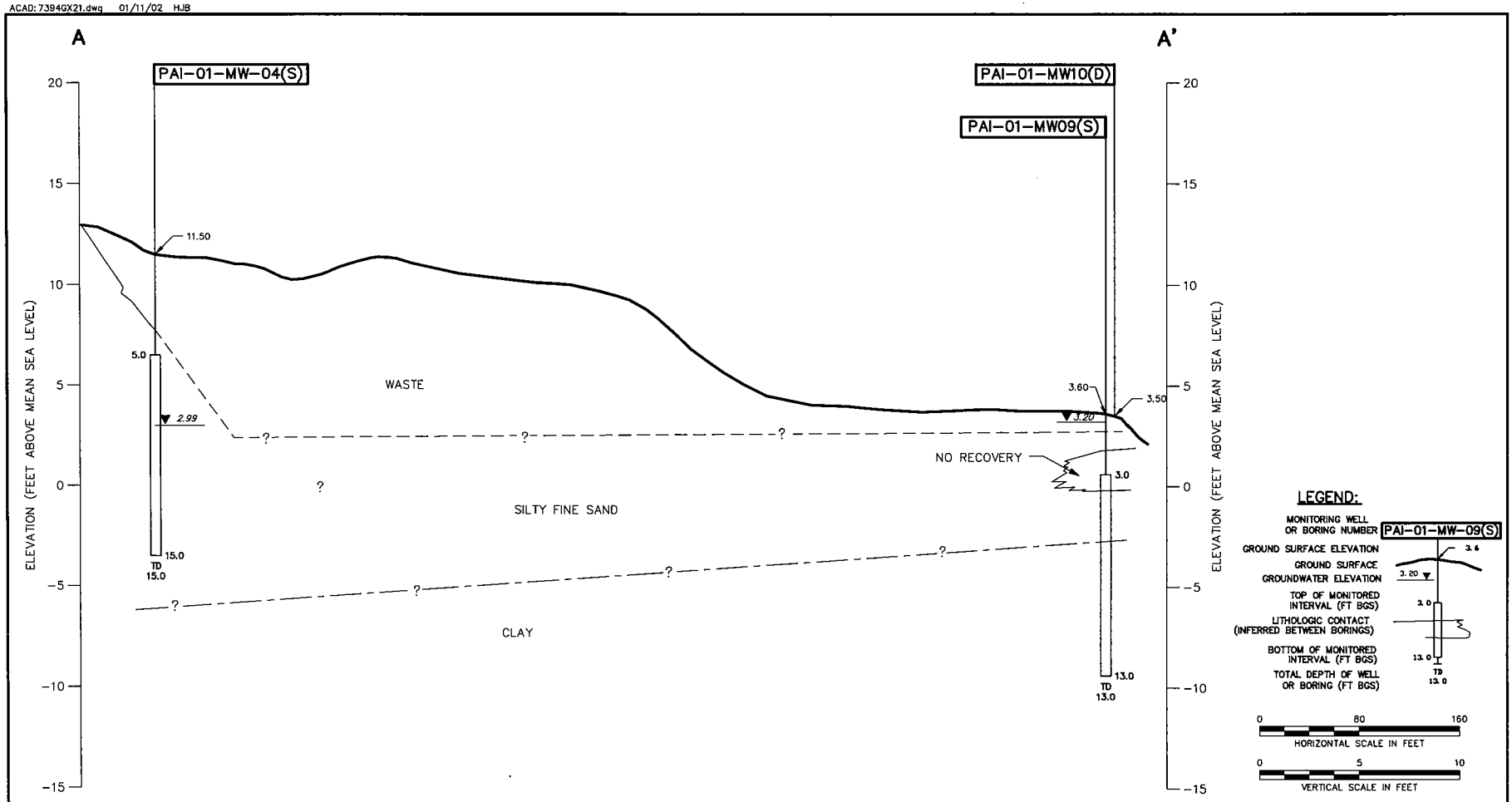

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DRAWN BY HJP DATE 12/27/00
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION A-A'
SITE 1 - INCINERATOR LANDFILL AND
SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-3
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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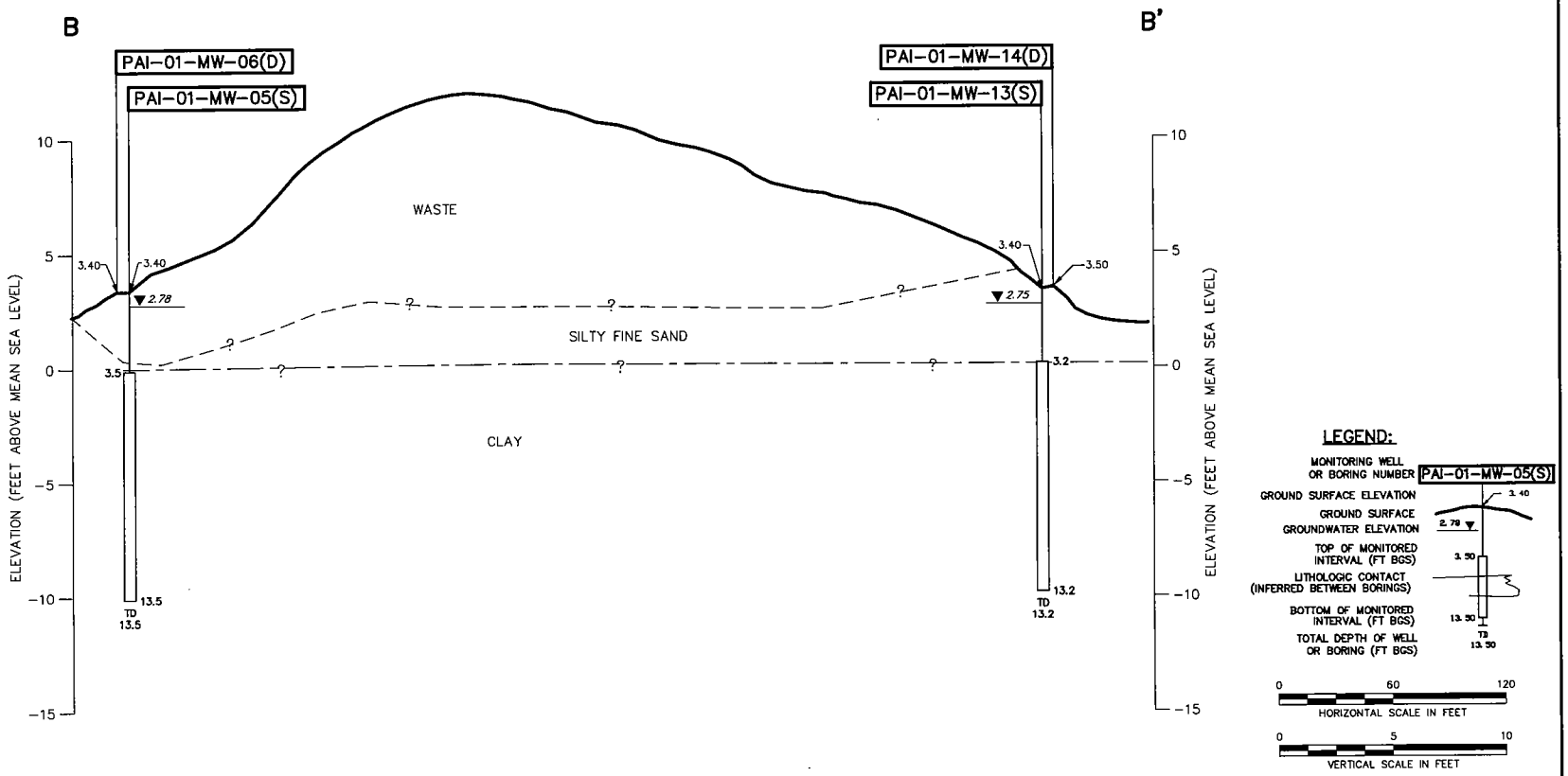

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 12/27/00
CHECKED BY DATE
COST/SCHED--AREA
SCALE AS NOTED

CROSS SECTION B-B'
SITE 1 - INCINERATOR LANDFILL AND
SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-4
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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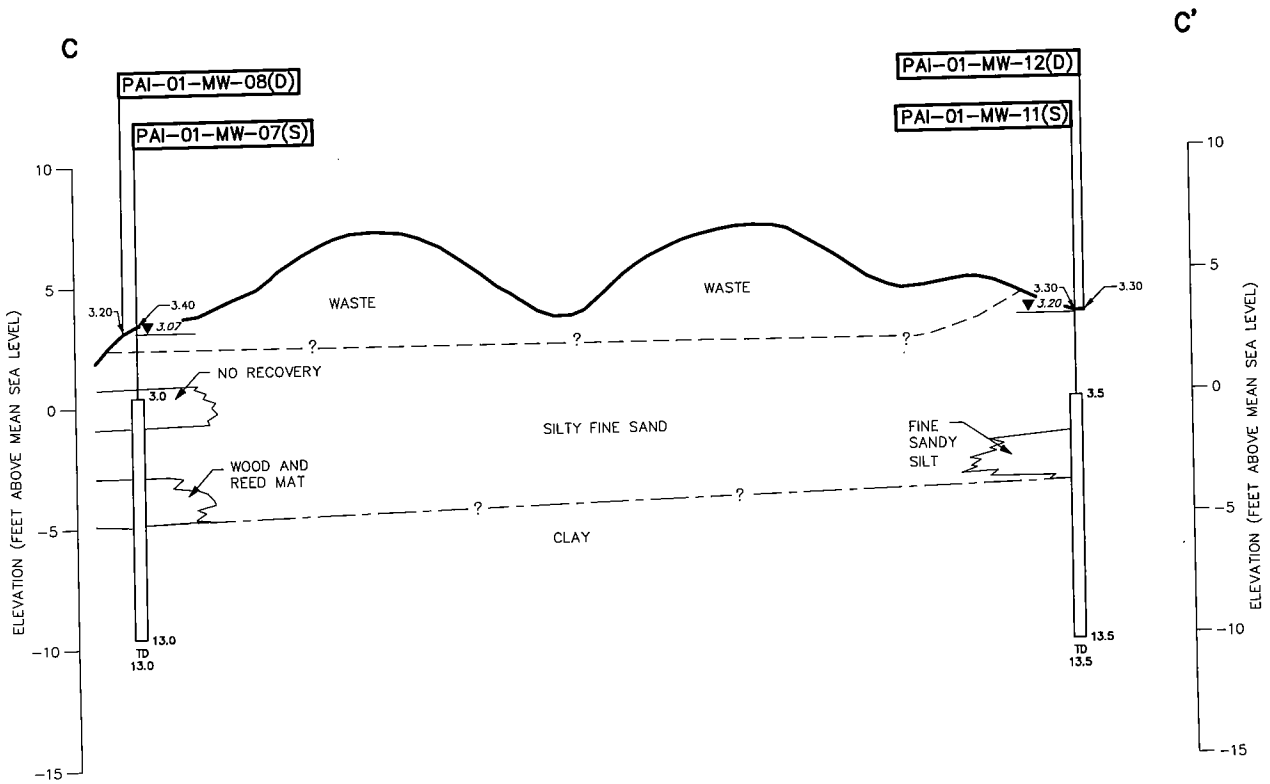

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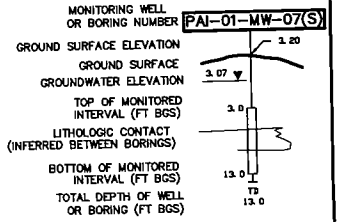

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 12/27/00
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION C-C'
SITE 1 - INCINERATOR LANDFILL AND
SMWU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-5
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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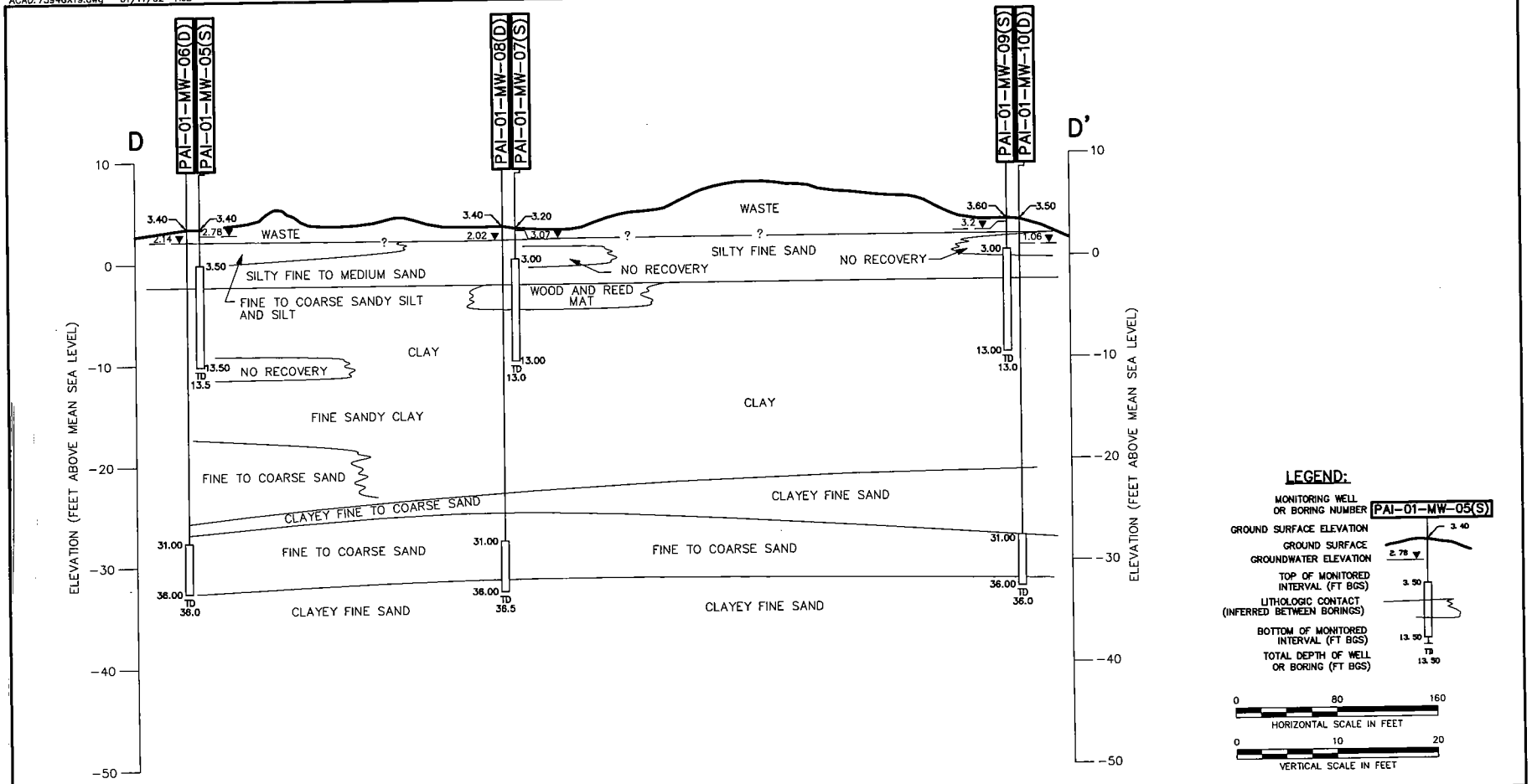

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CHECKED BY DATE
COST/SCHED--AREA
SCALE AS NOTED

CROSS SECTION D–D'
SITE – 1 INCINERATOR LANDFILL AND
SWMU 41 – FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2–6
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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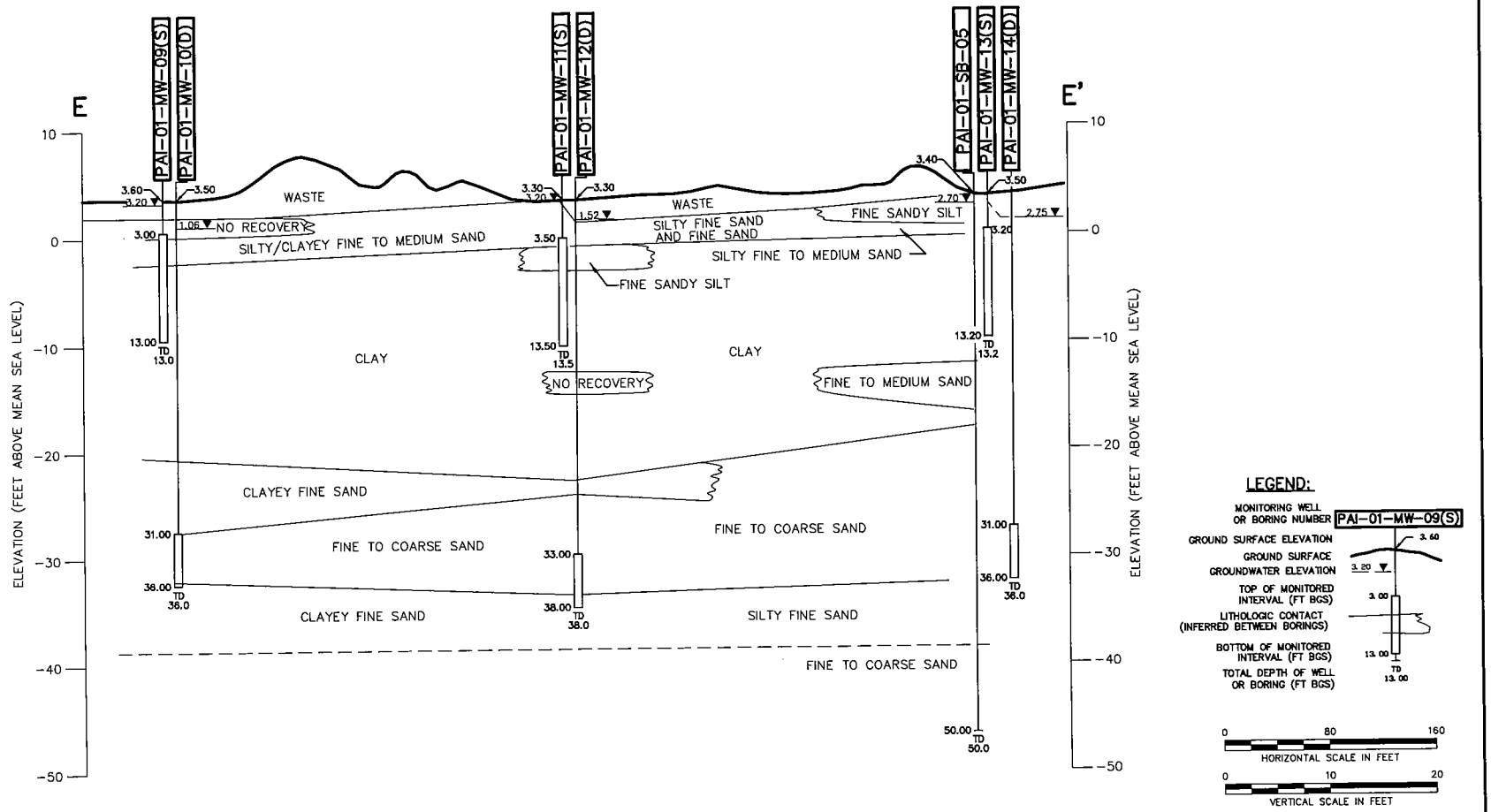

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DRAWN BY HJP DATE 12/28/98
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION E-E'
SITE 1 - INCINERATOR LANDFILL AND
SWMU 41 - FORMER INCINERATOR
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-7
REV. 0

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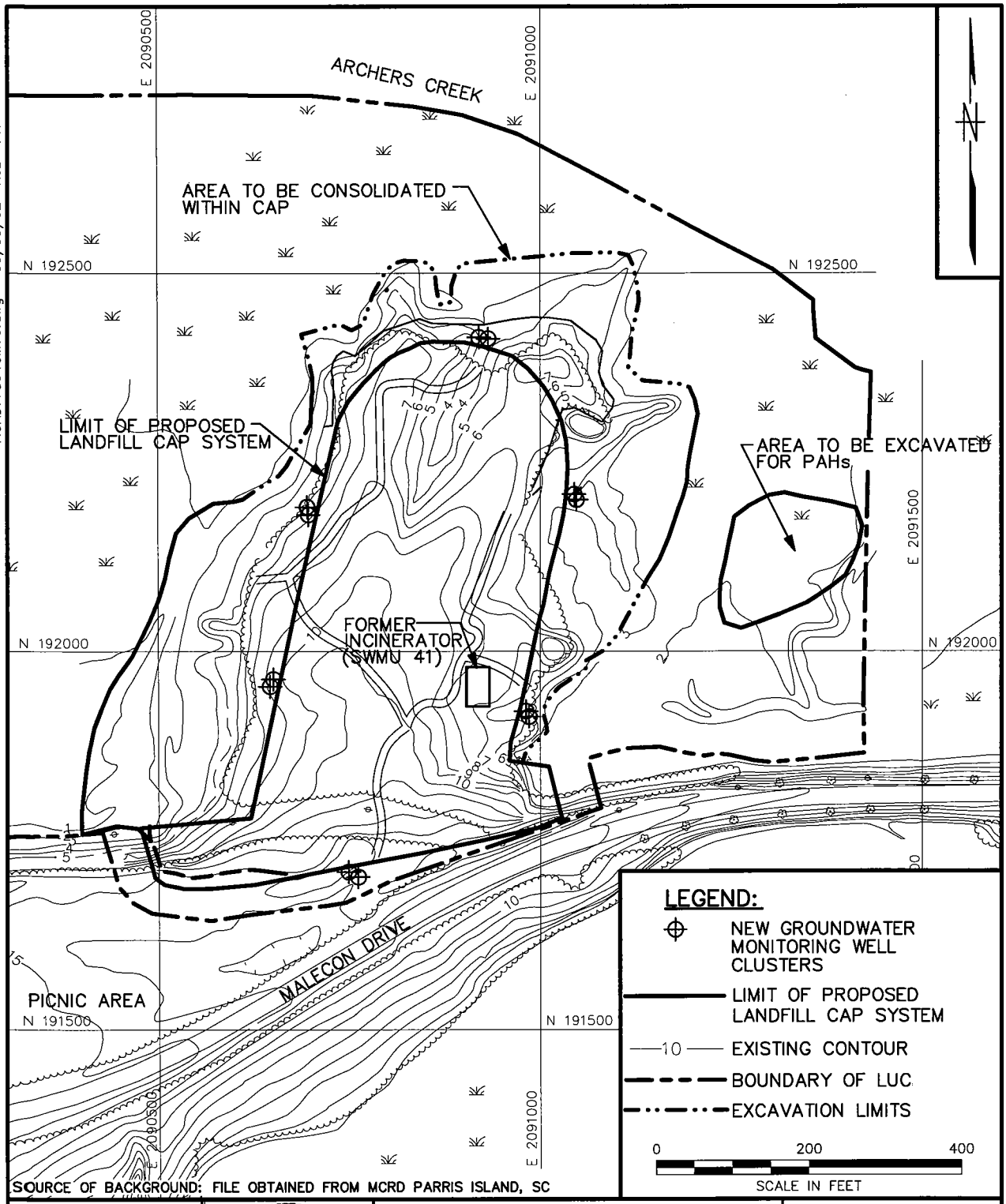

SOURCE OF BACKGROUND: FILE OBTAINED FROM MCRD PARRIS ISLAND, SC

ACAD: 7394CM76.dwg 03/05/02 HJB PIT

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CHECKED BY DATE			APPROVED BY DATE
COST/SCHED–AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2–8 REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98

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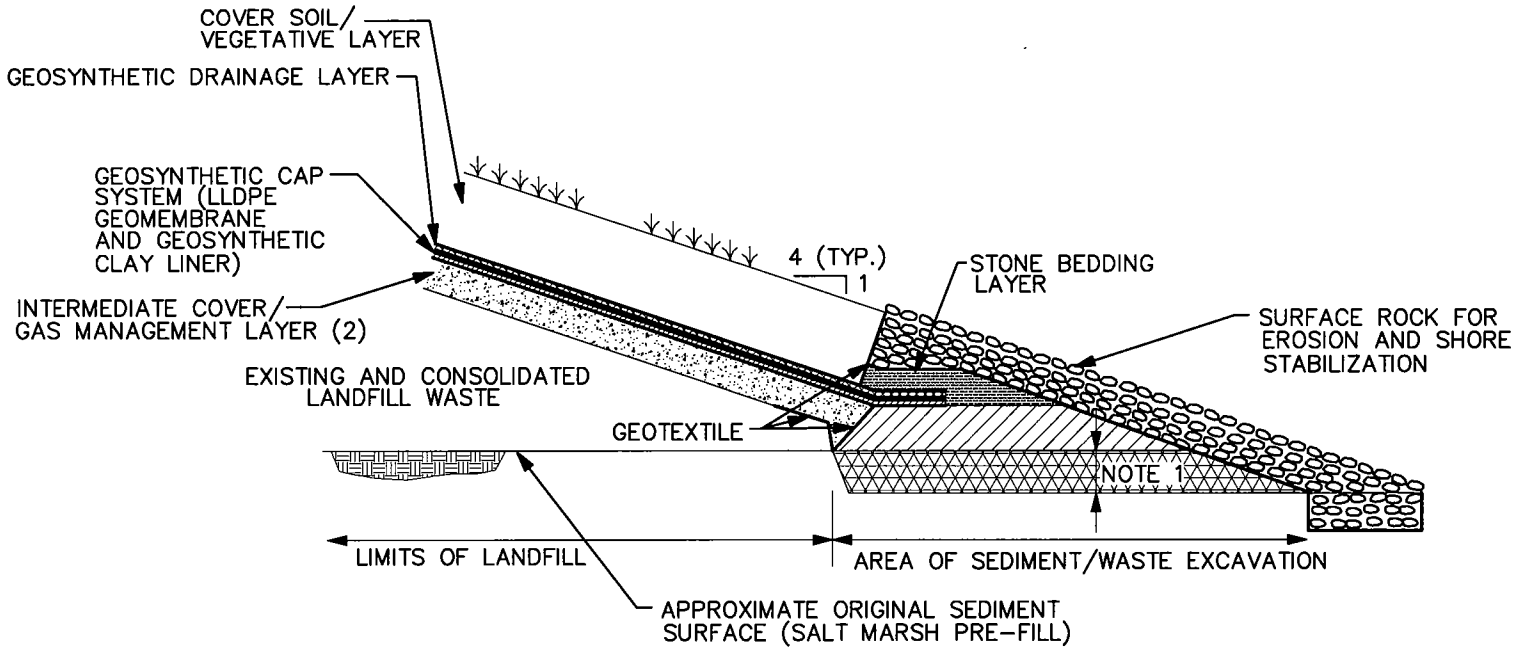

NOTES:

1. THIS SUBSURFACE AREA INCLUDES STRUCTURAL FILL WHERE SEDIMENT/WASTE EXCAVATION IS PERFORMED WITHIN LIMITS OF CAP SYSTEM
2. METHANE GENERATION WILL BE MEASURED AND A METHANE VENTING SYSTEM MAY BE NECESSARY BASED ON THE RESULTS OF THE METHANE GENERATION STUDY.

DRAWN BY HJP DATE 6/21/01		CONTRACT NO. 7394	
CHECKED BY DATE	TYPICAL CAP SYSTEM SECTION MODIFIED ALTERNATIVE 2A SITE 1 – INCINERATOR LANDFILL AND SWMU 41 – FORMER INCINERATOR MCRD PARRIS ISLAND, SOUTH CAROLINA	APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE NOT TO SCALE		DRAWING NO. FIGURE 2-9	REV. 0

FORM CADD NO. SDIV_AH.DWG - REV 0 - 1/20/98

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APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

A public comment period was held from January 31, 2002 to April 2, 2002 for the Proposed Plan for Soil and Sediment Remedial Action at Site 1 and SWMU 41. On January 31, 2002, the Proposed Plan was made available to the public in the Information Repository located at the Beaufort County Public Library's Headquarters location at 311 Scott Street, Beaufort, South Carolina 29902. Public notice of the Proposed Plan was also published in the Beaufort Gazette on January 31 and February 3, 10, and 17, 2002. This local newspaper targets the communities closest to MCRD Parris Island. Furthermore, a public information session was held on February 19, 2002, to present the results of the RI and the FS, explain the preferred remedy, and solicit comments from the community. At this information session, representatives from Southern Division, Naval Facilities Engineering Command, MCRD Parris Island, U.S. EPA Region 4, and SCDHEC were available to discuss aspects of Site 1 and SWMU 41 and the response actions under consideration.

One formal comment was submitted during the public comment period by Reed S. Armstrong of the South Carolina Coastal Conservation League, P.O. Box 1861, Beaufort, SC 29901. This comment and Navy response is presented as follows.

Comment: Proposed Clean-up plan seems well thought-out and well developed. Of options considered, I would prefer Alternative 3, which would completely remove all contaminated sediments from the site. However, it should be realized that under Alternative 3, land disturbance from the extensive excavation could well release more contaminants into the marine environment than the other options.

Therefore, I see your proposal for Modified Alternative 2a as a reasonable and the most practical solution for clean-up of the site, if, as found in your analysis that arsenic concentrations at the site pose no threat. This alternative provides for excavation and consolidation, with containment under a cap system, along with erosion control, tidal marsh restoration, long-term monitoring and maintenance, and land-use controls.

Modified plan 2a assumes the containment will be effective, and for this plan to meet objectives, post-project monitoring must be focused on assuring success of the containment system, through addressing (1) "trigger" criteria that could be used to identify system failure, and (2) contingency actions to be taken in the event of such failure.

The Navy appreciates the effort and thought in consideration of the proposed plan and offers the following in response to your comment:

Response: The implementation of Alternative 3 would pose risks to the marine environment as a result of the extensive land disturbance involved with this alternative. In addition to this concern, the Navy also considered the short-term risks to the local community in choosing modified Alternative 2a over Alternative 3. Alternative 3 would have resulted in approximately 6,000 truckloads of waste material being transported through the roads of the local communities whereas modified Alternative 2a would not involve such actions.

The land-use control implementation plan (LUCIP) that has been written and is included in the record of decision for Site 1 and SWMU 41 will address your concerns with the long-term effectiveness of modified Alternative 2a. This LUCIP identifies the actions that will be taken to assure the long-term effectiveness of the remedy. Actions incorporated within the LUCIP include long-term monitoring of the site's sediment and groundwater to assure that site contaminants are not being introduced into the marine environment above contaminant action levels. Also, the LUCIP provides for quarterly visual inspections of the landfill to determine whether maintenance to the landfill cap system is required.

Furthermore, the LUCIP restricts residential development within an area around Site 1 and SWMU 41. Human health evaluations of the arsenic-contaminated sediment have determined that the arsenic poses risks to human health only if residential housing were to be built within the affected area. Consequently, the residential development restriction will ensure that human health will be protected under modified Alternative 2a.

APPENDIX B

MODIFIED ALTERNATIVE 2A COST ESTIMATE

Capital Costs

Alternative 2a - Excavation and Consolidation of Pesticide and Inorganic Contaminated Sediment in Excess of Ecological RGOs and Containment of Waste

Marine Corps Recruit Depot
Parris Island, South Carolina

	Item	Quantity	Unit	Unit Cost				Extended Cost				Total Cost
				Subcontract	Materials	Labor	Equipment	Subcontract	Materials	Labor	Equipment	
1	SITE PREPARATION											
	1.1 Pre-construction/Construction/As-Built Survey	1	LS	$40,000.00				$40,000.00				$40,000.00
	1.2 Site Facilities (Trailers, etc.)	12	MONTH	$800.00				$9,600.00				$9,600.00
	1.3 Equipment Mobilization/Demobilization	1	LS	$5,000.00				$5,000.00				$5,000.00
	1.4 Site Utilities	12	MONTH	$2,000.00				$24,000.00				$24,000.00
	1.5 Abandonment of Existing Monitoring Wells	11	EACH	$2,500.00				$27,500.00				$27,500.00
	1.6 Clearing and Grubbing	7	ACRE	$4,000.00				$28,000.00				$28,000.00
	1.7 Site Access	1	LS		$2,500.00	$2,500.00	$1,000.00		$2,500.00	$2,500.00	$1,000.00	$6,000.00
	1.8 Temporary Cofferdams and Dewatering	1160	LF	$39.00	$12.00	$20.00	$15.00	$45,240.00	$13,920.00	$23,200.00	$17,400.00	$99,760.00
	1.9 Decontamination Pad	1	LS		$4,000.00	$2,000.00	$2,000.00		$4,000.00	$2,000.00	$2,000.00	$8,000.00
	1.10 Erosion and Sediment Controls	1	LS		$21,000.00	$18,000.00	$10,000.00		$21,000.00	$18,000.00	$10,000.00	$49,000.00
2	SEDIMENT EXCAVATION											
	2.1 Delineation of Impacted Area	25	EACH	$400.00		$10.00	$15.00	$10,000.00		$250.00	$375.00	$10,625.00
	2.2 Excavation of Impacted Sediment - Area I	1466	CY		$8.00	$2.00	$2.00		$11,727.70	$2,931.93	$2,931.93	$17,591.56
	2.3 Excavation of Impacted Sediment - Area III	1584	CY		$8.00	$2.00	$2.00		$12,674.07	$3,168.52	$3,168.52	$19,011.11
	2.4 Verification Sampling and Analysis	10	EACH	$1,500.00		$10.00	$15.00	$15,000.00		$100.00	$150.00	$15,250.00
	2.5 Transport of Sediment to Landfill	3660	CY		$5.85	$0.90	$0.90		$21,412.56	$3,294.24	$3,294.24	$28,001.04
3	SEDIMENT/WASTE EXCAVATION											
	3.1 Excavation of Impacted Sediment/Waste	10970	CY		$8.00	$2.00	$2.00		$87,762.96	$21,940.74	$21,940.74	$131,644.44
	3.2 Verification Sampling and Analysis	10	EACH	$1,500.00		$2.00	$2.00	$15,000.00		$20.00	$20.00	$15,040.00
	3.3 Transport of Sediment/Waste to Landfill	13164	CY		$5.85	$0.90	$0.90		$77,012.00	$11,848.00	$11,848.00	$100,708.00
4	CAP SYSTEM											
	4.1 Consolidation of Sediment and Waste	16825	CY			$3.00	$15.00			$50,474.13	$252,370.67	$302,844.80
	4.2 Grade Existing Landfill Material	5278	CY			$3.00	$2.00			$15,833.33	$10,555.56	$26,388.89
	4.3 Import and Place General Fill for Subgrade	5278	CY		$8.00	$2.00	$2.00		$42,222.22	$10,555.56	$10,555.56	$63,333.33
	4.4 Import and Place Intermediate Cover/Gas Layer	10556	CY		$8.00	$2.00	$2.00		$84,444.44	$21,111.11	$21,111.11	$126,666.67
	4.5 Placement of Geosynthetic Clay Liner	31667	SY		$5.85	$0.90	$0.90		$185,250.00	$28,500.00	$28,500.00	$242,250.00
	4.6 Placement of Geomembrane Liner	31667	SY		$3.60	$4.50	$2.25		$114,000.00	$142,500.00	$71,250.00	$327,750.00
	4.7 Placement of Geocomposite Drainage Layer	31667	SY		$4.50	$1.80	$0.90		$142,500.00	$57,000.00	$28,500.00	$228,000.00
	4.8 Import and Place Cover Soil	15833	CY		$8.00	$2.00	$2.00		$126,666.67	$31,666.67	$31,666.67	$190,000.00
	4.9 Import and Place Vegetative Layer	5278	CY		$20.00	$4.00	$4.00		$105,555.56	$21,111.11	$21,111.11	$147,777.78
	4.10 Toe Stabilization/Protection	3656	CY		$24.00	$6.00	$4.00		$87,747.56	$21,936.89	$14,624.59	$124,309.04
5	SITE RESTORATION											
	5.1 Installation of New Monitoring Wells	12	EACH	$3,200.00				$38,400.00				$38,400.00
	5.2 Restore Areas I and III, Sand	3050	CY		$10.50	$2.00	$1.00		$32,027.33	$6,100.44	$3,050.22	$41,178.00
	5.3 Restore Areas I and III, Vegetation	1.9	AC	$25,000.00				$47,265.84				$47,265.84
	5.4 Vegetative Establishment - Cap	1	LS	$45,000.00				$45,000.00				$45,000.00
	5.5 Land Use Controls	1	LS	$12,000.00				$12,000.00				$12,000.00
6	OVERSIGHT											
	6.1 Field Personnel	12	MONTH			$26,000.00				$312,000.00		$312,000.00
	6.2 Third-Party Field Oversight	12	MONTH			$3,900.00				$46,800.00		$46,800.00
	SUBTOTAL DIRECT COST							$362,005.84	$1,172,423.08	$854,842.67	$567,423.91	$2,956,695.50

3/6/02

Present Worth Calculation
Modified Alternative 2a - Excavation and Consolidation of Pesticide and Inorganic Contaminated Sediment in Excess of Ecological RGOs and Containment of Waste

Marine Corps Recruit Depot
Parris Island, South Carolina

Year	Maintenance Cost	Monitoring Cost		Subtotal of Annual O & M Cost	Annual Discount Rate	Annual Present Worth Cost
	(Years 1 - 30)	(Year 1)	(Years 2 - 30)		7.00%	
1	$5,000.00	$64,560.00		$69,560.00	0.935	$65,009
2	$5,000.00		$16,140.00	$21,140.00	0.873	$18,464
3	$5,000.00		$16,140.00	$21,140.00	0.816	$17,257
4	$5,000.00		$16,140.00	$21,140.00	0.763	$16,128
5	$5,000.00		$23,040.00	$28,040.00	0.713	$19,992
6	$5,000.00		$16,140.00	$21,140.00	0.666	$14,086
7	$5,000.00		$16,140.00	$21,140.00	0.623	$13,165
8	$5,000.00		$16,140.00	$21,140.00	0.582	$12,304
9	$5,000.00		$16,140.00	$21,140.00	0.544	$11,499
10	$5,000.00		$23,040.00	$28,040.00	0.508	$14,254
11	$5,000.00		$16,140.00	$21,140.00	0.475	$10,043
12	$5,000.00		$16,140.00	$21,140.00	0.444	$9,386
13	$5,000.00		$16,140.00	$21,140.00	0.415	$8,772
14	$5,000.00		$16,140.00	$21,140.00	0.388	$8,198
15	$5,000.00		$23,040.00	$28,040.00	0.362	$10,163
16	$5,000.00		$16,140.00	$21,140.00	0.339	$7,161
17	$5,000.00		$16,140.00	$21,140.00	0.317	$6,692
18	$5,000.00		$16,140.00	$21,140.00	0.296	$6,255
19	$5,000.00		$16,140.00	$21,140.00	0.277	$5,845
20	$5,000.00		$23,040.00	$28,040.00	0.258	$7,246
21	$5,000.00		$16,140.00	$21,140.00	0.242	$5,106
22	$5,000.00		$16,140.00	$21,140.00	0.226	$4,772
23	$5,000.00		$16,140.00	$21,140.00	0.211	$4,459
24	$5,000.00		$16,140.00	$21,140.00	0.197	$4,168
25	$5,000.00		$23,040.00	$28,040.00	0.184	$5,166
26	$5,000.00		$16,140.00	$21,140.00	0.172	$3,640
27	$5,000.00		$16,140.00	$21,140.00	0.161	$3,402
28	$5,000.00		$16,140.00	$21,140.00	0.150	$3,180
29	$5,000.00		$16,140.00	$21,140.00	0.141	$2,971
30	$5,000.00		$23,040.00	$28,040.00	0.131	$3,684

TOTAL OPERATION AND MAINTENANCE COST - PRESENT WORTH **$322,468.40**

Operation and Maintenance Costs
Modified Alternative 2a - Excavation and Consolidation of Pesticide and Inorganic Contaminated Sediment in Excess of Ecological RGOs and Containment of Waste

Marine Corps Recruit Depot
Parris Island, South Carolina

Item	Quantity	Unit	Unit Cost				Extended Cost				Total
			Subcontract	Materials	Labor	Equipment	Subcontract	Materials	Labor	Equipment	Cost
1 CAP MAINTENANCE (Years 1 to 30)											
1.1 General Cap Repairs - Soil Erosion	1	LS	$4,000.00				$4,000.00				$4,000.00
1.2 Vegetation Replacement	1	LS	$1,000.00				$1,000.00				$1,000.00
										ANNUAL COST	**$5,000.00**
2 MONITORING (Year 1)											
2.1 Site Inspection and Sample Collection	4	EACH		$300.00	$2,400.00	$300.00		$1,200.00	$9,600.00	$1,200.00	$12,000.00
2.2 Groundwater Laboratory Analysis	48	EACH	$900.00				$43,200.00				$43,200.00
2.3 Monitoring and Natural Attenuation Report	4	EACH		$100.00	$2,240.00			$400.00	$8,960.00		$9,360.00
										ANNUAL COST	**$64,560.00**
3 MONITORING (Years 2 to 30)											
3.1 Site Inspection and Sample Collection	1	EACH		$300.00	$2,400.00	$300.00		$300.00	$2,400.00	$300.00	$3,000.00
3.2 Groundwater Laboratory Analysis	12	EACH	$900.00				$10,800.00				$10,800.00
3.3 Monitoring and Natural Attenuation Report	1	EACH		$100.00	$2,240.00			$100.00	$2,240.00		$2,340.00
										ANNUAL COST	**$16,140.00**
4 FIVE-YEAR REVIEW (Years 5, 10, 15, 20, 25, and 30)											
4.1 Report for Review of Data and Evaluation	1	EACH		$500.00	$6,400.00			$500.00	$6,400.00		$6,900.00
										ANNUAL COST	**$6,900.00**

Cost Summary
Alternative 2a - Excavation and Consolidation of Pesticide and Inorganic Contaminated Sediment in Excess of Ecological RGOs and Containment of Waste

Marine Corps Recruit Depot
Parris Island, South Carolina

Cost Buildup Items	Percentage	Extended Cost				Total Cost
		Subcontract	Materials	Labor	Equipment	
SUBTOTAL DIRECT COST		$362,005.84	$1,172,423.08	$854,842.67	$567,423.91	$2,956,695.50
Overhead on Labor Cost	30%			$256,452.80		$256,452.80
G & A on Labor Cost	10%			$85,484.27		$85,484.27
G & A on Material Cost	10%		$117,242.31			$117,242.31
G & A on Subcontract Cost	10%	$36,200.58				$36,200.58
FOGMA on Equipment Cost	7%				$39,719.67	$39,719.67
SUBTOTAL DIRECT COST		$398,206.42	$1,289,665.39	$1,196,779.74	$607,143.58	$3,491,795.13

INDIRECT COSTS

Indirect Cost Based on Total Direct Cost	30%	$119,461.93	$386,899.62	$359,033.92	$182,143.07	$1,047,538.54
Profit Margin on Total Direct Cost	10%	$39,820.64	$128,966.54	$119,677.97	$60,714.36	$349,179.51
SUBTOTAL INDIRECT COST		$159,282.57	$515,866.15	$478,711.89	$242,857.43	$1,396,718.05
TOTAL DIRECT AND INDIRECT COST		$557,488.99	$1,805,531.54	$1,675,491.63	$850,001.01	$4,888,513.18

CONTINGENCY AND ADMINISTRATIVE COSTS

Project Contingency on Project Cost	20%					$977,702.64
Contract Administration on Total Project Cost	5%					$244,425.66
Engineering on Total Project Cost	5%					$244,425.66
Health and Safety on Total Project Cost	2%					$97,770.26

TOTAL PROJECT CAPITAL COST	**$6,452,837.40**
TOTAL OPERATION AND MAINTENANCE COST - PRESENT WORTH	**$322,468.40**
TOTAL COST FOR ALTERNATIVE 2a	**$6,775,305.80**

D H E C
PROMOTE PROTECT PROSPER
C. Earl Hunter, Commissioner
Promoting and protecting the health of the public and the environment.

August 3, 2006

Commanding Officer
Department of the Navy
SOUTHNAVFACENGCOM
ATTN: Mr. Art Sanford
2155 Eagle Drive
North Charleston, South Carolina 29406

RE: Concurrence
Record of Decision, Site/SWMU 1 – Incinerator Landfill and SWMU 41 – Former Incinerator
Marine Corp Recruit Depot, Parris Island
SC6 170 022 762

Dear Mr. Sanford:

The Corrective Action Engineering Section and Division of Hydrogeology of the South Carolina Department of Health and Environmental Control (Department) have completed the review of the above referenced document, which was received by the Department via email on August 1, 2006. The purpose of this Record of Decision (ROD) is to formalize the remedy for SWMU 1. The remedy includes the consolidation of waste material onto the landfill, the installation of a low permeability cap, slope stabilization and erosion control, long-term monitoring, and land use controls.

The Proposed Plan for SWMU 1 was public noticed on January 31, 2002. A public information session was held on February 19, 2002 to explain the proposed remedy and solicit comments. No comments were received objecting to the proposed remedy.

The Department has deemed the remedy to be protective of human health and the environment and satisfies the RCRA corrective action requirements of Section VI of the Federal Facilities Agreement (FFA) effective March 31, 2006. Consequently, the Department concurs with this ROD.

If you have any questions or concerns, please feel free to contact me at (803) 896-4285.

Sincerely,

Richard Haynes, P.E., Director
Division of Waste Management
Bureau of Land and Waste Management

Attachment:
Memorandum from Don Hargrove to Jerry Stamps dated August 2, 2006

cc:
Tim Harrington, MCRD Parris Island
Don Hargrove, Hydrogeology
Priscilla Wendt, SCDNR
Amanda Flake, EQC Region 8, Beaufort
Lila Koroma-Llamas, EPA Region 4
Tom Dillon, NOAA
Mark Sladic, TtNUS

D H E C
PROMOTE PROTECT PROSPER
2600 Bull Street
Columbia, SC 29201-1708

MEMORANDUM

TO: Jerry Stamps, Engineering Associate
Corrective Action Section
Division of Hazardous Waste Management
Bureau of Land and Waste Management

FROM: Donald C. Hargrove, Hydrogeologist
RCRA Hydrogeology Section I
Division of Hydrogeology
Bureau of Land and Waste Management

DATE: 2 August 2006

RE: Parris Island Marine Corps Recruit Depot (MCRD)
Parris Island, South Carolina
Beaufort County
SC6 170 022 762

DRAFT ROD for Site/SWMU 1 – Incinerator Landfill and SWMU 41 – Former Incinerator Unit (August 2006)

The Division of Hydrogeology has reviewed the Document listed above. This document (dated 1 August 2006) was received electronically on 1 August 2006. It provides a physical description of Solid Waste Management Units (SWMUs) 1 and 41, which includes the history of these SWMUs. It briefly describes previous investigations performed at SWMUs 1 and 41, and compares different remedial technologies to address contaminated media present at these SWMUs. This document describes the selection process for the proposed remedy, and discusses comments received as a result of the public meeting for the Proposed Plan for this Site/SWMU, held on 19 February 2002.

This document was reviewed with respect to R.61-79 of the South Carolina Hazardous Waste Management Regulations (SCHWMR), and appropriate guidance documents. Based on this review, the Division of Hydrogeology has no technical comments, and recommends that this document can be approved as written.

If you have any questions regarding this decision, please call me at (803) 896-4033.

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