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FINAL FIVE YEAR REVIEW FOR OPERABLE UNITS 1, 3, AND 5 (OU 1, OU 3, OU 5) MCRD  
PARRIS ISLAND SC (PUBLIC DOCUMENT)  
08/18/2016  
RESOLUTION CONSULTANTS

**FINAL  
FIVE-YEAR REVIEW FOR OPERABLE UNITS 1, 3, AND 5**



**MARINE CORPS RECRUIT DEPOT  
PARRIS ISLAND, SOUTH CAROLINA**

**Revision: 0**

**Prepared for:**



**Department of the Navy  
Naval Facilities Engineering Command, Mid-Atlantic  
9742 Maryland Avenue  
Norfolk, Virginia 23511-3095**

**Contract Number N62470-11-D-8013  
CTO JM38**

**August 2016**

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**Prepared by:**



**Resolution Consultants  
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**Contract Number N62470-11-D-8013  
CTO JM38**

**August 2016**

A handwritten signature in black ink, appearing to read "Dave Warren", enclosed in a white rectangular box.

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**Dave Warren  
Task Order Manager**

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## List of Acronyms

µg/L	Micrograms per liter
ARAR	Applicable or Relevant and Appropriate Requirement
BEHP	Bis(2-ethylhexyl)phthalate
bgs	Below ground surface
BHC	Hexachlorobenzene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	Corrective Measures Study
COC	Contaminant of concern
COPC	Contaminant of potential concern
CRA	Causeway removal area
CRABA	Causeway removal area borrow area
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
DDTR	DDT Residuals
ECC	Environmental Chemical Company
EMS	Environmental Management System
ERA	Ecological Risk Assessment
ESV	Ecological screening value
FFA	Federal Facility Agreement
FS	Feasibility Study
GIS	Geographical information system
HHRA	Human Health Risk Assessment
HI	Hazard Index
IAS	Initial Assessment Study
ILCR	Incremental Lifetime Cancer Risk
IRA	Interim Remedial Action
IROD	Interim Record of Decision
IRP	Installation Restoration Program
LTM	Long-term monitoring
LUC	Land use control
LUCIP	Land Use Control Implementation Plan
LUC RD	Land Use Control Remedial Design
MCL	Maximum contaminant level
MCRD	Marine Corps Recruit Depot
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
Navy	Department of the Navy

NAVFAC	Naval Facilities Engineering Command
NCSU	North Carolina State University
NFA	No further action
NIRIS	Naval Installation Restoration Information Solution
NPL	National Priorities List
NREAO	Natural Resources and Environmental Affairs Office
O&M	Operations and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable unit
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCP	Pentachlorophenol
PRG	Preliminary Remediation Goal
RA	Restoration area
RABA	Restoration area borrow area
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RAO	Remedial action objective
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFA	Resource Conservation and Recovery Act Facility Assessment
RFI	Resource Conservation and Recovery Act Facility Investigation
RGO	Remedial goal options
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SDZ	Surface danger zone
S-IES	Solutions-IES
SLERA	Screening Level Ecological Risk Assessment
SMP	Site Management Plan
SOP	Standard operating procedure
SVOC	Semi-volatile organic compound
SWMU	Solid waste management unit
TCL	Target compound list
TDS	Total dissolved solids
TEQ	Toxicity equivalent concentrations
TtNUS	Tetra Tech NUS, Inc.
U.S. EPA	United States Environmental Protection Agency
USMC	United States Marine Corps
UU/UE	Unlimited use and unrestricted exposure
VOC	Volatile organic compound

## **EXECUTIVE SUMMARY**

This five-year review has been prepared by the Department of the Navy, Naval Facilities Engineering Command Mid-Atlantic and Marine Corps Recruit Depot (MCRD) Parris Island, for the following Operable Units (OUs) at Marine Corps Recruit Depot Parris Island in Beaufort County, South Carolina:

- OU 1 — Site 1/Solid Waste Management Unit (SWMU) 1 (Incinerator Landfill) and Site 41/SWMU 41 (Former Incinerator)
- OU 3 — Site 3/SWMU 3 (Causeway Landfill)
- OU 5 — Site 12/SWMU 10 (Jericho Island Disposal Area)

This is the third five-year review for Marine Corps Recruit Depot Parris Island. In accordance with Navy policy, the triggering action for this five-year review is the U.S. Environmental Protection Agency signature on the previous MCRD Parris Island Five-Year Review, dated 17 September 2010.

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## Five-Year Review Summary Form

SITE IDENTIFICATION		
<b>Site Name:</b> Marine Corps Recruit Depot Parris Island		
<b>EPA ID:</b> SC6170022762		
<b>Region:</b> 4	<b>State:</b> SC	<b>City/County:</b> Parris Island/Beaufort
SITE STATUS		
<b>NPL Status:</b> Final		
<b>Multiple OUs?</b> Yes	<b>Has the site achieved construction completion?</b> No	
REVIEW STATUS		
<b>Lead agency:</b> Other Federal Agency <b>If "Other Federal Agency" was selected above, enter Agency name:</b> Department of the Navy, Naval Facilities Engineering Command Mid-Atlantic		
<b>Author name (Federal or State Project Manager):</b> Jose Parra		
<b>Author affiliation:</b> Navy Remedial Project Manager		
<b>Review period:</b> 13 November 2014 — 17 September 2015		
<b>Date of site inspection:</b> 14 January 2015; 5 February 2015		
<b>Type of review:</b> Statutory		
<b>Review number:</b> 3		
<b>Triggering action date:</b> 17 September 2010		
<b>Due date (five years after triggering action date):</b> 17 September 2015		

### Five-Year Review Summary Form (continued)

Issues/Recommendations				
Issues and Recommendations Identified in the Five-Year Review:				
<b>OU(s): OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> Maintenance (i.e., removal of woody vegetation) is currently implemented on an as-needed basis. A routine maintenance program does not currently exist.			
	<b>Recommendation:</b> Establish a routine maintenance program and implement accordingly.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	17 SEPT 2017
<b>OU(s): OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> The Base Master Plan, Depot Order, and associated records (e.g., Geographic Information System (GIS)) do not fully institutionalize site-specific Land Use Control (LUC) restrictions.			
	<b>Recommendation:</b> Reassess and clarify process and procedures to fully institutionalize LUC Remedial Design (RD) requirement.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	17 SEPT 2017
<b>OU(s): OU 3 (Site 3/SWMU 3)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> Sinkholes in the vicinity of the culverts have been identified in the causeway landfill cover.			
	<b>Recommendation:</b> Finalize Addendum to Remedial Action Work Plan and establish a Site Management Plan schedule to complete the work plan requirements by September 2019.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	01 MAR 2017

### Five-Year Review Summary Form (continued)

Issues/Recommendations				
<b>OU(s): OU 3 (Site 3/SWMU 3)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> Surface erosion and exposed geotextile has been noted along the slope (near the northern fishing dock) in the vicinity of the northern culverts.			
	<b>Recommendation:</b> Address eroded surface areas in the vicinity of the northern culverts in the Addendum to Remedial Action Work Plan for Site 3.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	01 MAR 2017
<b>OU(s): OU 3 (Site 3/SWMU 3)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> Erosion has also been observed on the marsh side of the Causeway at the southern end of the Causeway.			
	<b>Recommendation:</b> Evaluate erosion on the marsh side of the Causeway at the southern end of the Causeway to determine the need for repairs.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	17 SEPT 2017
<b>OU(s): OU 3 (Site 3/SWMU 3)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> Maintenance is currently implemented on an as-needed basis. A routine maintenance program does not currently exist.			
	<b>Recommendation:</b> Establish a routine maintenance program and implement accordingly.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	17 SEPT 2017

**Five-Year Review Summary Form (continued)**

<b>Issues/Recommendations</b>				
<b>OU(s): OU 3 (Site 3/SWMU 3)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> The Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully institutionalize site-specific LUC restrictions.			
	<b>Recommendation:</b> Reassess and clarify process and procedures to fully institutionalize LUC RD requirements.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	17 SEPT 2017
<b>OU(s): OU 5 (Site 12/SWMU 10)</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> The Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully institutionalize site-specific LUC restrictions.			
	<b>Recommendation:</b> Reassess and clarify process and procedures to fully institutionalize LUC RD requirements.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	Federal Facility	U.S. EPA/SCDHEC	17 SEPT 2017

## Five-Year Review Summary Form (continued)

PROTECTIVENESS STATEMENTS		
<p><i>OU 1</i> <i>(Incinerator Landfill, Site 1/SWMU 1 and Former Incinerator, Site 41/SWMU 41)</i></p>	<p><i>Protectiveness Determination:</i> Short-term Protective</p>	<p><i>Addendum Due Date</i> <i>(if applicable):</i></p>
<p><i>Protectiveness Statement:</i></p> <p>The remedy at OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) currently protects human health and the environment because sediment excavation/consolidation, waste consolidation, capping, marsh grass restoration, and the installation of revetments eliminate direct contact and contaminant migration pathways. Groundwater monitoring ensures contamination is not migrating offsite. The Navy has implemented land use controls which currently prevent disturbance of waste and unacceptable soil and groundwater exposures. However, in order for the remedy to be protective in the long term, the following actions need to be taken to ensure long-term protectiveness: establish a routine maintenance program and implement accordingly; reassess and clarify process and procedures to fully institutionalize Land Use Control Remedial Design requirements.</p>		
<p><i>OU 3</i> <i>(Causeway Landfill, Site 3/SWMU 3)</i></p>	<p><i>Protectiveness Determination:</i> Short-term Protective</p>	<p><i>Addendum Due Date</i> <i>(if applicable):</i></p>
<p><i>Protectiveness Statement:</i></p> <p>The remedy at OU 3 (Site 3/SWMU 3) currently protects human health and the environment because the cover components of the remedy eliminated direct contact with waste, soil, and sediment and minimized migration of contamination to environmental media. Groundwater monitoring ensures contamination is not migrating offsite. The Navy has implemented land use controls which currently prevent disturbance of wastes, unacceptable soil and groundwater exposures, and ingestion of fish. However, in order for the remedy to be protective in the long term, the following actions need to be taken to ensure long-term protectiveness: for sinkholes finalize Addendum to Remedial Action Work Plan and establish a site management plan schedule to complete the work plan requirements by September 2019; address the eroded surface areas in the vicinity of the northern culverts in the Addendum to Remedial Action Work Plan for Site 3; evaluate erosion on the marsh side of the causeway at the southern end of the causeway to determine the need for repairs; establish a routine maintenance program and implement accordingly; reassess and clarify process and procedures to fully institutionalize Land Use Control Remedial Design requirements.</p>		
<p><i>OU 5</i> <i>(Jericho Island Disposal Area, Site 12/SWMI)</i></p>	<p><i>Protectiveness Determination:</i> Short-term Protective</p>	<p><i>Addendum Due Date</i> <i>(if applicable):</i></p>
<p><i>Protectiveness Statement:</i></p> <p>The remedy at OU 5 (Site 12/SWMU 10) currently protects human health and the environment because the removal components of the remedy eliminated direct contact and contaminant migration pathways. The Navy has implemented land use controls which currently prevent unacceptable groundwater exposure. However, in order for the remedy to be protective in the long term, the following action needs to be taken to ensure long-term protectiveness: reassess and clarify process and procedures to fully institutionalize Land Use Control Remedial Design requirements.</p>		

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**AUTHORIZING SIGNATURE**

By my signature below, I approve the issuance of this Five-Year Review for the Marine Corps Recruit Depot, Parris Island, South Carolina.



18 Aug 16

Title: Assistant Chief of Staff, Installation and Logistics  
By direction of the Commanding General  
Marine Corps Recruit Depot Parris Island, South Carolina

Date

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## **1.0 INTRODUCTION**

The Department of the Navy (Navy), comprised of the United States Navy and the United States Marine Corps, is performing this five-year review at Marine Corps Recruit Depot (MCRD) Parris Island located in Beaufort County, South Carolina (Figure 1-1).

### **1.1 Purpose of the Five-Year Review**

The purpose of this five-year review is to evaluate implementation and performance of remedies at three operable units (OUs) to determine if they are protective of human health and the environment.<sup>1</sup> The methods, findings, and conclusions of the review are documented in this five-year review report. In addition, this report will document any deficiencies identified during the review and recommend specific follow-up actions to address them.

### **1.2 Authority for Conducting the Five-Year Review**

This five-year review was prepared pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section §121(c), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan in Title 40 Code of Federal Regulations §300.430(f)(4)(ii). Consistent with Executive Order 12580, the Secretary of Defense is responsible for ensuring that five-year reviews are conducted at federal facility sites under jurisdiction, custody, or control of the Department of Defense. The Navy, defined herein as Naval Facilities Engineering Command Mid-Atlantic (NAVFAC Mid-Atlantic) and MCRD Parris Island, is the lead agency responsible for this five-year review at MCRD Parris Island, working with the United States Environmental Protection Agency (U.S. EPA) and South Carolina Department of Health and Environmental Control (SCDHEC) under a Federal Facility Agreement (FFA).<sup>2</sup> At MCRD Parris Island, the Environmental Restoration Program, which comprises the Installation Restoration Program (IRP) and Munitions Response Program, is responsible for ensuring that appropriate CERCLA response alternatives are developed and implemented as necessary to protect public health, welfare, and the environment.

MCRD Parris Island has operated under Resource Conservation and Recovery Act (RCRA) Interim Status since 1990, which has resulted in corrective action activities and documents with both CERCLA and RCRA components: for example, combined Remedial Investigation (RI)/RCRA Facility Investigation (RFI) and Feasibility Study (FS)/Corrective Measures Study (CMS) reports.<sup>3</sup>

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<sup>1</sup> OUs are the U.S. EPA's designation for the purposes of tracking within the Comprehensive Environmental Response, Compensation, and Liability Information System database.

<sup>2</sup> The FFA, dated January 2005, became effective on 31 March 2006.

<sup>3</sup> The FFA states that CERCLA documents are acceptable as RCRA-equivalent by the SCDHEC.

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This Five-Year Review will follow the IRP naming convention outlined in the Draft D-1 Marine Corps Recruit Depot Parris Island Federal Facilities Agreement Site Management Plan Amendment Fiscal Year 2015 (United States Navy 2015). Table 1-1 identifies the IRP site numbers and common names, and cross references RCRA Solid Waste Management Unit (SWMU) numbers as well as FFA reference names, for sites included in this five-year review.

<b>Table 1-1</b>				
<b>Operable Units at Marine Corps Recruit Depot Parris Island</b>				
<b>Operable Unit</b>	<b>Installation Restoration Program Site Number</b>	<b>SWMU Number</b>	<b>Site/SWMU Name</b>	<b>FFA/SMP Nomenclature</b>
1	Site 1	SWMU 1	Incinerator Landfill	Site 1/SWMU 1
	Site 41	SWMU 41	Former Incinerator	Site 41/SWMU 41
3	Site 3	SWMU 3	Causeway Landfill	Site 3/SWMU 3
5	Site 12	SWMU 10	Jericho Island Disposal Area	Site 12/SWMU 10

**Notes:**

- FFA = Federal Facility Agreement
- SMP = Site Management Plan
- SWMU = Solid Waste Management Unit

This is the third five-year review for MCRD Parris Island, and is a statutory review due to the hazardous substances, pollutants, and contaminants, which remain at each site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The trigger event for the first Five-Year Review was the 26 September 2000, start date for interim remedial action (IRA) at Site 3. The first Five-Year Review (September 2005) addressed Site 1 and Site 41, and Site 3. The second Five-Year Review (September 2010), which was signed by the MCRD Parris Island Commanding General on 10 August 2010, and approved by the U.S. EPA on 17 September 2010, included Site 1 and Site 41, Site 3, and Site 12.

Following approval of the second Five-Year Review, the trigger date for five-year reviews at MCRD Parris Island was re-established as the U.S. EPA signature date of the 2010 Five-Year Review (17 September 2010). A five-year review is therefore due every five years from 17 September 2010. The Draft 2015 Five-Year Review was provided to the MCRD Parris Island Partnering Team for review on 28 May 2015; however, due to extenuating circumstances additional time was required for comment resolution. To satisfy U.S. EPA requirements for five-year reviews in advance of the 17 September 2015 trigger date, the U.S. EPA issued a *Five-Year Review Protectiveness Determination for Operable Units 1, 3, and 5 for the MCRD Parris Island, Parris Island, South Carolina*, on 15 September 2015 (U.S. EPA 2015a). Since that time, the MCRD Parris Island

Partnering Team has discussed the due date for submittal of the revised five-year review document. In order to allow for resolution of pending comments and facilitate review by NAVFAC Mid-Atlantic and U.S. EPA legal counsel, revised due dates were negotiated. As documented in a 21 September 2015 letter, from the U.S. EPA to NAVFAC Mid-Atlantic (U.S. EPA 2015b), the final 2015 Five-Year Review will be submitted for approval by the MCRD Parris Island Partnering Team by 31 May 2016. The Final 2015 Five-Year Review will reference the U.S. EPA's 17 September 2015, protectiveness determination and incorporate findings accordingly.

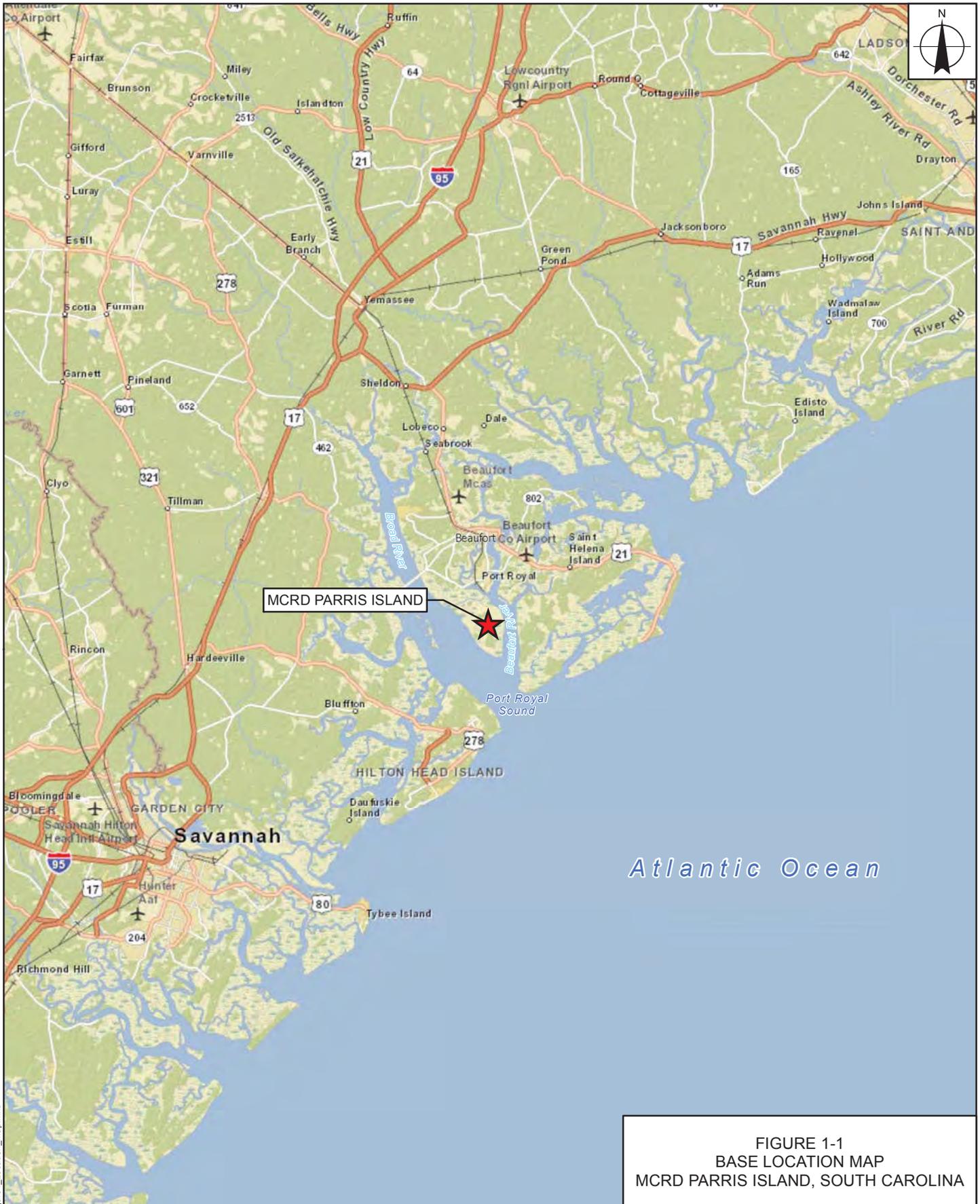
### **1.3 Report Organization**

This report is organized to meet the general format requirements specified in the Comprehensive Five-Year Review Guidance (U.S. EPA, June 2001), summarizing the results of the five-year review of each site in a cohesive and comprehensive manner. The remainder of Section 1 provides an overview of MCRD Parris Island and five-year review elements common to each site. Sections 2, 3, and 4 consist of the five-year reviews for Site 1 and Site 41, Site 3, and Site 12, respectively.

Each five-year review section includes discussions on chronology and background, remedial action progress since the last five-year review, findings, technical assessment, issues, recommendations, and protectiveness statements. Section 5 lists references used during this five-year review.



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MCRD PARRIS ISLAND

Atlantic Ocean

FIGURE 1-1  
 BASE LOCATION MAP  
 MCRD PARRIS ISLAND, SOUTH CAROLINA

1 inch = 10 miles



REQUESTED BY: D. WARREN	DATE: 4/28/2015
DRAWN BY: M. SENNE	TASK ORDER NUMBER: JM38

Source: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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The five-year review was conducted using the following U.S. EPA and Navy guidance.

- Navy/Marine Corps Policy for Conducting CERCLA Five-Year Reviews. May 2011.
- U.S. EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P Comprehensive Five-Year Review Guidance. U.S. EPA. June 2001.
- OSWER Directive 9355.7-18 Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance. U.S. EPA. 2011.
- OSWER Directive 9200.2-111 Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews. U.S. EPA. September 2012.
- Naval Facilities Engineering Command (NAVFAC) Toolkit for Preparing Five-Year Reviews. NAVFAC. April 2013.

## **1.4 Background**

MCRD Parris Island occupies roughly 8,000 acres in Beaufort County, South Carolina. The Depot is situated along the southeastern coast of South Carolina, immediately south of the Town of Port Royal and 6 miles south of the City of Beaufort. MCRD Parris Island lies within a system of islands, salt marshes, saltwater creeks, tidal ponds, and streams with interconnecting man-made causeways providing vehicular access from Port Royal and Beaufort through Horse Island and Scout Island (Figure 1-2).

### **1.4.1 History**

MCRD Parris Island has operated as a recruit reception and training facility for the United States Marine Corps (USMC) since 1915. Jericho Island, which includes Site 12, was acquired by the Navy in 1968.

The Navy conducted an Initial Assessment Study (IAS) of MCRD Parris Island in 1986, followed by a RCRA Facility Assessment (RFA) in April 1990. The RFA was conducted following the Navy's submittal of a RCRA Part A Permit Application for a Hazardous Waste Storage Building. The Part A Permit Application was later withdrawn; however, the Depot remains under RCRA Interim Status (see the FFA for additional details on the integration of CERCLA response obligations and RCRA corrective action obligations under Section 3005(e) of RCRA, 42 U.S.C. 6925(e)).

After MCRD Parris Island was placed on the National Priorities List (NPL) on 16 December 1994, the MCRD Parris Island Partnering Team (comprised of representatives from the Navy, including NAVFAC and MCRD Parris Island, U.S. EPA, and SCDHEC) commenced meetings to facilitate development, review, and approval of work plans, reports, and decision documents. In 1997, representatives of the National Oceanic and Atmospheric Administration, South Carolina Department of Natural Resources (SCDNR), and U.S. Fish and Wildlife Service were recognized as natural resource trustees for the Environmental Restoration Program at MCRD Parris Island.

The first Five-Year Review, issued in September 2005, provided IRP information for 55 areas (i.e., Sites, SWMUs, Areas of Concern), their status (e.g., No Further Investigation, Under Review, No Further Action [NFA] proposed, or the Fiscal Year for proposed work), and governing regulatory program (e.g., SCDHEC underground storage tank program). Sites which have achieved NFA, as well as those requiring additional investigation, are summarized in the Draft D-1 Marine Corps Recruit Depot Parris Island Federal Facilities Agreement Site Management Plan Amendment Fiscal Year 2015 (United States Navy 2015). The second Five-Year Review (September 2010) was limited to Site 1 and Site 41, Site 3, and Site 12.

## **1.4.2 Physical Characteristics**

### **1.4.2.1 Physiography and Topography**

MCRD Parris Island is in the Atlantic Coastal Plain of eastern South Carolina, widely referred to as the Lowcountry, between the Broad and Beaufort Rivers. Elevations, range from sea level to 22 feet above North American Vertical Datum of 1988, with an average elevation of 5 feet North American Vertical Datum of 1988 (Parsons 2014). Due to the low elevation, the majority of the Depot is within the 100-year flood plain. Approximately half of the Depot's real property consists of tidal marsh (Parsons 2014).

### **1.4.2.2 Climate**

MCRD Parris Island is in the southernmost region of South Carolina, where the coastal zone has a subtropical climate with warm humid summers and mild winters (Parsons 2014). Weather conditions are generally mild with average temperatures around 70 degrees Fahrenheit and humidity between 70 and 80 percent. Average summer temperatures range from 55 to 89 degrees Fahrenheit. During winter months, average daily temperatures range from 38 to 65 degrees Fahrenheit. Annual precipitation is approximately 50 inches, two-thirds of which falls between October and March. Maximum rainfall (approximately 7 inches) occurs during July and minimum rainfall (approximately 2 inches) occurs in November. Tropical storms occur on an average of once every 2 or 3 years, most commonly in October and November (Dames & Moore 1986).



FIGURE 1-2  
2015 FIVE-YEAR REVIEW SITE LOCATIONS  
MCRD PARRIS ISLAND, SOUTH CAROLINA

REQUESTED BY: D. WARREN		DATE: 8/10/2015	
DRAWN BY: M. SENNE		TASK ORDER NUMBER: JM38	

Aerial Imagery Date: 09-18-2013

0	1,500	3,000	4,500	6,000
Feet				

X:\Navy\ParrisIsland\Figure 1-2\_Site\_Locs.mxd

Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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### **1.4.2.3 Geology**

Beaufort County and MCRD Parris Island are in the southern portion of the Atlantic Coastal Plain physiographic province. Four geological units present in the Beaufort County Area are the Pleistocene sands and clays, the Hawthorn Formation, the Cooper Marl, and the Santee Limestone.

- The Pleistocene Epoch was marked by sea-level fluctuations that are recorded in the sediment depositional record as land emergence and submergence cycles (transgressive and regressive seas). That process resulted in deposition of approximately 40 to 70 feet of Pleistocene-age sands (the marine sands) and low permeability clay beds above the limestone bedrock.
- The Hawthorn Formation of Miocene age primarily consists of a thin (5 to 15 feet thick) Lower Miocene limestone known as the Tampa Limestone. The Tampa Limestone is composed of phosphatic sand, sandy marl, or sandy clay in southwest Beaufort County. The Hawthorn Formation also consists of sandy, clayey materials that are frequently eroded and therefore, locally discontinuous in coastal Beaufort County.
- In the area near Parris Island, the Cooper Marl of Oligocene age consists of phosphatic greenish-gray clay and fine-grained sand with a moderate to very abundant amount of shells. The Cooper Marl in the Parris Island area serves as a confining unit to the underlying Santee Limestone. Within the region of the Depot, the top of the unit is 20 to 120 feet below ground surface (bgs).
- The Santee Limestone of Eocene age is primarily composed of relatively pure to impure limestone containing clay, shale, or relatively thick marls.

The U.S. Soil Conservation Service mapped 17 different soils at MCRD Parris Island during a soil survey of Beaufort and Jasper Counties (Stuck 1980). Subsurface investigations have identified eight soil types and three soil units (Bohicket-Capers-Handsboro, Coosaw-Williman-Ridgeland, and Wando-Seabrook-Seewee) at MCRD Parris Island (Parsons 2014). In general, soil consists of a mixture of moderately well- to poorly drained sand and loam, with areas closest to the shore poorly drained due to the presence of clay subsoil. Soil at each site varies, with subsurface geology affected by human activities (e.g., landfilling, construction) as discussed in Sections 2.3.1 (Site 1 and Site 41), 3.3.1 (Site 3), and 4.3.1 (Site 12).

#### **1.4.2.4 Hydrogeology**

Two primary aquifers are present at the Depot, the shallow surficial aquifer and the Floridan Aquifer. These aquifers are separated by the Hawthorn/Cooper Marl Formation, which serves as a confining unit to the underlying Floridan Aquifer. Groundwater on Parris Island ranges from brackish to saline, and is not suitable for consumption or irrigation purposes due to salinity or total dissolved solids (TDS) concentrations. Potable water in the area is supplied by the Beaufort-Jasper Water and Sewer Authority.

#### **Shallow Surficial Aquifer**

In the MCRD Parris Island area, the shallow unconfined surficial aquifer generally consists of permeable, fine to medium marine sands, along with some silts and clays, deposited in barrier island depositional facies. The aquifer is typically 30 feet thick. The water table typically ranges from 0 to 10 feet bgs. Surface relief is relatively low.

Water-table fluctuations in the shallow surficial aquifer are a function of ocean tidal influence, surface recharge from creeks, rainfall, and evapotranspiration. The fluctuations in the aquifer 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. Although the shallow surficial aquifer is not used at Parris Island, the State Water Classifications and Standards "GB" classify the aquifer (effective 28 June 1995) as a potential underground source of drinking water.

A shallow surficial aquifer pumping test was conducted in the early 1990s immediately west of Marine Corps Air Station Beaufort at the Kalama Specialty Chemical Company. The rate of groundwater flow in the shallow surficial aquifer was generally in the range of 0.2 to 1.2 feet per day (SCDHEC 1982).

#### **Hawthorn Formation and Cooper Marl Aquitard**

The Miocene-age Hawthorn Formation and the underlying Oligocene-age Cooper Marl form an aquitard between the shallow surficial aquifer and the Floridan Aquifer, with a reported thickness of 2 to 40 feet in the South Carolina Lowcountry area. The Hawthorn Formation was not encountered in the northwest portion of MCRD Parris Island. The potential of the Hawthorn Formation as an aquifer is doubtful, owing to its thinness and general lithology; little is known about its water-bearing characteristics.

## **Floridan Aquifer**

The Floridan Aquifer is a regional aquifer and extends continuously from South Carolina into Florida. This aquifer is the most important source of groundwater in the South Carolina Lowcountry area, supplying thousands of wells in the central coastal plain. At MCRD Parris Island, the surface of the Floridan Aquifer lies 40 to 90 feet bgs with more than 20 feet of the Hawthorn Formation, the Cooper Marl, and an additional layer of clay under marsh areas confining it. The Santee Limestone corresponds to the Floridan Aquifer, which is considered to be a high-quality aquifer in the upper to middle units; water quality in the lower unit is high in mineral content (including chloride).

Groundwater of the Floridan Aquifer occurs mainly under artesian conditions at MCRD Parris Island. Water supply wells are generally less than 250 feet deep when completed in the aquifer. The aquifer is the only source of potable groundwater west, north, and east of MCRD Parris Island, but the Depot does not use water from the Floridan Aquifer due to high salt content. Groundwater extraction, combined with areas east of the barrier islands where there is no confining layer between the Floridan Aquifer and the saltwater, has led to saltwater intrusion into the Upper Floridan Aquifer.

As noted above, the Beaufort-Jasper Water and Sewer Authority provides drinking water to MCRD Parris Island and the surrounding communities; potable water is sourced from the Savannah River.

### **1.4.2.5 Surface Water**

The Depot is located between the Broad and Beaufort Rivers, which flow into the Port Royal Sound at the southern tip of the Depot. The Beaufort and Broad Rivers meet at the south end of Parris Island to form Port Royal Sound, an estuary of several rivers that extends approximately 4 miles southeast to the Atlantic Ocean. The Depot abuts substantial tidal marsh and rivers. As shown on Figure 1-2, a series of creeks, including Archers Creek and Ribbon Creek in the immediate vicinity of Sites 1, 41, 3, and 12, drain the majority of Parris Island into the Beaufort River (along the east boundary of the Depot) or Broad River (along the west boundary). Drainage off the land surface is typically to storm drains or the nearest surface water. Surface water salinity ranges from 1,950 to 6,820 milligrams per liter (mg/L), making it unsuitable for use as a drinking water source. Surface water bodies in the vicinity of MCRD Parris Island are classified as SA, SB, or SFH by SCDHEC (USMC 2001). Those classes are defined as follows.

- SA — Tidal saltwaters suitable for primary contact recreation; Depot waterways with SA classification include the Broad River and parts of the Beaufort River.

- SB — Tidal saltwaters suitable for secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption; Depot waterways with SB classification include parts of the Beaufort River.
- SFH — Tidal saltwaters protected for shellfish harvesting and suitable for uses listed in Classes SA and SB; Whale Creek is classified SFH.

The only permanent freshwater bodies on the Depot are eleven manmade ponds associated with the golf course (Parsons 2014) in the southern portion of MCRD Parris Island and away from Sites 1, 41, 3, and 12.

### **1.4.3 Land and Resource Use**

#### **1.4.3.1 MCRD Parris Island**

MCRD Parris Island trains and graduates an average of 20,000 recruits per year, with an average daily recruit population of 5,500. MCRD Parris Island is operated and maintained by a permanent staff of over 2,500 personnel. The roughly 8,000-acre Depot, of which approximately 3,262 acres are habitable, is one of three Beaufort County military installations including Marine Corps Air Station Beaufort and Naval Hospital Beaufort. The primary mission of MCRD Parris Island is to recruit and train U.S. Marines. This mission is supported by additional units which train recruits in weapons proficiency, field procedures, and survival. Tenant activities on MCRD Parris Island include the following: 6th Marine Corps District, Naval Medical Branch Clinic, Naval Dental Center, Defense Commissary Agency, Veterinarian Service, Navy Criminal Investigative Service, Naval Federal Credit Union, Fort Sill National Bank, and United States Postal Service.

#### **1.4.3.2 Resources**

The natural environment of the area surrounding MCRD Parris Island is dominated by a series of coastal plain rivers, tidal channels, and an extensive saltwater marsh complex. The shoreline of the Depot, along the Broad and Beaufort Rivers, is characterized by shell beaches, small tidal inlets, and smooth cordgrass. In addition to Parris Island (the largest and most developed island), the Depot consists of seven smaller named islands, many small unnamed islands, salt marshes, and related tidal creeks. Of the approximately 8,000 acres at MCRD Parris Island, approximately 1,500 are devoted to forest management, approximately 750 acres are comprised of grassland and facilities, approximately 4,500 acres are saltwater marsh, and the remainder consists of creeks, ponds, and causeways (Dames & Moore 1986). Parris Island is positioned within SCDHEC shellfish management areas 15 and 17. Within Parris Island, management areas are designated as Approved or Prohibited, some of which overlap with SCDNR designations.<sup>4</sup>

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<sup>4</sup> State shellfish grounds are designated on Parris Island as Area S-064 by the SCDNR, Marine Resources Division, Office of Fisheries Management.

- State shellfish management areas are located to the west, south, and east of Page Field and are approved for both commercial and recreational harvest with appropriate permits.
- Prohibited shellfish management areas are located to the north and northeast of Page Field.

### **1.4.3.3 Land Use**

Parris Island is developed with administrative office buildings, training facilities, recruit and family housing, building and vehicle maintenance shops, and community facilities. Land use patterns on Parris Island have evolved from the eastern shore line when the only access to the island was by boat, progressively west and south to encompass most of the buildable area on the island. Sites 1, 41, 3, and 12 are depicted on Figure 1-2.

### **Mainside**

The Mainside portion of Parris Island is the most heavily developed and includes the Mainside Historic District, with frontage along the shore of the Beaufort River. Existing land use on the Mainside is generally organized around recruit training, and includes barracks, mess halls, physical training fields, and indoor training facilities. In addition to the training areas, the Mainside includes most of the Base Support and Administrative functions including Natural Resources and Environmental Affairs, Facilities Maintenance, Supply and Services, Human Resources and Public Affairs. Community uses are present in the Mainside and include housing, commercial activities, recreational and athletic facilities, museum, theater, religious and family support facilities.

### **Weapons and Field Training Areas**

The Weapons and Field Training Area and Page Field include range and training facilities, along with housing and ancillary community support functions. Historical operations in these areas included airfield operations, which were placed in caretaker status in 1946 (Parsons 2014). Support and recreational functions south of the Weapons and field Training Areas include the golf course, Santa Elena National Historical Landmark, and Elliot's Beach (Parsons 2014).

### **Horse Island**

Horse Island, approximately 1 mile northwest of Mainside, includes a community center, recyclables/waste management facilities, inert landfill, and a boat ramp. Sites 1 and 41 are located on the northeastern tip of Horse Island. Site 3 is the causeway between Horse Island and Parris Island.

## **Jericho Island**

Jericho Island is approximately 1 mile northwest of Horse Island. The Navy acquired Jericho Island in 1968 to extend the impact zone safety area needed down-range of the Depot's small arms firing ranges. For safety purposes, each munitions training range is associated with a safety buffer area, called a surface danger zone (SDZ). The purchase of Jericho Island extended MCRD Parris Island's SDZ. There are no other current uses at Jericho Island. There are no roads leading to Jericho Island. Site 12 is located on Jericho Island.

### **1.5 Five-Year Review Process**

This five-year review includes document reviews, site inspections, and interviews and discussions with personnel associated/familiar with the Sites. Section 5 consists of a comprehensive reference list for this five-year review.

#### **1.5.1 Site Inspections**

Initial site inspections were performed on 14 January 2015 by the following personnel:

- David Warren and David Criswell, Resolution Consultants
- Lisa Donohoe, MCRD Parris Island Environmental Restoration Program Manager
- John Holloway, MCRD Parris Island Natural Resources Manager

On 5 February 2015, a follow-up inspection was performed at Sites 1 and 41 by Adam Freeze of Resolution Consultants. Findings associated with the site inspections have been incorporated into applicable sections of this Five-Year Review. Inspection forms and photographs are included in Appendix A.

#### **1.5.2 Interviews**

Interviews were conducted with the following MCRD Parris Island Partnering Team members.

- Lisa Donohoe, MCRD Parris Island Environmental Restoration Program Manager
- Nicole Cowand, former NAVFAC Mid-Atlantic Remedial Project Manager
- Timothy Harrington, MCRD Parris Island Natural Resources and Environmental Affairs Officer
- Lila Llamas, U.S. EPA Region 4 Remedial Project Manager
- Meredith Amick, SCDHEC Remedial Project Manager

An in-person interview was conducted with Ms. Donohoe on 14 January 2015. In person interviews with Ms. Cowand, Mr. Harrington, Ms. Llamas, and Ms. Amick were conducted in conjunction with the 11 February 2015 MCRD Parris Island Partnering Team meeting. During the 11 February 2015 meeting, U.S. EPA made a specific request that administrative aspects of the land use controls (LUCs) be re-assessed. The intent is for LUCs to be institutionalized via geographic information systems (GIS) and the Base Master Plan. Findings associated with interviews have been incorporated into applicable sections of this five-year review.

### **1.5.3 Community Involvement**

A public notice announcing the five-year review process was published in The Beaufort Gazette newspaper from 10 April 2015 through 12 April 2015. The public notice, along with an affidavit of publication, is included in Appendix B.

The estimated completion date for the 2015 Final Five-Year Review is 31 May 2016. The final report will be uploaded to the Naval Installation Restoration Information Solution (NIRIS) database and placed in the Information Repository for MCRD Parris Island at:

Beaufort County Public Library Headquarters  
311 Scott Street  
Beaufort, South Carolina 29902

In addition, the Administrative Record for MCRD Parris Island can be accessed on-line through the following NAVFAC Mid-Atlantic public website: <http://go.usa.gov/36SzJ>

### **1.6 Applicable or Relevant and Appropriate Requirements, To-Be-Considered Criteria, and Site-Specific Action Levels**

Applicable or Relevant and Appropriate Requirements (ARARs), as identified in each site's Record of Decision (ROD), were reviewed to identify any changes that could potentially affect the protectiveness of the remedy. While multiple action- and location-specific ARARs have changed since ROD signature dates, a review of the changes indicates that they have no effect on remedy protectiveness: the landfills onsite are closed in place, and the current active phases of the remedies consist of LTM. In the future, action- and location-specific ARAR changes could be triggered if remedial actions are changed or supplemented. Please note that changes to specific guidance (e.g., risk assessment guidance) and associated impacts are discussed in site specific evaluation sections included in this five-year review. Chemical-specific ARARs are discussed in each site specific evaluation section relative to Technical Assessment Question B.

The majority of changes to chemical-specific ARARs since issuance of ROD deliverables include changes to existing standards or addition of new constituents. Primary changes are summarized below:

- Since three of the four sites are landfill/disposal areas, any modifications or activities, which could have an impact to adjacent navigable waterways, require evaluation in the context of revisions to South Carolina's recently revised waste management and post-closure care regulations, recent modifications to the Clean Water Act, and other sections originally deemed relevant and appropriate in the Record of Decisions.<sup>5</sup>
- Since all four sites are in coastal floodplains, any future activities could impact wetlands or sensitive areas. Modifications to remedial actions (if required) should include an evaluation of potential changes to the Endangered Species Act, related fish and wildlife regulations, coastal management regulations, etc.
- The RODs and other historical decision documents did not specify contaminants of concern (COCs) or remediation levels for groundwater at Site 1 and Site 41, Site 3, or Site 12. Remediation levels are defined as the levels the remedial action needs to achieve in order to be protective of human health and ecological risks (U.S. EPA, January 2014). Instead the RODs concluded that groundwater would be addressed through the containment of the fill and waste, surface soil, and sediment, and the implementation of land use controls (LUCs). Since a COC list is not available, the evaluation performed during this five-year review was limited to analytes included in current long-term monitoring (LTM) programs for groundwater.<sup>6</sup> The objective of this evaluation was to confirm that current ARARs (maximum contaminant levels [MCLs]) are being used in assessing site data, which was determined to be the case.

It should be noted that ongoing LTM likely does not require a reassessment of ARARs. However, any anticipated repair activities (e.g., sinkhole repairs at Site 3) should be performed in full compliance with applicable federal, state, and local regulations; key ARARs will be identified and re-evaluated in forthcoming work planning documents.

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<sup>5</sup> Note that South Carolina revised both its hazardous waste regulations (in 2012) and its sanitary/municipal waste regulations (in 2008). Site 3 is the only Record of Decision to reflect the sanitary/municipal waste updates.

<sup>6</sup> Per U.S. EPA's request, analyte list reviewed was the full scan list evaluated once every five years.

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## **1.7 Risk Assessment Review Process**

In support of this five-year review, remedial action objectives (RAOs) and cleanup goals used at the time of each remedy selection were evaluated to determine validity with regard to current risk assessment methods (Technical Assessment Question B). Exposure pathways, land use, contaminant sources, toxicity values and other contaminant characteristics, risk assessment methods, COCs, and cleanup goals were reviewed in accordance with U.S. EPA's 2001 Five-Year Review Guidance. Findings of the risk assessment review, along with any changes to site conditions and resulting implications associated with the historical risk assessment processes are documented in site-specific sections of this five-year review. Changes that are common to all sites are as follows:

- Risk assessment models, input values, toxicity values, and screening values have changed over time, as recently as January 2015. In May 2014, U.S. EPA exposure models were updated; however, most RAOs were based on the presumptive remedy for municipal landfills, which calls for landfill wastes to be contained and covered, groundwater within the landfill to be monitored, and LUCs to be applied to ensure protectiveness.<sup>7</sup> RAOs were not developed for groundwater outside the landfill boundary as source control actions were expected to result in long-term improvements to groundwater. Remedy protectiveness assessments during this five-year review, therefore, will focus on containment and elimination of exposure pathways during the five-year review process, given presumptive remedy objectives.
- Risk Assessment Guidance for Superfund, Parts E and F (RAGS) (U.S. EPA, 2004, 2009) were published following completion of most RI/RFI and FS/CMS documents. Remediation levels could be affected by changes in RAGS. Risk-based remediation levels were calculated to incorporate current models, input parameters, and toxicity values, allowing for comparisons to confirm the protectiveness of corresponding remedies.
- Current risk assessment guidance would include the following considerations.
  - Risk would be evaluated using a cumulative approach.
  - Updated exposure models, such as models for dermal contact with water.

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<sup>7</sup> CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Interim Guidance) (U.S. EPA 1996)

- Updated exposure model parameters, such as water ingestion rates, exposure durations, body weights, and others updated in U.S. EPA's Region 9 Regional Screening Level (RSL) tables and models in November 2014.
- Updated toxicity values (e.g., slope factors and reference doses) for arsenic, chromium, and various polycyclic aromatic hydrocarbons (PAHs); for example, the cancer slope factor for naphthalene changed as of November 2014, chromium commonly assumed to be hexavalent, and arsenic ingestion models now account for bioavailability that is less than 100 percent for soil.
- Current U.S. EPA guidance recommends screening to identify contaminants of potential concern (COPCs) using U.S. EPA RSL tables, which are based on a target risk of 1.0E-06 and an adjusted target hazard index (HI) of 0.1 (U.S. EPA 2013).
- Ecological benchmarks and other factors have changed and evolved over time. Changes specific to ecological risk assessments (ERAs) are discussed in site-specific sections.

### **1.8 Next Five-Year Review**

As discussed in Section 1.2, a five-year review will be due every five years from 17 September 2010. Following approval of this 2015 Five-Year Review, the next five-year review is scheduled to be completed on 17 September 2020.

## 2.0 OPERABLE UNIT 1 (SITE 1/SWMU 1 AND SITE 41/SWMU 41)

### 2.1 Introduction

OU 1, at the northeastern terminus of Horse Island is comprised of Site 1 (Incinerator Landfill) and Site 41 (Former Incinerator). Historically, the Former Incinerator consisted of a coal-fired brick chamber. The Incinerator Landfill, north of the Former Incinerator, served as the disposal site for combustion residues from 1921 to 1959, when the incinerator ceased operating. The Incinerator Landfill remained in use for disposal of combustible trash and noncombustible waste until 1965.

#### **OU 1 (Site 1/SWMU 1 and SITE 41/SWMU 41) — Current Conditions**

- Incinerator Landfill and Former Incinerator
- Waste consolidation/cap installation in 2005
- Was the RAO to meet UU/UE? — **No**
- Remedy: cap, erosion control, LUCs, landfill inspections, marsh grass monitoring, and LTM of groundwater for select VOCs, select SVOCs, antimony, and arsenic

### 2.2 Site Chronology

Historical events and relevant dates in Site 1 and Site 41 chronology are listed in Table 2-1.

<b>Table 2-1 Chronology of Site Events at Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>	
<b>Event</b>	<b>Date</b>
Initial Assessment Study	September 1986
Interim Resource Conservation and Recovery Act (RCRA) Facility Assessment	April 1990
RCRA Facility Investigation Verification Step	May 1990
Remedial Investigation/RCRA Facilities Investigation Report	June 2001
Phase I Field Work	May to September 1998
Phase II Field Work	April 1999
Feasibility Study/Corrective Measures Study Report	January 2002
Record of Decision signed by MCRD Parris Island Commanding General	2 August 2006
Land Use Control Remedial Design	January 2008
Annual Groundwater Monitoring	2006 to 2009
Annual Long-term Groundwater and Sediment Sampling, Marsh Grass Monitoring/Landfill Operations and Maintenance; since the last five-year review, the following reports have documented landfill conditions: <ul style="list-style-type: none"> <li>• Annual Groundwater Monitoring, Sediment Sampling, Marsh Grass Monitoring and Operations and Maintenance (O&amp;M) Report, October 2011, Site 1/SWMU 1 Incinerator Landfill (Solutions-IES [S-IES], 21 December 2011).</li> <li>• Annual Groundwater Monitoring, Sediment Sampling, Marsh Grass Monitoring and O&amp;M Report, October 2012, Site 1/SWMU 1 Incinerator Landfill, Marine Corps Recruit Depot, Parris Island, South Carolina (S-IES, 21 February 2013).</li> <li>• Annual Groundwater Sampling, Marsh Grass Monitoring and O&amp;M Report, October 2013, Site 1/SWMU 1 Incinerator Landfill, Marine Corps Recruit Depot, Parris Island, South Carolina (S-IES, 20 January 2014).</li> </ul>	2011 to 2015*

<b>Table 2-1 Chronology of Site Events at Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>	
<b>Event</b>	<b>Date</b>
<ul style="list-style-type: none"> <li>• Draft Annual Groundwater Sampling, Marsh Grass Monitoring and O&amp;M Report, October 2014, Site 1/SWMU 1 Incinerator Landfill, Marine Corps Recruit Depot, Parris Island, South Carolina (S-IES, 12 January 2015).</li> </ul>	
Annual Land Use Control compliance certification; since the last five-year review, the following certificates have been issued by MCRD Parris Island for Site 1/SWMU 1: <ul style="list-style-type: none"> <li>• 2010-2011 — 2 August 2012</li> <li>• 2011-2012 — 2 August 2012</li> <li>• 2012-2013 — 13 January 2014</li> <li>• 2013-2014 — 2 June 2015</li> <li>• 2014-2015 — 11 August 2015</li> </ul>	2010 to 2015

**Notes:**

SWMU = Solid Waste Management Unit

MCRD = Marine Corps Recruit Depot

\* = Resolution Consultants, the Navy, and SCDHEC were unable to locate records associated with a 2010 groundwater monitoring event.

## **2.3 Background**

### **2.3.1 Physical Characteristics**

Combined Site 1 and Site 41 occupy approximately 7 acres. The area was wooded with mature pine trees until approximately 2001, when much of the timber was harvested. The Incinerator Landfill, north of the Former Incinerator, extends approximately 670 feet into the marsh and is approximately 400 feet in width. The site layout is depicted on Figure 2-1.

### **Geology and Hydrogeology**

Based on observations made during historical soil borings, surface soils consist of fine- to medium-grained sand with varying amounts of silt and clay. Material was buried in pits, creating topographic high and low areas within the landfill limits. The majority of buried wastes encountered during previous environmental investigations consisted of glass fragments and construction debris near the surface. Generally, the subsurface geology consists of a heterogeneous mixture of tidal- and storm-deposited silt, clay, and sand to approximately 28 feet bgs. Beneath the tidal sands, silts, and clays, soils consist of fine- to coarse-grained sand, with varying clay content to depths of 34 feet bgs. The upper surficial aquifer is approximately 30 feet thick. Groundwater is typically encountered between 2 to 3 feet bgs, with flow generally radial from the center of the landfill to adjacent surface water bodies, which serve as groundwater discharge points (Tetra Tech NUS, Inc. [TtNUS] 2001).



Basemap Source: Google Earth Pro - 11-20-2014

- Notes:**
- All locations are approximate
  - Site, LUC, and cap membrane boundaries were approximated based on figures included in the Land Use Control Remedial Design for Site 1 Incinerator Landfill and Site 41 Former Incinerator, MCRD Parris Island, SC, as prepared by CH2M Hill and dated October 1, 2008.
  - Approximate locations for transect origins and lines are as documented in the Annual Groundwater Sampling, Marsh Grass Monitoring and O&M Report, October 2013, Site 1/SWMU 1 Incinerator Landfill, dated January 20, 2014.
  - Former Incinerator Location was approximated per Figure 2-8 included in the Record of Decision Site 1/SWMU 1 - Incinerator Landfill and SWMU 41 - Former Incinerator, dated August 2006.

- Transect Origin
- Transect Lines
- Area of Erosion and Newly Discovered Debris
- Monitoring Well
- Cap Membrane Boundary
- Approximate Area of Potentially Incomplete Marsh Grass Restoration
- 140 ft Radius
- Site/LUC Boundary
- 

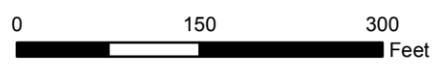


FIGURE 2-1  
SITE LAYOUT  
OPERABLE UNIT 1 (SITE 1/SWMU 1 AND SITE 41/SWMU 41)  
MCRD PARRIS ISLAND, SOUTH CAROLINA

REQUESTED BY: D. WARREN	DATE: 1/26/2016		
DRAWN BY: M. SENNE	TASK ORDER NUMBER: JM38		



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### **2.3.2 Land and Resource Use**

Site 1 and Site 41 are currently vacant, which remains the anticipated future use. Groundwater at Site 1 and Site 41 and the immediate vicinity is not used as a potable water supply; future potable groundwater use is not anticipated due to elevated TDS and salinity. LUCs prohibit extraction of groundwater for purposes other than LTM. Where allowed by depth, surface water near Site 1 and Site 41 is used for recreational boating.

### **2.3.3 History of Contamination**

From 1921 through 1959, the Site 1 Incinerator Landfill received incinerated waste from an approximate 43 feet long, 34 feet tall, and 20 feet wide coal-fired brick chamber incinerator (Site 41). Wastes were placed in trenches along the marsh and combined with fill dirt to extend the land outward. The majority of wastes consisted of combustible domestic wastes and other noncombustible wastes (e.g., cans, bottles, and construction debris); however, hazardous wastes, including, paint thinner/mineral spirits, strippers/methylene chloride, and petroleum products have also been disposed to the incinerator landfill. The IAS noted open burning occurred periodically on the landfill (Dames & Moore 1986). The Incinerator Landfill continued operation for approximately six years after incinerator operations ceased. Based on available information, approximately 56,000 total cubic yards of soil, fill, and waste materials were disposed at the Site (TtNUS 2006). No significant disposal or intrusive activity, beyond remedial action, has occurred since 1965 (TtNUS 2001).

### **2.3.4 Initial Response**

No initial remedial response actions were conducted between the time the Incinerator Landfill ceased operating and the 1986 IAS.

### **2.3.5 Basis for Taking Action**

#### **2.3.5.1 Remedial Investigation Findings**

In accordance with the Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Interim Guidance) (U.S. EPA 1996), the RI/RFI characterized surface soil and downgradient groundwater, surface water, and sediment where the potential for offsite migration of contamination was suspected. At the time of the RI/RFI, waste materials were observed to be exposed at the surface of the Incinerator Landfill. Tidal processes served to wash waste material into surrounding surface water and marsh sediment. The FS/CMS concluded that wastes were ongoing sources of contamination to surface water, sediment, and groundwater, and presented a direct contact threat to human and ecological receptors (TtNUS 2002). To eliminate unacceptable



exposure, the remedy outlined in Section 2.4.2 includes sediment and waste excavation; landfill cap installation; slope stabilization and erosion control; salt marsh restoration and monitoring; maintenance of the cap system; LUCs to prohibit intrusive activities, residential development, and use of groundwater; as well as long-term monitoring of groundwater and sediment.

### 2.3.5.2 Human Health Risk Assessment

A baseline Human Health Risk Assessment (HHRA) was performed at Site 1 and Site 41 to characterize and quantify potential health risks in the absence of remedial action. 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.

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 non-carcinogenic (non-cancer) concerns. For carcinogenic risks, U.S. 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 non-carcinogenic 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 2-2. The table also identifies contaminants which were the main contributors to site risks. Total (all media) cumulative ILCRs and HIs for all media exposure routes (except for fish consumption) are as follows:

	<b><u>Cancer</u></b>	<b><u>Non-cancer</u></b>
Construction Worker:	4.8E-06	HI = <b>2.2</b>
Maintenance Worker:	8.1E-06	HI = 0.2
Adolescent Recreational User:	<b>1.2E-04</b>	HI = 0.3
Adult Recreational User:	6.7E-05	HI = 0.2
Child Resident:	<b>1.4E-04</b>	HI = <b>11.0</b>
Adult Resident:	<b>2.8E-04</b>	HI = <b>1.3</b>
Lifelong Resident:	<b>4.2E-04</b>	HI (not applicable)

The HHRA discounted groundwater use due to its non-potable properties (high salinity/TDS, current and future use of the site as a landfill, and relative absence of toxic constituents) (TtNUS 2001). Cancer risks exceeding  $1.0E-04$  and Non-Cancer risks exceeding 1 are considered to be unacceptable risk and are the basis for taking action at Site 1 (**bolded above**). Exposure to surface waters by the adolescent recreational user and hypothetical future residents resulted in cancer exceedances. Bis(2-ethylhexyl) phthalate and pentachlorophenol are the main contributors of these carcinogenic risks. Ingestion of surface soil by the construction worker as well as hypothetical child, adult, and lifelong future residents resulted in HIs greater than 1.0. Antimony and iron were the main contributors to these non-carcinogenic risks.

ILCRs and HIs for fish consumption were evaluated at three different consumption rates and are specified in Table 2-2.



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**Table 2-2  
 2001 Human Health Risk Assessment Contaminants of Concern at Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)**

Receptor	Media	Exposure Route	Cancer Risk	Contaminant of Concern with Cancer Risk			Hazard Index (HI) > 1	Contaminant of Concern with HI > 1	
				>10 <sup>-4</sup>	>10 <sup>-5</sup>	>10 <sup>-6</sup>			
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	—
	Surface Water	Total	5.3E-07	—	—	—	0.05	—	
		Ingestion	Ingestion	6.5E-08	—	—	—	0.009	—
			Dermal contact	3.8E-06	—	—	BEHP and PCP	0.009	—
			Total	3.9E-06	—	—	BEHP and PCP	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	—	—	cPAHs <sup>(1)</sup>	0.01	—	
		Dermal contact	3.6E-06	—	—	—	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, PCP	—	0.009	—	
Total		1.1E-04	—	BEHP, PCP	—	0.02	—		
Total All Media			1.2E-04				0.3		



**Table 2-2  
 2001 Human Health Risk Assessment Contaminants of Concern at Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)**

Receptor	Media	Exposure Route	Cancer Risk	Contaminant of Concern with Cancer Risk			Hazard Index (HI) > 1	Contaminant of Concern with HI > 1	
				>10 <sup>-4</sup>	>10 <sup>-5</sup>	>10 <sup>-6</sup>			
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, PCP	—	0.006	—	
		Total	6.4E-05	—	BEHP, PCP	—	0.01	—	
	Total All Media			6.7E-05				0.2	
	Fish (maximum concentration in surface water)	Conservative	2E-03	Arsenic, PCP	BEHP	—	23.8	Dibenzofuran, PCP, Arsenic, Iron, Manganese	
		Site-Specific	1.4E-04	PCP	Arsenic	BEHP	8.2	Iron	
		Conservative	6E-04	PCP	Arsenic	BEHP	6.5	Iron	
Site-Specific		4.1E-05	—	PCP	Arsenic	2.2	Iron		
Child Resident	Soil	Ingestion	2.5E-05	—	Arsenic	cPAH, 4,4'-DDT	10.1	Antimony and Iron	
		Dermal contact	5.6E-06	—	—	cPAH, Arsenic	0.6	—	
		Total	3E-05	—	Arsenic	cPAH, 4,4'-DDT	10.7	Antimony and Iron	
	Sediment	Ingestion	5.7E-06	—	—	cPAH, Arsenic	0.2	—	
		Dermal contact	3.1E-06	—	—	cPAH	0.008	—	
		Total	8.8E-06	—	—	cPAH, Arsenic	0.2	—	
	Surface Water	Ingestion	6.4E-07	—	—	—	0.03	—	
		Dermal contact	1E-04	—	BEHP, PCP	—	0.03	—	
		Total	1E-04	—	BEHP, PCP	—	0.06	—	
	Total All Media			1.4E-04				11.0	



**Table 2-2  
 2001 Human Health Risk Assessment Contaminants of Concern at Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)**

Receptor	Media	Exposure Route	Cancer Risk	Contaminant of Concern with Cancer Risk			Hazard Index (HI) > 1	Contaminant of Concern with HI > 1
				>10 <sup>-4</sup>	>10 <sup>-5</sup>	>10 <sup>-6</sup>		
Adult Resident	Soil	Ingestion	1.1E-05	—	—	cPAH, Arsenic	1.1	—
		Dermal contact	4.8E-06	—	—	Arsenic	0.1	—
		Total	1.5E-05	—	Arsenic	cPAH	1.2	—
	Sediment	Ingestion	2.5E-06	—	—	cPAH	0.02	—
		Dermal contact	3E-06	—	—	cPAH	0.002	—
		Total	5.5E-06	—	—	cPAH	0.02	—
	Surface Water	Ingestion	5.5E-07	—	—	—	0.006	—
		Dermal contact	2.5E-04	PCP	BEHP	—	0.006	—
		Total	2.5E-04	PCP	BEHP	—	0.01	—
	Total All Media			2.8E-04				1.3
Lifelong Resident	Soil	Ingestion	3.5E-05	—	Arsenic	cPAH, 4,4'-DDE, 4,4'-DDT	NA	NA
		Dermal contact	1E-05	—	—	Arsenic	NA	NA
		Total	4.6E-05	—	Arsenic	cPAH, 4,4'-DDE, 4,4'-DDT	NA	NA
	Sediment	Ingestion	8.2E-06	—	—	cPAH, Arsenic	NA	NA
		Dermal contact	6.1E-06	—	—	cPAH	NA	NA
		Total	1.4E-05	—	cPAH	Arsenic	NA	NA
	Surface Water	Ingestion	1.2E-06	—	—	—	NA	NA
		Dermal contact	3.6E-04	BEHP, PCP	—	—	NA	NA
		Total	3.6E-04	BEHP, PCP	—	—	NA	NA
	Total All Media			4.2E-04				NA

**Notes:**

(1) cPAHs are benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene

- = Cancer risk or HI below designated threshold criteria
- cPAHs = Carcinogenic polynuclear aromatic hydrocarbons
- BEHP = Bis(2-ethylhexyl)phthalate
- SWMU = Solid Waste Management Unit
- PCP = Pentachlorophenol
- NA = Not Applicable
- HI = Hazard Index

Source: Table 2-7 Summary of Cancer Risks and Hazard Indices, Record of Decision, Site 1/SWMU 1 — Incinerator Landfill and Site 41/SWMU 41 — Former Incinerator, Marine Corps Recruit Depot, Parris Island, South Carolina (TtNUS 2006)

Tetrachlorodibenzodioxin and related isomers, measured as tetrachlorodibenzodioxin toxicity equivalent concentrations (TEQs), were found in sediment and groundwater at the Site, but below most stringent risk-based human health and drinking water criteria. The concentration of TEQ in sediment was similar to background; therefore, the presence of TEQ was determined to be from a regional source and not related to Site 1 and Site 41 activities. Similarly, pesticide concentrations in soil and sediment were consistent with those detected throughout the Depot as a result of routine surface application and thus were not considered COCs associated with past activities at Site 1 and Site 41 (TtNUS 2001).

### 2.3.5.3 Ecological Risk Assessment

To evaluate potential risks associated with analytes detected in surface soil, sediment, groundwater, and surface water a screening-level ecological risk assessment (SLERA) was also completed during the 2001 RI/RFI. Table 2-3 lists ecological assessment and measurement endpoints evaluated as part of the SLERA.

<b>Assessment Endpoint</b>	<b>Measurement Endpoint</b>	<b>Media</b>	<b>Approach</b>
Benthic Invertebrate Communities	Benthic Invertebrate Communities	Sediment Surface Water	Comparison to marine sediment and surface water ecological screening values
Fish Communities (forage fish and higher trophic level fish)	Mummichog, Red drum	Sediment	Food chain evaluation; Comparison of fish tissue concentrations to tissue guidelines
Piscivorous birds	Great blue heron, Osprey	Sediment Surface water (heron only)	Food chain evaluation
Vermivorous birds	American woodcock	Surface soil	Food chain evaluation
Omnivorous birds	American robin	Surface soil	Food chain evaluation
Carnivorous birds	Red-tailed hawk	Surface soil	Food chain evaluation
Carnivorous mammals	Red fox	Surface soil	Food chain evaluation
Omnivorous mammals	Raccoon	Sediment Surface water	Food chain evaluation (used tissue data from crab, clam, and oyster)
Herbivorous mammals	Cotton mouse	Surface soil	Food chain evaluation
Soil invertebrates	Soil invertebrates	Surface soil	Comparison to soil ecological screening values
Mammals that feed on soil invertebrates	Short-tailed shrew	Surface soil	Food chain evaluation
Terrestrial and aquatic vegetation	Terrestrial and aquatic vegetation	Groundwater Surface water	Comparison to marine surface water screening values

**Note:**  
SWMU = Solid Waste Management Unit

The following ecological COCs were identified in sediment and surface soil; no COCs were identified in surface water.

- **Sediment:**

Total PAHs, alpha-chlordane, gamma-chlordane, 4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-dichlorodiphenyldichloroethene (DDE), 4,4'-dichlorodiphenyltrichloroethane (DDT), lead, copper, and mercury

- **Surface Soil:**

Total PAHs, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, DDT Residuals (DDTR), alpha-hexachlorobenzene (BHC), beta-BHC, gamma-BHC, Aroclor-1260, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc

It should be noted that because sediment and surface water were evaluated for ecological risks directly, and there was no ecological exposure to groundwater, groundwater was not evaluated with respect to potential risk to ecological receptors other than terrestrial and aquatic vegetation, as noted in Table 2-3. 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.

Ecological remediation levels are discussed in Section 2.4.1. Ecological remediation levels were identified as the greater of the U.S. EPA Region 4 ecological screening values (ESVs) or the facility background concentration; the OU 1 SLERA used 2000 ESVs.<sup>8</sup> The detected TEQs at the Site were 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. As noted above, the concentration of TEQ in sediment was similar to that found in background; therefore, TEQ was attributed to a regional source and not related to Site 1 and Site 41 activities. Similarly, although pesticides were identified as ecological COCs in sediment, it should be noted that the HHRA found pesticide concentrations in soil and sediment were consistent with those detected throughout the Depot as a result of routine surface application.

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<sup>8</sup> Note that the different ERAs may have cited different ESVs depending upon publication date.

## **2.4 Remedial Actions**

The ROD for OU 1 (Site 1 and Site 41) was signed by the Marine Corps on 2 August 2006 (TtNUS 2006).

### **2.4.1 Remedial Action Objectives**

The following RAOs were identified in the ROD for protection of human health and the environment at Site 1 and Site 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.

Tables 2-4 and 2-5 list human health and ecological remediation levels for sediment and surface soil, respectively. Human health remediation levels were determined using U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) (U.S. EPA 2000) and background concentrations (TtNUS 2000). Ecological remediation levels were determined using U.S. EPA Region 4 ESVs (U.S. EPA 2000).

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 (TtNUS, August 2006).

#### **2.4.2 Remedy Selection**

The ROD selected sediment and waste excavation; landfill cap installation; slope stabilization and erosion control; salt marsh restoration and monitoring; maintenance of the cap system; LUCs to prohibit intrusive activities, residential development, and use of groundwater; as well as long-term monitoring of groundwater and sediment.

#### **2.4.3 Remedy Implementation**

The remedial design, which included RCRA closure and post-closure plans, was initiated in 1996 and completed in 1997. Remedial activities were accomplished in 1998.

##### **2.4.3.1 Excavation Activities**

Sediment containing copper, mercury, lead, PAHs, and pesticides above remediation levels for human and ecological receptors was excavated and consolidated within the limits of a landfill cap. No sediment was disposed offsite. Excavations did not include arsenic-impacted sediments to the north. Under current and future land-use scenarios which prohibit residential development, the arsenic concentrations are within acceptable risk ranges. Likewise, the arsenic concentrations do not pose a significant threat to ecological receptors. Any waste material discovered outside the limits of the cap was retrieved and consolidated within the cap. Waste consolidation was accomplished above the mean high tide level. Confirmatory sediment sampling determined final excavation limits.

Following several step-outs, COCs in sediment continued to exceed cleanup levels at the southwestern corner of the landfill, thus, the Navy, SCDHEC, and U.S. EPA agreed to limit excavation in that area and monitor any impacted sediment left-in-place via the LTM program (TtNUS 2005).



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**Table 2-4  
Record of Decision Remediation Levels for Sediment Contaminants of Concern at Operable Unit 1  
(Site 1/SWMU 1 and Site 41/SWMU 41)**

<b>Contaminant of Concern</b>	<b>Maximum Concentration</b>	<b>Background <sup>(1)</sup> (TtNUS 2001)</b>	<b>Region 9 Residential Soil Preliminary Remediation Goal (2000)</b>	<b>Selected Human Health Remediation Level <sup>(1)</sup></b>	<b>Region 4 Ecological Screening Value (2000)</b>	<b>Selected Ecological Remediation Level <sup>(2)</sup></b>
Benzo(a)pyrene Equivalents <sup>(3)</sup>	3,821 µg/kg	Not Available	434 µg/kg <sup>(4)</sup>	434 µg/kg	Not Available	Not Available
Total PAHs <sup>(5)</sup>	29,455 µg/kg	Not Applicable	Not Available	Not Applicable	1,684 µg/kg	1,684 µg/kg
4,4'-DDD	260 µg/kg	33.6 µg/kg	2,400 µg/kg	Not Applicable	3.3 µg/kg	33.6 µg/kg
4,4'-DDE	120 µg/kg	31.6 µg/kg	1,700 µg/kg	Not Applicable	3.3 µg/kg	31.6 µg/kg
4,4'-DDT	270 µg/kg	34.5 µg/kg	1,700 µg/kg	Not Applicable	3.3 µg/kg	34.5 µg/kg
DDTR <sup>(6)</sup>	650 µg/kg	99.8 µg/kg	5,800 µg/kg	Not Applicable	9.9 µg/kg	99.8 µg/kg
alpha-Chlordane	52 µg/kg	13.9 µg/kg	1,600 µg/kg <sup>(7)</sup>	Not Applicable	1.7 µg/kg <sup>(7)</sup>	13.9 µg/kg
gamma-Chlordane	130 µg/kg	13.2 µg/kg	1,600 µg/kg <sup>(7)</sup>	Not Applicable	1.7 µg/kg <sup>(7)</sup>	13.2 µg/kg
Arsenic	18.8 mg/kg	12 mg/kg	0.39 mg/kg	12.4 mg/kg <sup>(8)</sup>	7.24 mg/kg	Not Applicable <sup>(1)</sup>
Copper	95.3 mg/kg	10 mg/kg	2,900 mg/kg	Not Applicable	18.7 mg/kg	18.7 mg/kg
Lead	238 mg/kg	21 mg/kg	400 mg/kg <sup>(9)</sup>	Not Applicable	30.2 mg/kg	30.2 mg/kg
Mercury	0.67 mg/kg	0.09 mg/kg	23 mg/kg	Not Applicable	0.13 mg/kg	0.13 mg/kg

**Notes:**

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilogram

SWMU = Solid Waste Management Unit

<sup>(1)</sup> When maximum concentrations were less than background or Region 9 preliminary remediation goal, no goal was selected, as indicated by "not applicable"

<sup>(2)</sup> When ecological screening values were less than background, background concentrations were selected as the remediation level

<sup>(3)</sup> Benzo(a)pyrene Equivalents = benzo(a)anthracene(0.1) + benzo(a)pyrene(1.0) + benzo(b)fluoranthene(0.1) + benzo(k)fluoranthene(0.01) + chrysene(0.001) + dibenzo(a,h)anthracene(1.0) + indeno(1,2,3-cd)pyrene(0.1)

<sup>(4)</sup> Calculated as 7X the benzo(a)pyrene Region 9 residential preliminary remediation goal

<sup>(5)</sup> Total PAHs = Low Molecular Weight PAHs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) + High Molecular Weight PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, and pyrene)

<sup>(6)</sup> DDTR = 4,4'-DDD + 4,4'-DDE + 4,4'-DDT

<sup>(7)</sup> Based on total chlordane

<sup>(8)</sup> The remediation level is the sum of the background plus the Region 9 residential preliminary remediation goal

<sup>(9)</sup> OSWER Soil Screening Level for Residential Land Use (U.S. EPA 1994)



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**Table 2-5  
Record of Decision Remediation Levels for Surface Soil Contaminants of Concern at Operable Unit 1  
(Site 1/SWMU 1 and Site 41/SWMU 41)**

<b>Contaminant of Concern</b>	<b>Maximum Concentration</b>	<b>Background<sup>(1)</sup> (TtNUS 2001)</b>	<b>Region 9 Residential Soil Preliminary Remediation Goal (2000)</b>	<b>Selected Human Health Remediation Level<sup>(1)</sup></b>	<b>Region 4 Ecological Screening Value (2000)</b>	<b>Selected Ecological Remediation Level<sup>(2)</sup></b>
Benzo(a)pyrene Equivalents <sup>(3)</sup>	854 µg/kg	Not Available	434 µg/kg <sup>(4)</sup>	434 µg/kg	Not Available	Not Available
Total PAHs <sup>(5)</sup>	7,464 µg/kg	Not Available	Not Available	Not Available	1,000 µg/kg	1,000 µg/kg
alpha-BHC	42 µg/kg	Not Available	90 µg/kg	Not Applicable	2.5 µg/kg	2.5 µg/kg
beta-BHC	33 µg/kg	Not Available	320 µg/kg	Not Applicable	1 µg/kg	1 µg/kg
gamma-BHC (Lindane)	75 µg/kg	Not Available	440 µg/kg	Not Applicable	0.05 µg/kg	0.05 µg/kg
4,4'-DDD	180 µg/kg	33.6 µg/kg	2,400 µg/kg	1,700 µg/kg	2.5 µg/kg	33.6 µg/kg
4,4'-DDE	4,200 µg/kg	31.6 µg/kg	1,700 µg/kg	Not Applicable	2.5 µg/kg	31.6 µg/kg
4,4'-DDT	4,400 µg/kg	34.5 µg/kg	1,700 µg/kg	1,700 µg/kg	2.5 µg/kg	34.5 µg/kg
DDTR <sup>(6)</sup>	8,780 µg/kg	99.8 µg/kg	5,800 µg/kg	5,800 µg/kg	9.9 µg/kg	99.8 µg/kg
Aroclor-1260	80 µg/kg	Not Available	220 µg/kg	Not Applicable	20 µg/kg	20 µg/kg
Aluminum	8,610 mg/kg	7,270 mg/kg	76,000 mg/kg	Not Applicable	50 mg/kg	7,270 mg/kg
Antimony	90.6 mg/kg	Not Detected	31 mg/kg	31 mg/kg	3.5 mg/kg	3.5 mg/kg
Arsenic	24.9 mg/kg	1.44 mg/kg	0.39 mg/kg	1.83 mg/kg <sup>(7)</sup>	10 mg/kg	10 mg/kg
Barium	178 mg/kg	24 mg/kg	5,400 mg/kg	Not Applicable	165 mg/kg	165 mg/kg
Cadmium	5.4 mg/kg	Not Detected	37 mg/kg	Not Applicable	1.6 mg/kg	1.6 mg/kg
Chromium	53.2 mg/kg	6.2 mg/kg	210 mg/kg	Not Applicable	0.4 mg/kg	6.2 mg/kg
Copper	131 mg/kg	1.5 mg/kg	2,900 mg/kg	Not Applicable	40 mg/kg	40 mg/kg
Iron	147,000 mg/kg	3,920 mg/kg	23,000 mg/kg	26,920 mg/kg <sup>(7)</sup>	200 mg/kg	3,920 mg/kg
Lead	8,380 mg/kg	12.5 mg/kg	400 mg/kg <sup>(8)</sup>	412.5 mg/kg <sup>(7)</sup>	50 mg/kg	50 mg/kg
Manganese	752 mg/kg	129 mg/kg	1,800 mg/kg	Not Applicable	100 mg/kg	129 mg/kg
Mercury	1.1 mg/kg	0.11 mg/kg	23 mg/kg	Not Applicable	0.1 mg/kg	0.110 mg/kg
Nickel	47.8 mg/kg	1.8 mg/kg	1,600 mg/kg	Not Applicable	30 mg/kg	30 mg/kg
Selenium	1.1 mg/kg	0.29 mg/kg	390 mg/kg	Not Applicable	0.81 mg/kg	0.81 mg/kg
Silver	2.4 mg/kg	Not Detected	390 mg/kg	Not Applicable	2 mg/kg	2 mg/kg
Vanadium	47.4 mg/kg	9.5 mg/kg	550 mg/kg	Not Applicable	2 mg/kg	9.5 mg/kg
Zinc	497 mg/kg	9.7 mg/kg	23,000 mg/kg	Not Applicable	50 mg/kg	50 mg/kg

**Notes:**

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilogram

SWMU = Solid Waste Management Unit

- (1) When maximum concentrations were less than background or Region 9 preliminary remediation goal, no goal was selected, as indicated by "not applicable"
- (2) When ecological screening values were less than background, background concentrations were selected as the remediation level
- (3) Benzo(a)pyrene Equivalents = benzo(a)anthracene(0.1) + benzo(a)pyrene(1.0) + benzo(b)fluoranthene(0.1) + benzo(k)fluoranthene(0.01) + chrysene(0.001) + dibenzo(a,h)anthracene(1.0) + indeno(1,2,3-cd)pyrene(0.1)
- (4) Calculated as 7X the benzo(a)pyrene Region 9 Residential preliminary remediation goal
- (5) Total PAHs = Low Molecular Weight PAHs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) + High Molecular Weight PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, and pyrene)
- (6) DDTR = 4,4'-DDD + 4,4'-DDE + 4,4'-DDT
- (7) The remediation level is the sum of the background plus the Region 9 residential preliminary remediation goal
- (8) OSWER Soil Screening Level for Residential Land Use (U.S. EPA 1994)

#### **2.4.3.2 Cap Installation**

In 2003, a cap was installed over approximately 6.3 acres of consolidated and graded waste and contaminated sediment. In accordance with applicable federal and state solid waste and hazardous waste landfill closure requirements, the cap was designed as a multilayer, low-permeability system to reduce infiltration of surface water and migration of contaminants into groundwater. It should be noted that the MCRD Parris Island Partnering Team elected to install the cap prior to finalization of the ROD, which was pending resolution of the Post-ROD Authority dispute between U.S. EPA and DOD for LUCs.

#### **2.4.3.3 Slope Stabilization/Erosion Control**

To reduce the potential for erosion via surface water runoff, waves, and wind, a geomembrane was placed over the consolidated waste and impacted soils and sediments. A geotextile fabric was placed over the geomembrane and then covered with bedding material and rip rap.

#### **2.4.3.4 Salt Marsh Restoration**

Excavated marsh areas were restored with clean sand and native vegetation (e.g., cordgrass, *Spartina alterniflora*). The sediment in the area was temporarily stabilized to minimize erosion. LTM for salt marsh restoration was incorporated into the cap maintenance program, as described in Section 2.4.4.2.

#### **2.4.3.5 Cap Maintenance**

The selected remedy included routine mowing and tree/shrub removal to prevent the formation of root systems that could potentially impact the liner system. The LTM Work Plan (TtNUS 2005) proposed quarterly inspections and maintenance during the first year, followed by annual inspections thereafter. Such maintenance activities are expected to be performed for at least 30 years, consistent with the presumptive remedy for landfills. The remedy is currently in year 12 of maintenance.

#### **2.4.3.6 Land Use Controls**

LUCs consisting of both engineering controls and institutional controls were implemented to preclude unacceptable future human health or ecological risks associated with exposure(s) to COCs. As specified in the Land Use Control Remedial Design (LUC RD) (CH2M Hill 2008a), specific performance objectives for LUCs are to prohibit:

- Unauthorized construction or intrusive activities
- Residential development of the site
- Extraction or use of groundwater at the site

To ensure that the aforementioned LUC performance objectives are met and maintained, the LUC RD specified the following engineering and institutional controls as LUC implementation actions:

**Engineering Controls:**

- Signs were to be posted on the landward side of Site 1 and Site 41 advising that any excavation, construction, or intrusive activity is prohibited, unless authorized in advance by the Natural Resources and Environmental Affairs Office (NREAO).

**Institutional Controls:**

- The LUC RD was to be filed in the MCRD Parris Island Information Repository located at the Beaufort County Public Library's Headquarters at 311 Scott Street, Beaufort, South Carolina 29902.
- The following base planning and environmental management documents were to be updated to identify the prohibited groundwater use or extraction consistent with the Site 1 ROD and to depict the Site LUC boundaries as specified in the LUC RD:
  - Base Master Plan — The Base Master Plan was to include an appendix detailing the LUC RD requirements and figures identifying areas subject to LUC restrictions. The Base Master Plan should be prepared to serve as a reference document available through the Environmental Management System (EMS).
  - Geographic Information System — GIS should serve as a live version of all IRP site data, which is updated at irregular intervals based on the need to incorporate new site investigation data. Sites should be made visible as shaded polygons, with sampling data tied to monitoring wells and sampling locations. LUC data and restrictions should be added to each site as LUCs are implemented.
  - Environmental Management System — MCRD Parris Island shall maintain the LUCs by assuring unauthorized breaches are prohibited and any necessary construction is designed and approved prior to implementation. Additionally, erosion and invasive plant growth on the landfill cover should be controlled. To accomplish this MCRD Parris Island should establish standard operating procedures (SOPs) which will serve as enforceable compliance assurance measures. These compliance assurance measures should include the following:

- Depot Order prohibiting unauthorized disturbances.
  - SOPs that detail the inspection, repair, and prohibitions and outline requirements for necessary construction approval in the areas.
  - Inspection record keeping, that in addition to inspection documentation, will describe any required repair and note repair completion date.
  - Training plans and schedules that will explain to key facilities' staff the SOPs, updated site information, and approvals required. The training plan should include a course outline and a roster of key facilities' personnel that require annual training.
- MCRD Parris Island was to ensure that the LUCs for Site 1 and Site 41 were incorporated into a Depot Order governing ground disturbing activities across MCRD Parris Island.
- Appropriate notification was to be provided to U.S. EPA and SCDHEC in advance of any changes to LUC management procedures, which could interfere with or negatively impact the effectiveness of the LUCs.
- MCRD Parris Island was to conduct annual physical inspections of Site 1 and Site 41 to confirm continued compliance with LUC performance objectives and to verify the Base Master Plan, GIS, EMS, and Depot Order governing ground disturbing activities correctly describe the prohibited uses and restrictions at Site 1 and Site 41. The Commanding General was to provide to U.S. EPA and SCDHEC an annual LUC Compliance Certificate for Site 1 and 41. Should any deficiencies be found, MCRD Parris Island was to separately notify U.S. EPA and SCDHEC within 10 business days of the deficiencies being discovered.
  - Any activity that is inconsistent with the LUC objectives or land use restrictions, or any other action that may interfere with the effectiveness of the LUCs, should be addressed by MCRD Parris Island as soon as practicable, but in no case will the process be initiated later than 10 business days after MCRD Parris Island becomes aware of the breach.

- MCRD Parris Island shall notify U.S. EPA and SCDHEC at least 45 days in advance of any proposed land use changes at Site 1 and Site 41 that would be inconsistent with the LUC performance objectives or the selected remedy. If changes are proposed for any area of land within the boundaries of the site where restrictions apply, such changes should not be implemented without the approval of the U.S. EPA and SCDHEC.
- Notice should be provided to U.S. EPA and SCDHEC at least six months prior to any transfer or sale of Site 1 and Site 41 property, so that U.S. EPA and SCDHEC can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for the facility to notify U.S. EPA and SCDHEC at least six months prior to any transfer or sale, then the facility will notify U.S. EPA and SCDHEC as soon as possible, but no later than 60 days prior to the transfer or sale of any property subject to LUCs.
- Prior to conveyance of the real property encompassing all or a portion of Site 1 and Site 41, U.S. EPA and SCDHEC representatives should be given reasonable opportunity to review and concur on the applicable deed language related to all LUCs and associated rights of entry. U.S. EPA and SCDHEC should be provided with a copy of any executed deeds.
- LUCs at Site 1 and Site 41 should be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels as to allow for unrestricted use and unlimited exposure. LUCs and associated implementation actions should not be terminated or modified without approval by U.S. EPA and SCDHEC. The Navy shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

MCRD Parris Island has implemented various policies and procedures to ensure that LUC performance objectives continue to be met and that implementation actions are maintained. Signs have been posted to provide notification of unauthorized activities at Site 1 and Site 41. IRP sites have been included in a Depot Order titled *Land Use Control Standard Operating Procedure* (MCRD Parris Island, 19 July 2012), which governs ground-disturbing activities across MCRD Parris Island. IRP site boundaries have been included in the Base Master Plan. In addition to incorporating IRP site boundaries, MCRD Parris Island's GIS included NREAO contact information tied to each IRP site. Authorization is required from the NREAO prior to any excavation, construction, or intrusive activities.

MCRD Parris Island completes quarterly inspections to assess the landfill cap and perimeter revetment and confirm continued compliance with LUC performance objectives and to verify the Base Master Plan, GIS, EMS, and Depot Order governing ground disturbing activities correctly describe the prohibited uses and restrictions at Site 1 and Site 41. Annual LUC compliance certificates, which evaluate the status of engineering and institutional controls and identify any deficiencies or inconsistent uses, are submitted to U.S. EPA and SCDHEC. Copies of annual LUC compliance certificates are included in Appendix C. Key findings associated with compliance inspections performed during this five-year review period are discussed in Section 2.6.1.

#### **2.4.4 System Inspections and Maintenance**

Requirements for cap inspections, marsh grass counts, and LTM of groundwater and sediment, as detailed in the September 2005 LTM Work Plan (TtNUS 2005), are summarized below.

##### **2.4.4.1 Landfill Inspections and Maintenance**

The surface of the landfill cap and perimeter revetment is visually inspected quarterly by MCRD Parris Island (as part of LUC inspection processes) and annually by NAVFAC's contractor. The contractor walkover follows procedures outlined in the Site/SWMU 1 Incinerator Landfill Long-Term Monitoring Work Plan (TtNUS February 2005). The appropriate grid spacing is determined in the field, based on the density and height of the vegetative cover at the time of the inspection; the perimeter is also inspected. Findings from MCRD Parris Island inspections are documented in annual LUC compliance certificates, and NAVFAC contractor inspections are reported in annual groundwater sampling, marsh grass monitoring, and O&M reports. Both are submitted to U.S. EPA and SCDHEC.

Grass and other non-woody vegetation are maintained by the Depot on an as-needed basis to minimize disturbance to the unique meadow ecosystem, which includes nesting birds and pollinators. Tree and shrub removal is also performed as needed. Maintenance techniques are typically less invasive, and selected to fit the task; hand-clearing methods are preferred, to minimize impact on wildlife. See Section 2.7.1.2 for additional details.

#### **2.4.4.2 Native Marsh Grass Counts**

As required by the Site/SWMU 1 Incinerator Landfill Long-Term Monitoring Work Plan, native marsh grass counts are conducted at nine marsh grass inventory (plot) locations randomly selected from pre-defined transects. Individual grass stems are counted within 1-meter by 1-meter square frames, with results used to evaluate the status of restoration. Results of marsh grass counts are reported in annual groundwater sampling, marsh grass monitoring, and O&M reports submitted to U.S. EPA and SCDHEC; the last two years indicate the remedy has been successfully implemented (see Section 2.6.2.1).

#### **2.4.4.3 Long-Term Monitoring Program**

The annual LTM groundwater and sediment sampling program was initiated in 2005; monitoring well locations are shown on Figure 2-1. Groundwater samples collected during LTM events from 2006 through 2012 were collected using low-recharge sampling techniques and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PAHs, pesticides, and select inorganic compounds, with results compared to U.S. EPA MCLs in annual monitoring reports.<sup>9</sup> As recommended in the 2012 annual monitoring report and upon SCDHEC approval, the annual groundwater analyte list was reduced to antimony, arsenic, and lead beginning with the 2013 event, with a full analytical suite required every five years (S-IES 2013).<sup>10</sup> U.S. EPA has issued its support for SCDHEC and SCDNR review of LTM issues, and expects issues relative to LTM to be resolved within the MCRD Parris Island Partnering Team.<sup>11</sup>

Between 2005 and 2012, sediment samples collected from 0 to 1 foot bgs, at low tide, were analyzed for copper, lead, and mercury. Results were compared to U.S. EPA ESVs in annual monitoring reports. As recommended in the 2012 annual monitoring report (S-IES 2013) and upon receipt of SCDHEC concurrence, sediment sampling was deemed complete and eliminated from the LTM program following the 2012 event.<sup>12</sup> Results associated with the LTM program are summarized in Sections 2.6.2.2 and 2.6.2.3.

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<sup>9</sup> Select inorganic compounds monitored between 2006 and 2012 included antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

<sup>10</sup> M. Amick to D. Owens and T. Harrington, 17 May 2013

<sup>11</sup> L. Llamas to N. Cowand and T. Harrington, 6 April 2015

<sup>12</sup> M. Amick to D. Owens and T. Harrington, 17 May 2013

## **2.5 Progress Since the Last Five-Year Review**

### **2.5.1 Protectiveness Statement from the 2010 Five-Year Review**

The following protectiveness statement is from the 2010 Five-Year Review: “The remedy at OUs 1, 3, and 5 are expected to be or is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.”

### **2.5.2 Issues, Recommendations, and Follow-Up Actions**

No issues or recommendations for follow-up actions were identified during the 2010 Five-Year Review.

## **2.6 2015 Five-Year Review Process**

### **2.6.1 Document Review (Annual Landfill Inspections)**

This five-year review included review of relevant documents generated after March 2010 (the end review period date for the 2010 Five-Year Review) and applicable information from previous documents including the RI/RFI, ROD, LTM reports, and prior five-year reviews. This five-year review also included review of annual LUC compliance certificates from 2010 through 2015.

### **Annual Landfill Inspections**

Annual inspections of the low-permeability cap by the LTM contractor identified little to no evidence of settlement or drainage that could potentially affect cap integrity. Burrowing animals that could affect cap integrity have not been reported during historical inspections; however an isolated burrow was observed during the January 2015 five-year review site visit, as noted in Section 2.6.3. Vegetation was observed growing in the rip rap during inspections and was consequently removed. During each annual inspection, the cap was covered by a mixture of plants and grasses, consistent with the selected remedy, and not expected to be damaging to the cap. During annual landfill inspections between 2012 and 2014, small (less than 4 square feet) scattered barren areas were observed; these isolated barren areas are not expected to have a significant impact on effectiveness. The 2014 annual groundwater sampling, marsh grass monitoring, and O&M report noted an overall uniform density and mixture of vegetation (S-IES 2015). In comments dated 27 January 2015, SCDHEC expressed concern associated with two washout areas along the unprotected banks outside of the southeastern boundary of Site 1 and Site 41 and requested continued monitoring to determine the necessity for re-vegetation or stabilization.<sup>13</sup> Areas where erosion/washout was observed are depicted on Figure 2-1. Section 2.6.3 discusses observations made during site inspections performed as part of this five-year review.

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<sup>13</sup> Amick, M. to Coward, N. and Harrington, T. 27 January 2015.

In addition to annual inspections performed by the LTM contractor, MCRD Parris Island also performs quarterly LUC compliance inspections at Site 1 and Site 41. Findings are submitted to U.S. EPA and SCDHEC on an annual basis via LUC compliance certificates (Appendix C). Key findings of Site 1 and Site 41 compliance inspections performed by MCRD Parris Island from 2010 to 2015 are as follows:

- Vegetation, including woody species, has been observed growing in the rip rap and has subsequently been removed as part of maintenance.
- Marsh grass has re-established well on north, east, and west sides of Site 1 and Site 41.
- Marsh grass has not re-established as well on the south side of Site 1 and Site 41, but has shown increasing growth from 2013 through 2015.
- Other than depicting site boundaries, the Depot's current Base Master Plan (Parsons 2014) and GIS records do not identify site-specific data, and there are no notifications specific to LUCs.
- A Depot Order does not currently exist to identify the site, the LUC boundary, and the LUCs.

## **2.6.2 Data Review**

The following evaluation was performed using LTM data obtained from 2011 through 2014.

### **2.6.2.1 Native Marsh Grass Counts**

The Evaluation of Marsh Restoration Sites at the Marine Corps Recruit Depot (North Carolina State University [NCSU], June 2009) initially assessed conditions following marsh grass restoration. The NCSU study indicated:

- The elevation of the restoration area appeared correct and the area was inundated at high tide.
- Fill material consisted of very fine sandy loam, with silt and clay. The soil appeared to be oxidized when compared to surrounding marsh sediments, and its surface did not have any accumulated sediments.

- At the time of the study (February 2009) no *Spartina alterniflora* seedlings were present, but the authors noted that this was still early in the sprouting season.
- Salinity in Port Royal Sound was, generally, too high for optimal growth of *Spartina*, and salinity effects were influenced more by (a) the Atlantic Ocean (due to tidal ranges) and (b) evaporative effects during drought years. Salinity was 40 to 45 parts per thousand.
- Mats of *Spartina* wrack (dead stems from the prior year) may inhibit growth of seedlings if it is too thick and remains in place (e.g., tidal “dead spots”).
- Dark soil was noted in some locations, and NCSU authors indicated *Spartina* growth was unlikely in these areas due to highly reduced conditions.

Overall, the NCSU study indicated that conditions were amenable to *Spartina* growth, though, saline conditions, nutrient deficiencies, and wrack would hinder growth. Test plots measured during LTM were successful. Since 2009, the marsh grass growth has been successful across the majority of the area.

Re-vegetated marsh grass stems are counted annually at three sub-areas of Site 1, from one randomly selected transect of five possible predetermined transects per sub-area, as shown on Figure 2-1. In 2014, a background (native) undisturbed marsh grass stem count was performed for comparative purposes (S-IES 2015). As outlined in the LTM Work Plan (TtNUS 2005), restoration is considered complete when stem counts of re-vegetated areas are equal to 75 percent of the native marsh grass stem count collected from adjacent, undisturbed marsh. The reference location was added based on SCDHEC’s comments associated with the 2013 annual groundwater sampling, marsh grass monitoring, and O&M report; however, as noted in SCDNR’s 2 April 2015 comments, associated with the October 2014 draft annual groundwater sampling, marsh grass monitoring, and O&M report, only one location was used for the background count.<sup>14</sup> During the next LTM event, the reference stem count will be developed using an average of multiple stem counts, as referenced in SCDNR’s 18 September 2007 letter, discussing marsh grass restoration assessment.<sup>15</sup> Table 2-6 provides a summary of marsh grass inventory results since the last five-year review. Marsh grasses exceeded the 75 percent restoration objective during counts performed in 2013 and 2014, using the 2014 single-plot count as a provisional assessment of background conditions. This reference value will be verified in future field events.

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<sup>14</sup> Wendt, P. to Cowand, N., 2 April 2015

<sup>15</sup> Wendt, P. to Sandford, A., 18 September 2007

Date	Provisional Reference Marsh Count <sup>[1]</sup>	Transect A			Transect B			Transect C			Average Number of Stems/Plot (% Restored) <sup>[2]</sup>
		#1	#2	#3	#1	#2	#3	#1	#2	#3	
2011	NA	*	*	*	*	*	*	*	*	*	*
2012	NA	38	40	29	77	52	56	95	49	102	60 (64%)
2013	NA	48	66	63	73	104	97	172	203	243	119 (100%)
2014	94	34	102	40	120	86	99	130	150	158	102 (100%)

**Notes:**

- [1] Reference marsh counts were inadvertently not completed until 2014; at that time, only one reference plot was counted. Per SCDNR comments on 18 September 2007 and 2 April 2015, a single reference location does not meet the intent of the LTM Work Plan and is not acceptable for determination of compliance. The single plot is used for provisional reference comparison purposes, with the understanding that a background stem count will be obtained in future LTM events.
- [2] Percent restoration for years prior to 2014 are estimated using 2014 background marsh counts.
- \* Omitted: Stem counts were inadvertently taken from the undisturbed marsh areas in 2011; therefore, the 2011 counts were not included for comparison.

SWMU = Solid Waste Management Unit

Resolution Consultants, the Navy, and SCDHEC were unable to locate records associated with the 2010 marsh grass count, thus 2010 data was not reviewed

As indicated in SCDNR’s 2 April 2015 letter, additional review of marsh grass restoration efforts is necessary along the eastern/southeastern perimeter of the landfill. This area extends north from the southeast corner of the landfill along the base of the revetment approximately 300 feet, extending east from the revetment between 30 and 70 feet into the marsh, with the widest section adjacent to Malecon Drive. During the next LTM event (scheduled for late 2015), the reference stem count will evaluate marsh grass restoration along the eastern/southeastern perimeter of the landfill, with findings reported to the MCRD Parris Island Partnering Team.

**2.6.2.2 Groundwater Data**

Table 2-7 summarizes groundwater analytical data since the last five-year review. Figures showing groundwater results and flow directions may be found in the latest annual groundwater sampling, marsh grass monitoring, and O&M report (S-IES 2014) and are not reproduced herein.



<b>Table 2-7 Summary of Groundwater Analytical Results (Detections Only) — Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41) (all concentrations presented in micrograms per liter)</b>						
<b>Contaminant of Concern</b>	<b>U.S. EPA MCL<sup>(1)</sup></b>	<b>Well ID</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<b>Volatile Organic Compounds</b>						
Acetone	Not Established	PAI-01-MW-22	12.5 J	10.6 J	Not Analyzed	Not Analyzed
Carbon Disulfide	Not Established	PAI-01-MW-20 PAI-01-MW-21	1.2 J 0.84 J	1.3 J 0.79 J	Not Analyzed	Not Analyzed
Methylene Chloride	5	PAI-01-MW-23	0.75 J	<0.50	Not Analyzed	Not Analyzed
Xylenes (total)	10,000	PAI-01-MW-24	0.32 J	0.29 J	Not Analyzed	Not Analyzed
<b>Semi-Volatile Organic Compounds/Polynuclear Aromatic Hydrocarbons</b>						
3&4-methylphenol	Not Established	PAI-01-MW-22	44.7	<1.3	Not Analyzed	Not Analyzed
Phenol	Not Established	PAI-01-MW-22	71.6	<0.53	Not Analyzed	Not Analyzed
<b>Total/Dissolved Inorganic Compounds (Metals)</b>						
<b>Antimony (total)</b>	6	PAI-01-MW-20	<2.0	<1.3	3.5 J	<2.3
		PAI-01-MW-21	<2.0	<1.3	4.0 J	<2.3
		PAI-01-MW-22	<b>12.9</b>	<b>9.8</b>	5.2 J	<2.3
		PAI-01-MW-23	3.0 J	1.4 J	<2.6	<b>14.6</b>
		PAI-01-MW-24	<2.0	<1.3	<1.3	<2.3
Antimony (dissolved)	Not Established	PAI-01-MW-20	<2.0	1.8 J	<2.6	<2.3
		PAI-01-MW-21	<2.0	<1.3	<2.6	<2.3
		PAI-01-MW-22	3.5 J	11.8	13.1	5.3 J
		PAI-01-MW-23	<2.0	8.3	<2.6	2.6 J
		PAI-01-MW-24	<2.0	1.5 J	<1.3	<2.3
<b>Arsenic (total)</b>	10	PAI-01-MW-20	9.7 J	6.2 J	<5.0	3.1 J
		PAI-01-MW-21	9.0 J	6.8 J	<5.0	10.0
		PAI-01-MW-22	<b>21.5</b>	<b>16.7</b>	5.6 J	3.4 J
		PAI-01-MW-23	<2.0	<2.5	<5.0	<b>11.2</b>
		PAI-01-MW-24	<2.0	<2.5	<2.5	<2.4
Arsenic (dissolved)	Not Established	PAI-01-MW-20	9.7 J	3.3 J	<5.0	<2.4
		PAI-01-MW-21	5.5 J	7.7 J	6.4 J	4.4 J
		PAI-01-MW-22	8.4 J	9.7 J	18.0 J	10.8
		PAI-01-MW-23	<2.0	<2.5	<5.0	<2.4
		PAI-01-MW-24	<2.0	<2.5	<2.5	<2.4
Chromium (total)	100	PAI-01-MW-20	1.7 J	2.0 J	Not Analyzed	Not Analyzed
		PAI-01-MW-21	2.8 J	<2.0		
		PAI-01-MW-22	2.5 J	2.9 J		
		PAI-01-MW-23	2.1 J	<2.0		
		PAI-01-MW-24	1.3 J	<2.0		
Chromium (dissolved)	Not Established	PAI-01-MW-21	<1.0	2.0 J	Not Analyzed	Not Analyzed
		PAI-01-MW-22	<1.0	2.4 J		
Copper (total)	1,300	PAI-01-MW-22	<2.0	5.0 J	Not Analyzed	Not Analyzed
		PAI-01-MW-23	33.8	36.0		
<b>Lead (total)</b>	15	PAI-01-MW-20	7.3	<1.1	<2.2	<1.1
		PAI-01-MW-21	7.3	<1.1	<2.2	<5.5
		PAI-01-MW-22	9.8	<1.1	<2.2	<5.5
		PAI-01-MW-23	71	34.8	<2.2	<b>1,040</b>
		PAI-01-MW-24	1.1 J	<1.1	<1.1	<1.1

<b>Table 2-7 Summary of Groundwater Analytical Results (Detections Only) — Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41) (all concentrations presented in micrograms per liter)</b>						
<b>Contaminant of Concern</b>	<b>U.S. EPA MCL<sup>(1)</sup></b>	<b>Well ID</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Lead (dissolved)	Not Established	PAI-01-MW-20	<2.0	<11	2.9 J	<5.5
		PAI-01-MW-21	<4.0	<11	<2.2	<5.5
		PAI-01-MW-22	<4.0	3.5 J	<2.2	<5.5
		PAI-01-MW-23	<4.0	<1.1	<2.2	<5.5
		PAI-01-MW-24	<1.0	<1.1	<1.1	<1.1
Nickel (total)	Not Established	PAI-01-MW-20	6.9 J	3.7 J	Not Analyzed	Not Analyzed
		PAI-01-MW-21	2.3 J	<0.50		
		PAI-01-MW-22	12.2 J	8.2 J		
Nickel (dissolved)	Not Established	PAI-01-MW-20	7.0 J	2.9 J	Not Analyzed	Not Analyzed
		PAI-01-MW-22	<2.0	0.60 J		
Selenium (total)	50	PAI-01-MW-20	<2.0	2.5 J	Not Analyzed	Not Analyzed
		PAI-01-MW-22	<2.0	3.3 J		
Selenium (dissolved)	Not Established	PAI-01-MW-20	<2.0	3.4 J	Not Analyzed	Not Analyzed
Zinc (total)	5,000 <sup>(2)</sup>	PAI-01-MW-20	7.0 J	<5.0	Not Analyzed	Not Analyzed
		PAI-01-MW-21	24.8	<5.0		
		PAI-01-MW-22	10.7 J	10.4 J		
		PAI-01-MW-23	114	53.9		
		PAI-01-MW-24	6.6 J	<5.0		
Zinc (dissolved)	Not Established	PAI-01-MW-20	10.2 J	<5.0	Not Analyzed	Not Analyzed
		PAI-01-MW-23	5.1 J	<5.0		

**Notes:**

(1) United States Environmental Protection Agency Primary Drinking Water Standards Maximum Contaminant Levels (MCL) (U.S. EPA 2014)

(2) Criteria cited is a secondary MCL (U.S. EPA 2014).

J = Analyte detected between the laboratory Method Detection Limit and Method Quantification Level; value was estimated by the laboratory.

SWMU = Solid Waste Management Unit

Values in **bold** exceed its corresponding U.S. Environmental Protection Agency Maximum Contaminant Level.

Resolution Consultants, the Navy, and SCDHEC were unable to locate records associated with a 2010 groundwater monitoring event.

Collective data from the first seven years of the LTM program indicated that concentrations are generally decreasing over time. By 2012, antimony, arsenic, and lead were the only groundwater constituents consistently detected at concentrations above their respective U.S. EPA MCLs. Based on recommendations in the 2012 Annual Monitoring Report (S-IES 2013) and upon receipt of SCDHEC concurrence, VOCs, SVOCs, PAHs, and pesticides were eliminated from the annual LTM groundwater sampling program beginning in 2013. It should be noted that as requested by SCDHEC, LTM groundwater samples will be submitted for the full analytical suite once during each five year review period. MCL exceedances for total antimony, arsenic, and lead were limited to wells PAI-01-MW-22

and PAI-01-MW-23.<sup>16</sup> During the most recent 2013 and 2014 LTM events, concentrations of these metals were reported below MCLs at PAI-01-MW-22. While the total lead concentration (1,040 micrograms per liter [ $\mu\text{g/L}$ ]) detected at PAI-01-MW-23 in 2014 was above the historical maximum (91  $\mu\text{g/L}$  in 2006), the dissolved lead result (non-detect at less than 5.5  $\mu\text{g/L}$ ) was consistent with historical levels. Such results suggest that the 2014 total lead result was anomalous and was influenced by suspended solids and/or colloidal particles.<sup>17</sup> Trend graphs are included in Appendix D.

### 2.6.2.3 Sediment Data

With the exception of lead at 54.3 mg/kg in 2011, concentrations of copper, lead, and mercury were reported one to two orders of magnitude below U.S. EPA ESVs, during sediment LTM sampling activities from 2005 through 2012. The 2011 lead result was considered anomalous, as the subsequent 2012 result (5.3 mg/kg) was reported within historical ranges (1.9 to 6.1 mg/kg). Table 2-8 summarizes analytical results associated with sediment sampling activities from 2005 through 2012. As recommended in the 2012 Annual Monitoring Report (S-IES 2013) and upon receipt of SCDHEC concurrence, sediment sampling was deemed complete and eliminated from the LTM program following the 2012 event.

<b>U.S. EPA Region 4 ESV (all results presented in milligrams per kilogram)</b>	<b>Copper</b>	<b>Lead</b>	<b>Mercury</b>
	<b>18.7</b>	<b>30.2</b>	<b>0.13</b>
29 September 2005	2.2	4.1	0.042
19 October 2006	1.7	6.1	0.012
26 October 2007	0.23 J	4.8	0.0092
28 October 2008	0.75	2.2	0.013
13 October 2009	0.36	1.9	0.91
12 October 2011	9.3	<b>54.3</b>	0.031 J
10 October 2012	2.3	5.3	0.013 J

**Notes:**

J = Analyte detected between the laboratory Method Detection Limit and Method Quantification Level; value was estimated by the laboratory.

U.S. EPA = United States Environmental Protection Agency

ESV = Ecological Screening Value

SWMU = Solid Waste Management Unit

Values in **bold** exceed its corresponding U.S. EPA ESV

<sup>16</sup> Total arsenic was detected at its 10  $\mu\text{g/L}$  U.S. EPA MCL in PAI-01-MW-21 during the 2014 annual monitoring event.

<sup>17</sup> No purge data are provided in the October 2014 report to document field conditions.

### **2.6.3 Site Walkover**

On 14 January 2015, Resolution Consultants, accompanied by Ms. Donohoe (MCRD Parris Island Environmental Restoration Program Manager) and Mr. Holloway (MCRD Parris Island Natural Resources Manager), walked the perimeter and interior of Site 1 and Site 41. Findings associated with the site visit were documented via an inspection form, drawing, and photographs included as Appendix A-2. Two signs on the landward (south) side advise that excavation and construction are prohibited unless authorized by the Commanding General. The cap appeared to be in good condition with sufficient vegetative cover to prevent erosion.<sup>18</sup> No areas of settling or ponding were observed in the surface cover. An inspection of the revetment indicated that the rip rap was stable and in good condition, with no visible signs of washouts, scouring, or shear failure. Vegetation was present within the rip rap. MCRD Parris Island removed woody vegetation from the rip rap on 31 January 2015. An isolated burrow was noted near the northeast revetment (Photo 19, Appendix A-2), during the 14 January 2015 site visit. Consistent with the SWMU 1 LTM Work Plan, an assessment of the burrow area is recommended as part of future LTM activities. Findings of LTM inspections and recommendations for maintenance activities to address any issues will be included and tracked in future LTM reports. Groundwater monitoring wells appeared to be in good condition.

Interviews and site inspections identified consensus between the NAVFAC Remedial Project Manager and MCRD Parris Island for reassessing field inspection and documentation procedures relative to annual landfill inspections and LUC compliance activities performed by MCRD Parris Island. At this time, inspection activities are performed by both NAVFAC contractors and by MCRD Parris Island on differing schedules. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.

On 5 February 2015, Resolution Consultants personnel conducted a follow-up visit to document removal of woody growth in the rip rap, and to observe conditions in washout areas, as identified in SCDHEC's review of the January 2015 Groundwater Sampling, Marsh Grass Monitoring Report and O&M Report for Site/SWMU 1.<sup>19</sup> During the follow-up visit, erosion was observed along the unprotected banks within and outside of the southeastern boundary of Site 1, see photo log (Appendix A-2). Within the eroded area, layered debris (including ceramic plates, light bulbs, burned debris, and metal) was observed in strata in the root network of a live oak tree. The debris was observed along roughly 50 to 75 linear feet of the exposed bank, extending outside of the combined

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<sup>18</sup> The SWMU 1 LTM Work Plan (Revision 2) (TtNUS 2008) defines cap deficiencies which could affect protectiveness and require engineering review as erosion/gullies deeper than 9 inches.

<sup>19</sup> Amick, M. to Cowand, N. and Harrington, T. 27 January 2015.



Site 1 and Site 41 boundary. The amount of visible debris appeared to decrease with increasing distance to the east. Historical documents suggest that the newly discovered debris area is outside the area of previous investigations. The area where erosion and newly discovered debris was observed is depicted on Figure 2-1.

**2.7 Technical Assessment**

**2.7.1 Question A: Is the Remedy Functioning as Intended by Decision Documents?**

The remedy at Site 1 and Site 41 included: source control (sediment excavation, installation of a low-permeability cap, and LUCs), site restoration (re-vegetation and slope stabilization), LTM of sediment and groundwater, and native marsh grass stem counts in re-vegetated areas. This five-year review finds that the remedy is functioning as intended by the ROD.

**2.7.1.1 Remedial Action Performance**

The remedial actions for the source control alternative were implemented as designed. The installation of the cap/revetments and marsh restoration provide effective containment of landfill contents and impacted media, and prevent both human and ecological receptor exposure. Additionally, based on LTM results (both groundwater and sediment), the source control alternative appears to have eliminated contaminant migration from the source material to downgradient areas.

<b>OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>	
<b>Remedy Status</b>	
Excavation	Complete
Cap installation	Complete
Slope stabilization/erosion control	Complete
Salt marsh restoration	Ongoing
Cap maintenance	Ongoing
LUCs	Ongoing
LTM — sediment	Complete
LTM — groundwater	Ongoing

- Contaminant concentrations in groundwater samples collected from all wells except PAI-01-MW-23 have been below their respective U.S. EPA MCLs since 2013.
- Groundwater analysis for VOCs, SVOCs, PAHs, and pesticides was suspended prior to the 2013 LTM event, as contaminant concentrations were below applicable remediation levels.
- Sediment sampling was deemed complete prior to the 2013 LTM event, as contaminant concentrations were below applicable remediation levels.

- Stem counts conducted in 2013 and 2014 exceeded the restoration RAO of 75 percent of native and undisturbed marsh grass stem count; however as noted by SCDHEC, a more robust background value is required to validate the marsh grass assessment. Additional assessment is also required along the eastern/southeastern landfill perimeter.

### **2.7.1.2 Inspections and Maintenance**

Annual inspections of the low-permeability cap indicate it is covered by a mixture of grasses, consistent with the selected remedy for Site 1 and Site 41. Settlement or significant erosion that could potentially affect cap integrity has not been observed to date. Additionally, slope stabilization and erosion control measures remain in place and effective. Landfill inspections, which also include visual observations of monitoring wells, are documented via annual LUC compliance certificates. The monitoring well network remains in good condition. If the presence of woody vegetation on the cap and/or in the rip rap is identified during inspection procedures (either quarterly LUC inspections by MCRD Parris Island or annual inspections by NAVFAC's contractor), it is subsequently removed, to comply with CERCLA requirements. A program of routine maintenance needs to be established and implemented. Due to the unique meadow ecosystem at Site 1, which includes nesting birds and pollinators, the Depot prefers less aggressive woody vegetation removal methods; bush-hogging is recommended only during the December through February period.

Between 2010 and 2014, native marsh grass had reestablished well on the north (transect B) and southernmost (transect A) marsh restoration areas. Marsh grass Restoration along transect C (the eastern/southeastern perimeter of the landfill) needs further assessment, as discussed in Section 2.6.2.1.

Based on feedback provided during five-year review interviews, NAVFAC Mid-Atlantic and MCRD Parris Island will reassess field inspection and documentation procedures relative to annual landfill inspections and LUC compliance activities. At this time, inspection activities are performed by both NAVFAC contractors and by MCRD Parris Island on differing schedules. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.

### **2.7.1.3 Opportunities for Optimization**

During this last five-year review period, sediment sampling was deemed complete and, thus, eliminated from the LTM program. Also during the last five-year review period, annual groundwater monitoring parameters were reduced to antimony, arsenic, and lead, with full analysis once during each five year review period.<sup>20</sup> Based on the limited number of original HHRA COCs and review of RAOs and LTM data during this five-year review, there are additional opportunities for optimization of the groundwater monitoring program. The program will be evaluated further, with recommendations for optimization presented to the MCRD Parris Island Partnering Team, during forthcoming LTM efforts.

### **2.7.1.4 Implementation of LUCs and Institutional/Engineering Controls**

LUCs are required as described in Section 2.4.3.6. Site 1 and Site 41 LUC field inspections have been completed quarterly by MCRD Parris Island personnel during this five-year review period. No issues affecting short-term protectiveness were identified in 2010 through 2015 Annual LUC compliance certificates submitted to U.S. EPA and SCDHEC in accordance with the LUC RD. Site inspections performed as part of this five-year review confirmed LUC compliance certificate findings.

Current conditions for LUCs at Site 1 and 41, as required by OSWER Directive 9355.7-18 Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance, are summarized in Table 2-9.

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<sup>20</sup> The 2015 sampling event will include the full (original) analytical suite for groundwater.

<b>Table 2-9 Land Use Control Current Condition Summary — Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>		
<b>Objective</b>	<b>Requirement</b>	<b>Current Conditions</b>
Clarity of Use Restrictions and Exposure Pathways	Decision documents and LUCs should clearly articulate the restrictions needed to achieve Remedial Action Objectives. Assumptions made as part of remedy decisions should still be accurate.	<p>The ROD and LUC RD articulate restrictions needed to achieve Remedial Action Objectives. Assumptions made as part of remedy decisions remain accurate.</p> <p>During this five-year review, it was noted that the Base Master Plan, GIS, and Depot Order do not fully institutionalize site-specific LUC restrictions as prescribed in the LUC RD. While the Base Master Plan and GIS include IRP site boundaries, they do not include notifications of site-specific LUCs and do not depict LUC boundaries. Furthermore, a Depot Order does not currently exist to identify the site, the LUC boundary, and the LUCs. While the protectiveness of the remedy is not affected in the short term, it is recommended that these documents/systems be revised to clarify processes and procedures necessary to fully institutionalize LUC RD requirements.</p>
Accuracy of Property Information and Mapping	All physical areas that do not support unrestricted UU/UE should be identified and the administrative record should have information regarding LUC mechanisms/ footprint.	<p>LUC mechanisms and footprints are documented in the LUC RD, which is part of the administrative record.</p> <p>While the Base Master Plan, GIS, and Depot Order do not fully institutionalize site-specific LUC restrictions as prescribed in the LUC RD and do not depict LUC boundaries, procedures are in place to identify areas which do not support UU/UE. Authorization is required from the NREAO prior to any excavation, construction, or intrusive activities at IRP Sites. Furthermore, signs have been posted to provide notification of unauthorized activities.</p>
Adequacy of Long-term Stewardship of LUCs	Planning documents should be in place and detail long-term roles and responsibilities for implementing, maintaining, and enforcing LUCs.	<p>The LUC RD details long-term roles and responsibilities for implementing, maintaining, and enforcing LUCs.</p> <p>During this five-year review, it was noted that field inspection and LUC compliance inspection and reporting procedures are not clearly established. While protectiveness of the remedy is not impacted in the short term, it is recommended that specifications for annual landfill inspections and LUC compliance inspections be established to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.</p>

**Notes:**

GIS	=	Geographic Information Systems
IRP	=	Installation Restoration Program
LUC	=	Land Use Control
NREAO	=	Natural Resources and Environmental Affairs Office
RD	=	Remedial Design
ROD	=	Record of Decision
UU/UE	=	Unrestricted use/Unlimited exposure
SWMU	=	Solid Waste Management Unit

**2.7.1.5 Early Indicators of Potential Remedy Problems**

This five-year review has not identified early indicators of potential remedy problems.

## **2.7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the time of the remedy selection still valid?**

### **2.7.2.1 Changes in Chemical-, Location-, and Action-Specific ARARs and To-Be-Considered Criteria**

Site 1 and Site 41 groundwater is not used as a potable water supply, nor is it expected to be used as such in the future. Furthermore, LUCs prohibit groundwater use. To assess effectiveness of the landfill cap in preventing the migration of contaminants into the groundwater, LTM groundwater samples are collected and compared to MCLs (as ARARs). The ARAR list is updated during each LTM event to reflect current MCLs. A summary table reflecting the full analyte list analyzed every five years at Site 1 and Site 41 is included as Appendix E, and compares reference limits from 2006 versus 2015.

Antimony, arsenic, and lead are the only parameters retained in the current LTM program; MCLs for those parameters have not changed since the ROD was signed in 2006.

Changes in action- and location-specific ARARs are shown in Appendix F.

### **2.7.2.2 Expected Progress towards Meeting RAOs**

The RAOs for the site are still valid: eliminate direct contact; reduce migration of COCs; eliminate human exposure; and eliminate ecological exposure. The remedy has achieved several RAOs defined in the ROD, including eliminating and/or reducing exposure to wastes or migration of contaminated media. Contaminant concentrations have been below their respective U.S. EPA MCLs for the majority of groundwater samples collected since 2013. Sediment sampling was deemed complete and has been eliminated from the LTM program, as contaminant concentrations were below respective U.S. EPA ESVs. Comprehensive LTM data indicate that the selected IRA and final remedy have contained landfill wastes and minimized contaminant migration.

### **2.7.2.3 Changes in Exposure Pathways**

Exposure pathways at Site 1 and Site 41 have not changed.

### **2.7.2.4 Changes in Land Use**

Site 1 is a closed landfill and Site 41 is a former incinerator; as discussed in Section 2.3.2. No change to land use as discussed in Section 2.3.2 is anticipated, based on review of the 2014 Base Master Plan. LUCs are discussed in Section 2.4.3.6.

### **2.7.2.5 New/Emerging Contaminants and Contaminant Sources**

No emerging contaminants were identified at Site 1 and Site 41. During the site inspection, debris was identified outside the site boundary; as discussed in Section 2.6.3 and in Section 2.7.3.

### **2.7.2.6 Changes in Toxicity, Risk Assessment Methods, and Cleanup Levels**

Overall, the HHRA used U.S. EPA Region 9 PRGs (U.S. EPA 2000) to identify COPCs. The U.S. EPA updated these screening values, toxicity values, and exposure models in 2015. The five-year review holistically re-evaluated the COPCs retained for human health, as well as those constituents considered as ecological parameters, to determine if they would contribute to risk or hazard under current exposure scenarios. A full list of constituents evaluated can be found in Appendix G.

### **Human Health**

This five-year review developed upper bound risk-based remedial goal options using four land use scenarios as a method of reviewing the protectiveness of risk management decisions. The scenarios used in this five-year review are default land use scenarios used in the U.S. EPA Regional Screening Level calculator and the Oak Ridge National Laboratory Risk Assessment Information System (RAIS) (<http://rais.ornl.gov/>), and the original scenarios were compared to default scenarios in Table 2-10. Input information for each of the default scenarios evaluated in the five-year review, toxicity values, as well as resulting remediation levels, are included in Appendix G. Remedial goal options were estimated using U.S. EPA's upper bound risk range (1E-04) to assess the protectiveness of the site remedy under each of these scenarios, consistent with U.S. EPA's U.S. EPA Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, OSWER Directive 9355.0-30 (U.S. EPA 1991). This holistic approach (development of updated remedial goal options) is directly comparable to the ROD remediation levels.

Table 2-11 compares ROD-selected remediation levels to present day upper-bound remedial goal options calculated using current toxicity values and current exposure models. The risk re-evaluation for the human health COPCs indicates that the Site 1 and Site 41 remedy remains protective of human health, particularly given the current land use and LUCs in place at the site. Concurrent review of ecological COPCs for human health risks (see Appendix G) indicates that these constituents would not alter protectiveness conclusions at Site 1 and Site 41. Lead remediation levels were reviewed separately during the five-year review because these remediation levels are not based on risk or hazard. Instead, they are based on another model from U.S. EPA. Comparisons to current RSLs for lead (400 mg/kg residential scenario; 800 mg/kg industrial scenario) indicate that remediation levels developed in the ROD remain protective.

It should also be noted that some existing background concentrations for MCRD Parris Island are above some remediation levels and some of the U.S. EPA Region 9 RSLs (U.S. EPA, June 2015), indicating that background could be a decision driver. Historically, background values were selected as remediation levels in some cases, as noted in the ROD. Revisions to the MCRD Parris Island background data set are currently underway. If background concentrations are updated, future five-year reviews need to consider updated background values in the review process.

### **Ecological**

The SLERA used Region 4 ESVs published in 2000 to identify COPCs in surface soil, groundwater, surface water, and sediment. These screening values were updated most recently in 2001 (U.S. EPA 2001); updates are as follows:

- 30 November 2001: Citation for Dioxin listed under Table 3
- 20 April 2001: U.S. Fish and Wildlife Service Contacts Updated

Table 3 provides sediment screening values, to which a citation for dioxin was added in 1999. This change has no impact on the conclusions of the risk assessment or protectiveness of the selected remedy. Since the 2001 ecological risk evaluation, U.S. EPA has also developed Ecological Soil Screening Levels for some compounds; these updates did not affect the protectiveness of the selected remedies. Food-chain modeling conducted as part of the 1999 risk assessment was limited to COPCs identified in the preliminary screening step. This approach was approved by U.S. EPA and SCDHEC and is the recommended approach for military bases in U.S. EPA Region IV (U.S. EPA 1998). No substantial changes have been made to ERA methods, exposure parameters, or toxicity reference values since the 2001 ecological risk evaluation, as shown in Table 2-12. In conclusion, there have been no changes in toxicity, risk assessment methods, or clean up levels related to ecological risk assessment that impact the conclusions of the risk assessment or protectiveness of the selected remedy.



<b>Table 2-10 Risk Assessment Exposure Scenario Comparison — Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>	
<b>HHRA Exposure Scenario</b>	<b>Five-Year Review Exposure Scenario</b>
<b>Construction Workers</b> — the HHRA considered exposure to surface soil during a 6 month to 1 year period, and to groundwater, surface, and sediment during a 1 month period.	<b>Excavation Worker</b> — Same as construction worker scenario. The current default U.S. EPA model output uses the term Excavation Worker instead of Construction Worker and uses updated exposure factors, models, and toxicity values.
<b>Maintenance Workers</b> — the HHRA considered maintenance activities to include long-term activities such as mowing, landscaping, site inspections, or daily duties. The maintenance worker was assumed to be non-military personnel, and was assessed for exposure to surface soil and sediment only.	<b>Industrial Site Worker</b> — Includes workers exposed regularly across the site and tasks that would be common for maintenance workers (e.g., mowing, inspection, daily duties). The current default U.S. EPA model output uses the term Indoor Worker instead of Maintenance Worker or Site Worker and uses updated exposure factors, models, and toxicity values. This default scenario generally goes beyond that of a typical maintenance worker, with the exception of invasive activities. The default Excavation Worker scenario would be protective of occasional invasive activities.
<b>Hypothetical Future Residents</b> — this scenario was included as a comparative indicator of potential risks in the event the base were to close and the site were developed for residential use. Groundwater was not included in the evaluation due to non-potable characteristics (high salinity).	<b>Residential Land Use</b> — Same as hypothetical future resident scenario. The current default U.S. EPA model output uses updated exposure factors, models, and toxicity values.
<b>Recreational Site Users (adult and adolescent)</b> — infrequent exposure of recreational users stationed on-base to soil, surface water, and sediment. Recreational use was assumed to include fishing.	<b>Recreational Site User (Recreationist)</b> — Same as recreational scenario considered in the HHRA. The current default U.S. EPA model output uses updated exposure factors, models, and toxicity values.
<b>Basis for ROD Remediation Levels:</b> Remediation levels in the ROD based on human health risk were developed for the parameters shown in Table 2-9 using a target risk of 1E-06 and a target hazard quotient of 1.0, as indicated in the ROD.	<b>Basis for Evaluating Protectiveness:</b> Remedy protectiveness in terms of changes to toxicity values and risk assessment methods was evaluated in accordance with RAGS, which uses a 1E-04 target risk and target hazard quotient of 1.0 to develop upper bound risk-based remedial goal options and to determine if actions are warranted in accordance with U.S. EPA's <i>Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions</i> , OSWER Directive 9355.0-30 (U.S. EPA 1991). Risk-based concentrations were calculated using current risk assessment methods for the purpose of that evaluation and were compared to remediation levels in the ROD, as indicated in the five-year review and corresponding appendices.

**Notes:**

- HHRS = Human Health Risk Assessment
- RAGS = Risk Assessment Guidance for Superfund
- U.S. EPA = United States Environmental Protection Agency
- OSWER = Office of Solid Waste and Emergency Response
- ROD = Record of Decision
- SWMU = Solid Waste Management Unit



<b>Table 2-11 ROD-Selected Remediation Levels compared to Present Day Upper Bound Remedial Goal Options for Soil and Sediment — Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>									
<b>Chemical</b>	<b>ROD-Selected Remediation Level (mg/kg)</b>	<i>Resident</i>		<i>Industrial Worker</i>		<i>Excavation Worker</i>		<i>Recreational User</i>	
		<b>Carcinogenic RGO TR=1.0E-4 (mg/kg)</b>	<b>Noncarcinogenic Child RGO THI=1 (mg/kg)</b>	<b>Carcinogenic RGO TR=1.0E-4 (mg/kg)</b>	<b>Noncarcinogenic RGO THI=1 (mg/kg)</b>	<b>Carcinogenic RGO TR=1.0E-4 (mg/kg)</b>	<b>Noncarcinogenic RGO THI=1 (mg/kg)</b>	<b>Carcinogenic RGO TR=1.0E-4 (mg/kg)</b>	<b>Noncarcinogenic Child RGO THI=1 (mg/kg)</b>
		<b>Soil</b>							
Antimony (metallic)	31	NA	31.3	NA	934	NA	1,770	NA	146
Arsenic, Inorganic	1.83	42.4	21.7	436	695	18,900	1,210	198	101
Benzo[a]pyrene Equivalents	0.434	1.53	NA	89.6	NA	3,010	NA	7.14	NA
DDD	1.7	222	123	2,730	4,670	98,100	6,730	1,040	575
DDT	1.7	187	36.2	1,920	1,170	83,200	2,020	874	169
Iron	26,920	NA	54,800	NA	1,640,000	NA	3,100,000	NA	256,000
<b>Sediment</b>									
Arsenic, Inorganic	12.4	42.4	21.7	436	695	18,900	1,210	198	101
Benzo[a]pyrene Equivalents	0.434	1.53	NA	89.6	NA	3,010	NA	7.14	NA

**Notes:**

- RGO = Remedial goal option
- NA = Not applicable
- TR = Target risk used to calculate RGO
- THI = Target hazard index used to calculate RGO
- mg/kg = Milligrams per kilogram
- ROD = Record of Decision
- SWMU = Solid Waster Management Unit



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**Table 2-12  
 Comparison of Ecological Screening Criteria (Soil and Sediment) to ROD-Selected  
 Remediation Levels — Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)**

Contaminant of Concern	Region 4 Ecological Screening Value (2000)	ROD-Selected Ecological Remediation Level	Current Ecological Screening Value (1)
<b>Surface Soil</b>			
Total PAHs <sup>(2)</sup>	1,000 µg/kg	1,000 µg/kg	1,000 µg/kg
alpha-BHC	2.5 µg/kg	2.5 µg/kg	2.5 µg/kg
beta-BHC	1 µg/kg	1 µg/kg	1 µg/kg
gamma-BHC (Lindane)	0.05 µg/kg	0.05 µg/kg	0.05 µg/kg
4,4'-DDD	2.5 µg/kg	33.6 µg/kg <sup>(4)</sup>	21 µg/kg
4,4'-DDE	2.5 µg/kg	31.6 µg/kg <sup>(4)</sup>	21 µg/kg
4,4'-DDT	2.5 µg/kg	34.5 µg/kg <sup>(4)</sup>	21 µg/kg
DDTR <sup>(3)</sup>	9.9 µg/kg	99.8 µg/kg <sup>(4)</sup>	21 µg/kg
Aroclor-1260	20 µg/kg	20 µg/kg	20 µg/kg
Aluminum	50 mg/kg	7,270 mg/kg <sup>(4)</sup>	1 mg/kg
Antimony	3.5 mg/kg	3.5 mg/kg	0.27 mg/kg
Arsenic	10 mg/kg	10 mg/kg	18 mg/kg
Barium	165 mg/kg	165 mg/kg	330 mg/kg
Cadmium	1.6 mg/kg	1.6 mg/kg	0.36 mg/kg
Chromium	0.4 mg/kg	6.2 mg/kg <sup>(4)</sup>	26 mg/kg
Copper	40 mg/kg	40 mg/kg	28 mg/kg
Iron	200 mg/kg	3,920 mg/kg <sup>(4)</sup>	20,000 mg/kg
Lead	50 mg/kg	50 mg/kg	11 mg/kg
Manganese	100 mg/kg	129 mg/kg <sup>(4)</sup>	220 mg/kg
Mercury	0.1 mg/kg	0.110 mg/kg <sup>(4)</sup>	0.1 mg/kg
Nickel	30 mg/kg	30 mg/kg	38 mg/kg
Selenium	0.81 mg/kg	0.81 mg/kg	0.52 mg/kg
Silver	2 mg/kg	2 mg/kg	4.2 mg/kg
Vanadium	2 mg/kg	9.5 mg/kg <sup>(4)</sup>	7.8 mg/kg
Zinc	50 mg/kg	50 mg/kg	46 mg/kg
<b>Sediment</b>			
Total PAHs <sup>(2)</sup>	1,684 µg/kg	1,684 µg/kg	1,684 µg/kg
4,4'-DDD	3.3 µg/kg	33.6 µg/kg <sup>(4)</sup>	3.3 µg/kg
4,4'-DDE	3.3 µg/kg	31.6 µg/kg <sup>(4)</sup>	3.3 µg/kg
4,4'-DDT	3.3 µg/kg	34.5 µg/kg <sup>(4)</sup>	3.3 µg/kg
DDTR <sup>(3)</sup>	9.9 µg/kg	99.8 µg/kg <sup>(4)</sup>	9.9 µg/kg



**Table 2-12**  
**Comparison of Ecological Screening Criteria (Soil and Sediment) to ROD-Selected Remediation Levels — Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)**

Contaminant of Concern	Region 4 Ecological Screening Value (2000)	ROD-Selected Ecological Remediation Level	Current Ecological Screening Value <sup>(1)</sup>
alpha-Chlordane	1.7 µg/kg <sup>(5)</sup>	13.9 µg/kg <sup>(4)</sup>	1.7 µg/kg <sup>(5)</sup>
gamma-Chlordane	1.7 µg/kg <sup>(5)</sup>	13.2 µg/kg <sup>(4)</sup>	1.7 µg/kg <sup>(5)</sup>
Arsenic	7.24 mg/kg	Not Applicable <sup>(6)</sup>	18 mg/kg
Copper	18.7 mg/kg	18.7 mg/kg	18.7 mg/kg
Lead	30.2 mg/kg	30.2 mg/kg	30.2 mg/kg
Mercury	0.13 mg/kg	0.13 mg/kg	0.13 mg/kg

**Notes:**

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilogram

ROD = Record of Decision

SWMU = Solid Waste Management Unit

- (1) U.S. EPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated 30 November 2001: <http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html> and Ecological Soil Screening Levels <http://www.epa.gov/ecotox/ecossl/>
- (2) Total PAHs = Low Molecular Weight PAHs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) + High Molecular Weight PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, and pyrene)
- (3) DDTR = 4,4'-DDD + 4,4'-DDE + 4,4'-DDT
- (4) Selected value is background concentration (TtNUS 2001)
- (5) Based on total chlordane
- (6) When maximum concentrations were less than background or Region 9 residential preliminary remediation goals, no goal was selected, as indicated by "not applicable"

### **2.7.2.7 Summary**

In summary, the risk review performed for this five-year review at Site 1 and Site 41 assumed the industrial worker or excavation worker scenarios could occur in the future; residential and recreationist scenarios are presented for comparative purposes. Warning signs and LUCs restrict unauthorized disturbance (e.g., construction, drilling, and intrusive activity). Current LUCs adequately prohibit residential use. Consequently, the scenario used to develop remediation levels is unlikely to impact the conclusions of the risk assessment or protectiveness of the selected remedy, with the exception of lead in soil. While lead exceeds remediation levels under all scenarios considered (Table 2-10), due to the remedy implemented (cap, revetments), any exposure to lead exceeding this criterion has been mitigated. The changes in risk assessment are unlikely to impact the conclusions of the risk assessment or protectiveness of the selected remedy. RAOs for Site 1 and Site 41 were based on the presumptive remedy for municipal landfills, which calls for landfill wastes to be contained and covered, groundwater within the landfill to be monitored, and LUCs to be applied to ensure protectiveness. Because no unacceptable exposure pathways remain at Site 1 and Site 41, due to the landfill cover, future detailed evaluation of site risk will not be necessary unless exposure scenarios change.

### **2.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?**

An isolated burrow was noted near the northeast revetment (Photo 19, Appendix A-2) during the January 2015 five-year review site visit. Consistent with the SWMU 1 LTM Work Plan, an assessment of the burrow area is recommended as part of future LTM activities. The assessment should include a review of construction specifications of the cap to determine if this type burrowing would affect the remedy. If it is determined that such burrowing would affect the remedy, the following steps will be taken: (a) a determination of the bird/mammal causing the burrow, (b) additional visible inspection to define the impacted area, and (c) a proposal to the MCRD Parris Island Partnering Team for eradication. The findings of this assessment and any subsequent recommendations will be integrated into future LTM reports. At this time, it is not believed that this isolated burrow impacts remedy protectiveness at Site 1 and Site 41.

Debris observed along the unprotected banks and outside the combined Site 1 and Site 41 boundary suggests the extent of waste materials may not have been fully delineated. Additional investigation and historical research will be conducted by the Navy to determine the extent of debris outside the landfill boundary and to confirm the presence/absence and nature of any contaminants associated with the debris. The remedy protectiveness at Site 1 and Site 41 is not affected by the presence of this debris outside of the site boundary.

## **2.8 Issues, Recommendations, and Follow-Up Actions**

Issues and recommendations for follow-up actions identified during this five-year review are summarized in Table 2-13.

## **2.9 Protectiveness Statement**

The remedy at OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) currently protects human health and the environment because sediment excavation/consolidation, waste consolidation, capping, marsh grass restoration, and the installation of revetments eliminate direct contact and contaminant migration pathways. Groundwater monitoring ensures contamination is not migrating offsite. The Navy has implemented land use controls which currently prevent disturbance of waste and unacceptable soil and groundwater exposures. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness: establish a routine maintenance program and implement accordingly; reassess and clarify process and procedures to fully institutionalize LUC RD requirements.



<b>Table 2-13 Issues and Recommendations/Follow-Up Actions at Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)</b>							
Issue Number	Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date <sup>[1]</sup>	Affects Protectiveness (Y/N)	
						Current	Future
1	Isolated burrow near northeast revetment.	Assessment to review construction specifications of the cap to determine if burrowing animals were accounted for in the remedy and an assessment to determine the cause of the burrow, the extent of impacts, and if eradication and repairs are necessary.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
2	Maintenance (i.e., removal of woody vegetation) is currently implemented on an as-needed basis. A routine maintenance program does not currently exist.	Establish a routine maintenance program and implement accordingly.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	Y
3	Layered debris was observed along the east revetment, outside the boundary of Site 1 and Site 41.	Additional investigation to determine the extent of debris outside of Site 1 and Site 41 and evaluate presence/absence and nature of any associated contamination.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
4	Marsh grass restoration may be incomplete along the eastern/southeastern perimeter of the landfill. Background/reference values needed to facilitate evaluation of marsh grass restoration.	Evaluate conditions in area where marsh grass restoration may be incomplete. Review findings and recommendations with MCRD Parris Island Partnering Team. Develop background/reference marsh grass counts and evaluate remedy progress.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
5	Field inspection and LUC compliance inspection and reporting procedures are not clearly established.	Reassess field inspection and documentation procedures relative to O&M landfill inspections and LUC compliance activities. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
6	The Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully institutionalize site-specific LUC restrictions.	Reassess and clarify process and procedures to fully institutionalize LUC RD requirements.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	Y

**Notes:**

- |          |   |   |      |   |                                 |   |   |     |
|----------|---|---|------|---|---------------------------------|---|---|-----|
| [1]      | = | Proposed milestones dates are contingent upon funding.        | GIS  | = | Geographical information system | Y | = | Yes |
| LUC      | = | Land use control  | MCRD | = | Marine Corps Recruit Depot      | N | = | No  |
| O&M      | = | Operations and maintenance                                    | RD   | = | Remedial Design                 |   |   |     |
| SCDHEC   | = | South Carolina Department of Health and Environmental Control | SEPT | = | September                       |   |   |     |
| U.S. EPA | = | United States Environmental Protection Agency                 | SWMU | = | Solid Waste Management Unit     |   |   |     |



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### 3.0 OPERABLE UNIT 3 (SITE 3/SWMU 3)

#### 3.1 Introduction

OU 3 (Site 3/SWMU 3) a former landfill in the northwest portion of MCRD Parris Island, serves as a causeway connecting Horse Island to Parris Island (TtNUS 2011). This causeway crosses Ribbon Creek and tidal marshes associated with the Broad River. Site 3 is bordered on the northeast by the 3rd Battalion Pond and on the southwest by marshes.

#### **OU 3 (Site 3/SWMU 3) — Current Conditions**

- Causeway Landfill
- Limited sediment removal and waste consolidation/cover installation in 2001
- Was the RAO to meet UU/UE? — **No**
- Remedy: maintain cover/causeway surface, LUCs, landfill inspections, and LTM of groundwater for VOCs, SVOCs, pesticides, PCBs, and metals

#### 3.2 Site Chronology

Historical events and relevant dates in Site 3 chronology are listed in Table 3-1.

Event	Date
Initial Assessment Study	September 1986
Interim Resource Conservation and Recovery Act (RCRA) Facility Assessment	April 1990
Extended Site Inspection	1993
Remedial Investigation/RCRA Facility Investigation (Field Investigation)	May to September 1998
Remedial Investigation/RCRA Facility Investigation (Report Issued)	November 1999
Feasibility Study/Corrective Measures Study Report	June 2000
Proposed Plan for Interim Remedial Action at Areas 1, 2, 3, and 4	June 2000
Interim Record of Decision	September 2000
Interim Remedial Action	August 2000 to July 2001
Post-Interim Remedial Action Sediment Investigation	April to August 2003
Fish Tissue Sampling	2009
Post-Interim Construction Risk Assessment Technical Memorandum	2010
Proposed Plan	25 February 2011
Record of Decision signed by MCRD Parris Island Commanding General	19 August 2011
Underwater Culvert Inspection Report	6 December 2011
Remedial Action Completion Letter Report	June 2012
Long-Term Groundwater Monitoring; since the last five-year review, groundwater monitoring has been documented in the following reports:	2010 to 2014





Basemap Source: Google Earth Pro - 11-20-2014  
 Note: Per the Land Use Controls Remedial Design, dated February 2012, the outer perimeter of the combined LUC boundary also serves as the site boundary

**FIGURE 3-1**  
**SITE LAYOUT**  
 OPERABLE UNIT 3 (SITE 3/SWMU 3)  
 MCRD PARRIS ISLAND, SOUTH CAROLINA

- + Approximate Monitoring Well Location
- 3rd Battalion Pond LUC Boundary
- Causeway Landfill LUC Boundary
- Covered Contaminated Sediment

444 Building Number



<b>NAVFAC</b> Naval Facilities Engineering Command		
REQUESTED BY: D. WARREN	DATE: 8/7/2015	
DRAWN BY: M. SENNE	TASK ORDER NUMBER: JM38	



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## **Geology and Hydrogeology**

Sediment at Site 3 consists of silts and clay, with varying sand content. Soil beneath the asphalt pavement consists of an approximate 4-foot layer of fine- to medium-grained sands with varying silt content, followed by approximately 18 feet of fill material. The fill material consists of loose- to medium-dense silty fine sand, miscellaneous landfill debris, cemented sands, and zones of very loose silty fine sand.<sup>22</sup> Beneath the fill material, overburden (native) materials consist of tidal sands with varying silt content to 28 feet bgs; clay was encountered from 28 to 40 feet bgs (boring terminus). This clay layer serves as a confining unit to overlying sands of the upper surficial aquifer. The upper surficial aquifer is approximately 18 to 20 feet thick, based on the depth of the clay unit encountered. The water table surface varies seasonally by as much as 3 feet, generally falling during dry summer months and rising during the winter. During the most recent (April 2014) LTM event, groundwater was generally encountered between 3 and 5 feet bgs. The groundwater flow direction is not estimated during LTM, due to limitations associated with the straight line orientation of the wells.<sup>23</sup> The Interim Record of Decision (IROD) noted that groundwater is saline to brackish, thus, not a viable drinking water source (TtNUS 2000).

### **3.3.2 Land and Resource Use**

The causeway consists of an asphalt road (3rd Battalion Pond Road) and an adjacent, asphalt pedestrian path. Site 3 is not used for residential purposes and LUCs (discussed in Section 3.4.3.2) prohibit future residential use. The current and reasonably anticipated future land use remains a causeway for vehicle and pedestrian traffic. Groundwater is not used as a potable water source and is not anticipated to be used in the future. There are no offsite, downgradient residents in the immediate vicinity of the Site that might use groundwater as a potable water source. LUCs prohibit recreational activities (i.e., fishing, boating, swimming, etc.).

### **3.3.3 History of Contamination**

The Site 3 causeway was gradually constructed using layers of solid waste, fill dirt, and other debris placed from the 1960s to 1972. The causeway landfill was the main disposal area during that period for solid waste accumulated in dumpsters located throughout MCRD Parris Island. Unknown quantities of the following wastes were disposed of at Site 3: municipal trash with empty pesticide containers, oily rags, spent absorbent, petroleum and chlorinated solvent sludge, tetrachloroethylene still bottoms, mercury amalgam and beryllium waste, polychlorinated biphenyl- (PCB-) contaminated oil, and metal shavings. Waste disposal practices and landfill construction methods (waste was used to build the causeway) at Site 3 resulted in residual

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<sup>22</sup> Landfill debris generally consisted of wood, metal (cans), paper, plastics, concrete, and brick. The boundary between landfill debris and natural materials is fairly distinct.

<sup>23</sup> Earlier groundwater monitoring reports estimated groundwater flow direction as southwest to northeast during high tides and northeast to southwest during low tides.

contamination in soil and surrounding sediment. Human health risks were associated with benzo(a)pyrene. Ecological risks were associated with benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, arsenic, lead, mercury, and zinc. Four areas of sediment on the 3rd Battalion Pond side of the causeway (Areas 1 through 4) exhibited COCs that posed risks significant enough to warrant remedial action.

### **3.3.4 Initial Response**

Based on the findings of the RI/RFI (see Section 3.3.5), the initial response at Site 3 consisted of an Interim Remedial Action/Corrective Action in 2000. The IRA was designed to address buried wastes and contaminated soils/sediments adjacent to the causeway and prevent future migration of contaminants to environmental media. Furthermore, the IRA would provide adequate protection until a final remedy was selected and implemented, following re-characterization of sediment (TtNUS 2000).

The IROD, signed by the Marine Corps on 22 September 2000, consisted of slope stabilization and erosion control, placement of soil cover, roadway construction, sediment re-characterization, implementation of LUCs and periodic inspections, and LTM of groundwater (TtNUS 2000). Embankments were re-graded and slopes were stabilized with clean imported fill material, a 4-inch layer of bedding materials, followed by a 12-inch layer of rip rap. Steeper slopes were protected with a layer of 4-inch Fabriform. Slope stabilization and limited sediment excavation along the base of the causeway were intended to address the most contaminated sediments, thereby eliminating the majority of risks associated with human and ecological exposure to sediment. In accordance with federal and state landfill regulations, soil was added to the top and sides of the causeway to ensure a minimum of 2 feet of compacted cover over buried material. The soil cover protects human health by eliminating exposure to waste materials, reducing the ILCR to 1.0E-06 or less. In other areas of the causeway, 1 foot of additional soil cover was added to protect terrestrial wildlife. Four areas of contaminated sediment on the northeast side (3rd Battalion Pond) of the causeway were covered with a minimum of 1 foot of soil and 1 foot of rip rap. Geotextile layers were used to separate existing sediment, imported soil, and rip rap. Specifications for the surface cover were designed to allow an adequate subgrade for roadway construction (CCI 2002). The asphalt roadway and pedestrian path were constructed to reduce precipitation infiltration into the waste and reduce erosion of cover material. At the conclusion of the IRA, no further actions were required to control exposure to wastes, soil, or sediment. As noted in the IROD, further characterization of fish tissue samples was required after completion of the IRA due to unacceptable risks to subsistence fishermen. Sampling completed in 2001, 2003, and 2009 was used to assess post-construction risks, and is discussed in further detail in Section 3.3.5.3.

Post-construction, sediment sampling (outside of the covered areas), groundwater monitoring, operations and maintenance of the cover, and LUCs were implemented to maintain the integrity and continued performance of the IRA. The LTM groundwater program included annual sampling and analysis for the first five years to monitor potential leachate via monitoring wells positioned inside the Site 3 boundary and re-evaluation of the site every five years to determine the necessity for changes to restrictions and monitoring frequency. To protect human health and the environment under existing and potential future conditions, LUCs were specified in the Land Use Control Implementation Plan (herein referred to as the LUCIP) (TtNUS 2000), included as an appendix to the June 2002 Long-Term Monitoring Plan (CCI 2002).<sup>24</sup> The LUCIP was replaced by the LUC RD (TtNUS 2012), which was completed after the ROD was finalized; the LUC RD is discussed in Section 3.4.3.2.

### **3.3.5 Basis for Taking Action**

The RI/RFI and associated baseline risk assessment, upon which the IRA and IROD were based, were supplemented with additional sediment investigations in 2000, 2001, and 2003 and fish tissue sampling in 2009. The resulting July 2010 Post-Interim Remedy Construction Risk Assessment, which also updated the HHRA and ERA, was used to determine the final remedy discussed in Section 3.4.

#### **3.3.5.1 Remedial Investigation Findings**

Conducted between 1998 and 1999, the RI/RFI included collection and analysis of surface and subsurface soil, surface water, sediment, and groundwater samples; a tidal study; and aquifer tests to establish background conditions. The RI/RFI Report (TtNUS 1999) identified surface soil and sediment as the primary media of concern, based on elevated concentrations of PAHs, PCBs, pesticides, and metals. As noted in Section 3.3.4, contaminated surface soil and sediment was covered as part of the IRA in 2000. Fish tissue sampling was completed in 2009, following the IRA, and is discussed in Section 3.3.5.3; LUCs based on risks due to fish consumption are discussed in Section 3.4.3.2.

#### **3.3.5.2 RI/RFI Human Health Risk Assessment**

Risk characterization was originally conducted as part of the 1999 RI/RFI, and a Post-Interim Construction Risk Assessment was completed in 2010 after implementation of the IRA, which evaluated chemical concentrations in fish tissue. A quantitative HHRA conducted as part of the RFI in 1999, used chemical concentrations detected in soil, sediment, groundwater, and surface water samples. Table 3-2 lists receptors and exposure routes evaluated.

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<sup>24</sup> The LUCIP was developed pursuant to the 24 July 2000 Memorandum of Agreement between the Navy, the U.S. EPA, and SCDHEC regarding development and maintenance of LUCs.

<b>Table 3-2 Human Health Risk Assessment Contaminants of Concern at Operable Unit 3 (Site 3/SWMU 3)</b>		
<b>Receptor</b>	<b>Media</b>	<b>Exposure Route</b>
<b>1999 Remedial Investigation/RCRA Facility Investigation</b>		
Construction Workers (current and future land use)	Soil Sediment Groundwater Surface Water	Dermal contact, incidental ingestion, and inhalation Dermal Contact and incidental ingestion Dermal contact Derma contact and incidental ingestion
Maintenance Workers (current and future land use)	Soil Sediment	Dermal contact, incidental ingestion, and inhalation Dermal contact and incidental ingestion
Recreational Users (child and adult fisherman) (current and future land use)	Sediment Surface Water	Ingestion of fish tissue (calculated and fish tissue samples)
<b>2010 Post-Interim Construction Risk Assessment</b>		
Recreational Fisherman (child and adult) (current and future land use)	Sediment Surface Water	Ingestion of fish (fish tissue)
Subsistence Fisherman (child and adult) (current and future land use)	Sediment Surface Water	Ingestion of fish (fish tissue)
U.S. EPA Default Fisherman (current and future land use)	Sediment Surface Water	Ingestion of fish (fish tissue)

**Notes:**

SWMMU = Solid Waste Management Unit  
 RCRA = Resource Conservation and Recovery Act  
 U.S. EPA = United States Protection Agency

The 1999 RI/RFI HHRA calculated risks for current and future construction workers, maintenance workers, and recreational fishermen. Total HIs for all applicable exposure routes ranged from 0.47 for current and future construction workers to 17.8 for adult recreational users. Non-cancer Hazard Quotients for sediment and surface water exposure by fish ingestion from the Post-Interim Construction HHRA indicated total HIs range from 1 for adult military and civilian fisherman to 19 for child subsistence fisherman. Concentrations of several PAHs, aluminum, arsenic, iron, and vanadium in sediment exceeded human health screening levels.

Main contributors to cancer risks (greater than 1.0E-05) from surface water and sediment through fish ingestion included carcinogenic PAHs, PCBs, and arsenic. Total risk estimates for all applicable exposure routes ranged from 1.7E-05 for current and future construction workers to 1.8E-03 for recreational fisherman exposed to surface water and sediment by fish ingestion.

Post-IRA concentrations (from samples collected in 2001 and 2003) had decreased since the RI/RFI, and suggested that under post-IRA conditions, risks to construction workers and maintenance workers would continue to be acceptable. Therefore, risks for these specific scenarios were not re-evaluated in the 2010 Post-Interim Construction Risk Assessment.

However, results of post-IRA soil and sediment investigations indicated additional remedial action was required because of unacceptable human health risks to adult subsistence fishermen, child subsistence fishermen, child recreational fishermen, and U.S. EPA Region 4 default adult recreational fishermen. Additional sampling was performed in 2009 to supplement the dataset.

### **3.3.5.3 2009 Fish Tissue Sampling/2010 Post-Interim Construction Risk Assessment**

Exposure point concentrations were initially estimated from surface water and sediment concentrations and bioconcentration factors, and indicated elevated risks to subsistence fishermen.<sup>25,26</sup> Based on an interview with a site-specific civilian fisherman who can be classified as a highly exposed individual, and on regulatory agency comments received on the draft Post-Interim Construction Risk Assessment, fish tissue samples were collected from four areas within the 3rd Battalion Pond and from a reference area on Parris Island (Generals Landing) in 2009; these were incorporated into the final 2010 Post-Interim Construction Risk Assessment (TtNUS, July 2010). Human health risks were evaluated for the military recreational fisherman, civilian recreational fisherman, civilian subsistence fisherman, and standard U.S. EPA Region 4 default fisherman, all of which included child and adult receptors.

Unacceptable risks were identified for both child and adult subsistence fishermen, the child recreational fisherman (military and civilian), and the U.S. EPA Region 4 default fisherman. Risk values were comparable for both Site 3 and Generals Landing. Fish consumption was the only unacceptable exposure pathway for human health identified at Site 3 and resulted in LUCs being implemented (see Section 3.4.3.2). A summary post-construction risk and hazard table for 3<sup>rd</sup> Battalion Pond samples is shown in Table 3-3.

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<sup>25</sup> 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 the fish. Most aquatic animals are able to metabolize PAHs and excrete them rapidly. Consequently, the use of bioconcentration factors to estimate PAH concentration in fish tissue most likely overestimates the actual PAH concentration in fish tissue, resulting in an overestimation of risk.

<sup>26</sup> The risk evaluations performed in 2009 and 2010 are follow-up actions from the previous five-year review; see Section 3.5.2 for a summary of issues/recommendations.

**Table 3-3  
2010 Post Construction Risk Assessment — Summary of Cancer Risks and Hazard Indices  
3rd Battalion Pond Samples — Operable Unit 3 (Site 3/SWMU 3)**

Receptor	Cancer Risk	Contaminant of Concern with Cancer Risk			Hazard Index (HI) > 1	Contaminant of Concern with HI > 1
		>10 <sup>-4</sup>	>10 <sup>-5</sup>	>10 <sup>-6</sup>		
Child Recreational Fisher	2E-05	—	—	Dioxin-like PCBs	4	Dioxin-like PCBs
Child Subsistence Fisher	7E-05	—	Dioxin-like PCBs	4,4'-DDE	17	Dioxin-like PCBs, Mercury
Adult Recreational Military Fisher	8E-06	—	—	Dioxin-like PCBs	1	—
Adult Recreational Civilian Fisher	9E-05	—	Dioxin-like PCBs	4,4'-DDE	1	—
Adult Subsistence Fisher	7E-04	Dioxin-like PCBs	4,4'-DDE	4,4'-DDD, 4,4'-DDE	7	Dioxin-like PCBs, Mercury
Default Adult Recreational Fisher	1E-04	—	Dioxin-like PCBs	4,4'-DDE	3	Dioxin-like PCBs
Original Adult Recreational Fisher (Original RFI/RI document)	4E-05	—	Dioxin-like PCBs	—	1	—

**Notes:**

- = Cancer risk or HI below designated threshold criteria
- SWMU = Solid Waste Management Unit
- HI = Hazard Index
- RFI/RI = RCRA Facility Investigation/Remedial Investigation
- RCRA = Resource Conservation and Recovery Act
- PCBs = Polychlorinated biphenyl

Source: Table 18A Summary of Cancer Risks and Hazard Indices, 3<sup>rd</sup> Battalion Pond Samples, Site/SWMU 3 — Causeway Landfill, MCRD Parris Island South Carolina (TtNUS 2010)

### 3.3.5.4 Ecological Risk Assessment

A SLERA was completed at Site 3 as part of the RI/RFI (TtNUS 1999) to evaluate potential risks from chemical concentrations detected in surface soil, sediment, groundwater, and surface water samples. A second SLERA was completed as part of the post-interim construction evaluation (TtNUS 2010) to evaluate potential risks from chemical concentrations detected in sediment remaining after the IRA. Data were evaluated again in the Post-Construction Risk Assessment (2010). Soil and sediment had originally been retained for evaluation in the SLERAs; no COCs were identified for surface water. Table 3-4 lists ecological assessment and measurement endpoints evaluated.

<b>Table 3-4 Ecological Assessment and Measurement Endpoints at Operable Unit 3 (Site 3/SWMU 3)</b>			
<b>Assessment Endpoint</b>	<b>Measurement Endpoint</b>	<b>Media</b>	<b>Approach</b>
<b>1999 Remedial Investigation/RCRA Facility Investigation</b>			
Benthic Invertebrate Communities	Benthic Invertebrate Communities	Sediment and Surface Water	Comparison to marine sediment and surface water Ecological Screening Values
Fish Communities (forage fish and higher trophic level fish)	Mummichog, Red drum	Sediment	Food chain evaluation; Comparison of fish tissue concentrations to tissue guidelines
Piscivorous birds	Great blue heron, Bald eagle	Sediment	Food chain evaluation (Eagle assessment used tissue data from striped mullet and summer flounder)
Omnivorous birds	American robin	Surface soil	Food chain evaluation
Carnivorous birds	Red-tailed hawk	Surface soil	Food chain evaluation
Omnivorous mammals	Raccoon	Sediment	Food chain evaluation (used tissue data from crab, clam, and oyster)
Herbivorous mammals	Cotton mouse	Surface soil	Food chain evaluation
Mammals that feed on soil invertebrates	Short-tailed shrew	Surface soil	Food chain evaluation
Terrestrial and aquatic vegetation	Terrestrial and aquatic vegetation	Groundwater, Surface water	Comparison to marine surface water screening values
<b>2010 Post-Interim Construction Risk Assessment</b>			
Benthic organisms and semi-aquatic wildlife	Benthic organisms (growth, survival, and reproduction)	Sediment (2001 and 2003)	Comparison to marine sediment Ecological Screening Values

**Notes:**

RCRA = Resource Conservation and Recovery Act  
SWMU = Solid Waste Management Unit

The Post-Construction Risk Assessment (2010) evaluated COPCs from 2001 and 2003 considering magnitude and spatial distribution of detections, and background conditions for the site, and concluded minimal ecological risks:

- COPCs from the marsh area southwest of the causeway pose minimal risks to benthic invertebrates and upper-level receptors.

- COPCs represented by samples collected from Areas 1, 2, and 3 of the 3rd Battalion Pond also pose minimal risks to benthic invertebrates and upper-level receptors.
- 4,4'-DDE and 4,4'-DDD in a 2001 sample from Area 4 on the 3rd Battalion Pond side of the causeway suggested potential risk to benthic invertebrates; however, additional sampling in 2003 indicated that elevated pesticide concentrations were an isolated occurrence, and the concentrations of pesticides in the Area 4 sediment samples pose negligible site-related risk to benthic invertebrates.

### **3.4 Remedial Actions**

The Final ROD for Site 3 was signed by the Marine Corps on 19 August 2011.

#### **3.4.1 Remedial Action Objectives**

The Final ROD retained original RAOs from the IROD as well as defined a new objective (see last bullet below) based on the outcome of the Post-Construction Risk Assessment (2010):

- Control human exposure (existing maintenance worker, future construction workers, and recreational user) to COCs in surface soil at concentrations above remediation levels
- Control exposure of ecological receptors to COCs in surface soil at concentrations above remediation levels
- Eliminate migration of COCs from fill material to sediment, surface water, and groundwater
- Comply with chemical-, location-, and action-specific federal and state ARARs
- Control human exposure to COCs in fish via consumption.

Implementation of the final remedy allowed industrial and commercial reuse of the Site, consistent with the overall cleanup strategy for MCRD Parris Island (TtNUS 2011). No unacceptable risk for soil remains due to the cover (consistent with implementation of the presumptive landfill remedy).

Groundwater at this site has been affected by site contaminants; however, since the groundwater is not usable as a potable water supply and other groundwater contact pathways are minor, the groundwater does not represent a significant risk to human receptors. In addition, the proposed interim remedy will reduce migration of contaminants to groundwater (TtNUS, September 2000). No additional groundwater RAOs were discussed in the Final ROD.

### **3.4.2 Remedy Selection**

The Final ROD documented that no further action is required for sediment and surface water, other than fish consumption to be addressed by LUCs, since:

- Analysis of sediment showed that chemical concentrations continued to decrease such that no unacceptable human health risk or ecological risks remained in sediment at the 3rd Battalion Pond; and
- Evaluation of surface water samples indicated that human health risks posed by surface water COPCs were negligible since the IRA landfill cover had contained the source(s) of contamination.

The IRAs (combined fill dirt, asphalt, fabric, rip rap, and vegetative cover placed on the site) successfully precluded unacceptable human and ecological exposures from covered wastes, surface soils, and sediments; therefore, the Final ROD adopted the interim remedy as final. The final remedy also adopted the LUCs discussed in Section 3.3.4 (implemented as part of the IRA), but added a LUC to prohibit fishing in 3rd Battalion Pond, and modified requirements related to maintenance of the landfill cover (TtNUS 2011), which were implemented in the LUC RD (TtNUS February 2012). In addition to inspection and maintenance of the landfill cover, ongoing groundwater monitoring was required as part of the remedy.

### **3.4.3 Remedy Implementation**

#### **3.4.3.1 Maintenance of Landfill Cover**

Maintenance of the landfill cover system (e.g., soil cover, geotextile, rip rap, culverts) including related structural remedy components (e.g., monitoring wells) was implemented in accordance with the LTM Plan (CCI 2002). The IRA Corrective Action Report (CCI 2002) included a plan for maintaining the integrity and effectiveness of the landfill cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events. Following completion of the IRA, routine visual inspections of soil cover, slope stabilization, and roadway components were performed quarterly (for the first year) and semi-annually or following major storm events thereafter. After the Final ROD was finalized, inspection of the landfill was conducted in accordance with the LUC RD and the Remedial Action Completion Letter Report (TtNUS 2012).

### **3.4.3.2 Land Use Controls**

LUCs consisting of both engineering controls and institutional controls were implemented to preclude unacceptable future human health or ecological risks associated with exposure(s) to COCs. As specified in the LUC RD (TtNUS 2012), LUC performance objectives were established to:

- Prohibit residential, commercial, agricultural, and recreational use (including wading, swimming, and fishing).
- Prevent unauthorized excavation, construction, or intrusive activities that would compromise the integrity of the causeway landfill cover, unless a construction plan is submitted and approved by the Navy, U.S. EPA, and SCDHEC prior to initiating the work.
- Prohibit disturbance of covered sediment areas in the 3rd Battalion Pond.
- Prohibit the extraction and any use of groundwater beneath the site.
- Prevent ingestion of contaminants in fish tissue.
- Maintain the integrity of the landfill cover, as well as any existing or future monitoring systems (such as groundwater wells).

To ensure that the aforementioned LUC performance objectives are met and maintained, the LUC RD specified the following engineering and institutional controls as LUC implementation actions:

#### **Engineering Controls:**

- Signs stating “No fishing, shrimping, crabbing or boating” and “No digging” were to be posted.

#### **Institutional Controls:**

- The LUC RD was to be filed in the MCRD Parris Island Information Repository located at the Beaufort County Public Library's Headquarters at 311 Scott Street, Beaufort, South Carolina 29902.
- The following base planning and environmental management documents were to be updated to identify LUC restrictions applied at Site 3.

- Base Master Plan — The Base Master Plan was to include an appendix detailing the LUC RD requirements and figures identifying areas subject to LUC restrictions. The Base Master Plan should be prepared to serve as a reference document available through the EMS.
- Geographic Information System — GIS should serve as a live version of all IRP site data, which is updated at irregular intervals based on the need to incorporate new site investigation data. Sites should be made visible as shaded polygons.
- Environmental Management System — The EMS should include LUC compliance as an environmental compliance aspect. Implementation of these compliance assurance procedures and policies should be audited on an annual basis.
- Depot Order prohibiting unauthorized disturbances.
- SOPs that detail quarterly inspection procedures and prohibitions in the area and record keeping to describe any required repairs and note repair completion date.
- Appropriate notification was to be provided to U.S. EPA and SCDHEC in advance of any changes to the Depot Order or internal LUC management procedures, which could interfere with or negatively impact the effectiveness of the LUCs.
- MCRD Parris Island was to conduct quarterly physical inspections of Site 3 to confirm continued compliance with LUC performance objectives and to verify the Base Master Plan, GIS, EMS, and Depot Order governing ground disturbing activities correctly describe the prohibited uses and restrictions at Site 3. Should any deficiencies be found, MCRD Parris Island was to separately notify U.S. EPA and SCDHEC within 10 business days of the deficiencies being discovered.
- Any activity that is inconsistent with the LUC objectives or land use restrictions, or any other action that may interfere with the effectiveness of the LUCs, should be addressed by MCRD Parris Island as soon as practicable, but in no case will the process be initiated later than 10 business days after MCRD Parris Island becomes aware of the breach.

- MCRD Parris Island shall notify U.S. EPA and SCDHEC as soon as practicable, but no later than 10 business days after discovery of any activity that is inconsistent with the LUC performance objectives or use restrictions or other action that may interfere with the effectiveness of the LUCs.
- MCRD Parris Island shall notify U.S. EPA and SCDHEC at least 45 days in advance of any proposed land use changes that would be inconsistent with the LUC performance objectives or selected remedy. If changes are proposed for any area of land within the boundaries of the site where restrictions apply, such changes should not be implemented without the approval of the U.S. EPA and SCDHEC.
- Notice should be provided to U.S. EPA and SCDHEC at least six months prior to any transfer or sale of Site 3 property, so that U.S. EPA and SCDHEC can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for the facility to notify U.S. EPA and SCDHEC at least six months prior to any transfer or sale, then the facility will notify U.S. EPA and SCDHEC as soon as possible, but no later than 60 days prior to the transfer or sale of any property subject to LUCs.
- Prior to conveyance of the real property encompassing all or a portion of Site 3, U.S. EPA and SCDHEC representatives should be given reasonable opportunity to review and concur on the applicable deed language related to all LUCs and associated rights of entry. U.S. EPA and SCDHEC should be provided with a copy of any executed deeds.
- LUCs at Site 3 should be maintained until the concentration of hazardous substances in the surface soil, sediment, and fish are at such levels as to allow for unrestricted use and unlimited exposure. LUCs and associated implementation actions should not be terminated or modified without approval by U.S. EPA and SCDHEC. The Navy shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

During this five-year review, a discrepancy was noted regarding the LUC boundary at Site 3. Text in the LUC RD identifies the site boundary as follows: "Site 3 consists of the original landfill, the causeway constructed over the landfill, and sediments within 200 feet of the northeastern side of the causeway (within 3rd Battalion Pond). Sediments within 200 feet of the northeastern side of the

causeway are included in the site boundary to account for any waste material that could have eroded from the causeway into nearby sediments and to protect the sediment covers installed as part of the interim remedy." Attachment 1 of the LUC RD depicts the Site 3 LUC boundary to include sediment within 200 feet of both northeast and southwest sides of the causeway. Attachment 1 of the LUC RD also includes a note stating: "The outer perimeter of the LUC Boundaries Serves as the Site 3 Boundary." During an 18 November 2015 meeting, the MCRD Parris Island Partnering Team collectively agreed that the LUC RD should be revised to include text necessary to clarify the LUC boundary includes sediment within 200 feet of both northeast and southwest sides of the causeway. This revision should be accomplished via an addendum to the LUC RD.

Also during the 18 November 2015 MCRD Parris Island Partnering Team meeting, MCRD Parris Island informed the team that a no fishing restriction is not currently enforced for waters within 200 feet of the southwest (marsh) side of the causeway. While prohibition of fishing on the southwest side of the causeway is not a requirement of the Final ROD, the MCRD Parris Island Partnering Team agreed that administrative controls prohibiting fishing on both sides of the causeway is logistically more enforceable. The MCRD Parris Island Partnering Team agreed that additional efforts should be made to enforce the no fishing restriction for waters within 200 feet of the southwest side of the causeway.

MCRD Parris Island has implemented various policies and procedures to ensure that LUC performance objectives continue to be met and that implementation actions are maintained. Implementation is documented in the June 2012 Remedial Action Completion Report (TtNUS 2012). Signs have been posted to provide notification of unauthorized activities and restrictions at Site 3. IRP sites have been included in a Depot Order titled *Land Use Control Standard Operating Procedure* (MCRD Parris Island, 19 July 2012), which governs ground-disturbing activities across MCRD Parris Island. IRP site boundaries have been included in the Base Master Plan. In addition to incorporating IRP site boundaries, MCRD Parris Island's GIS included NREAO contact information tied to each IRP site. Authorization is required from the NREAO prior to any excavation, construction, or intrusive activities.

In accordance with the LUC RD, MCRD Parris Island completes quarterly inspections to assess the landfill cap and perimeter revetment and confirm continued compliance with LUC performance objectives and to verify the Base Master Plan, GIS, EMS, and Depot Order governing ground disturbing activities correctly describe the prohibited uses and restrictions at Site 3. Annual LUC compliance certificates, which evaluate the status of engineering and institutional controls and identify any deficiencies or inconsistent uses, are submitted to U.S. EPA and SCDHEC. Copies of annual LUC compliance certificates are included in Appendix C. Key findings associated with compliance inspections performed during this five-year review period are discussed in Section 3.4.4.1.

### **3.4.4 System Inspection and Maintenance**

Landfill cover integrity inspections are performed by MCRD Parris Island. Leachate monitoring via four monitoring wells is performed by NAVFAC contractors, as discussed below.

#### **3.4.4.1 Landfill Inspection and Maintenance**

The integrity of the landfill cover at Site 3 currently is inspected quarterly by MCRD Parris Island as part of LUC inspection processes. Findings from MCRD Parris Island compliance inspections are documented via annual LUC compliance certificates (Appendix C), which are submitted to U.S. EPA and SCDHEC. Key findings of Site 3 compliance inspections performed from 2010 to 2015 are as follows:

- Vegetation, including woody species, has been observed growing in the rip rap and has subsequently been removed as part of maintenance.
- Surficial cracks have been observed in the concrete headwalls at the northern and southern culverts (marsh side).
- Sinkholes have been observed along the unpaved shoulders of the road in the vicinity of both sets of culverts (northern and southern). Notifications of the sinkholes were sent to the MCRD Parris Island Partnering Team. In addition to several new sinkholes having been discovered, the circumference and depth of the new and existing sinkholes have increased over the last five-year review reporting period. The asphalt surface of the road and the exercise trail has been undercut by the sinkholes.
- A depressed area has been observed at the northern culvert on the marsh side of the road that may represent a sinkhole.
- Dips and depressions in the road along the Causeway have increased in number and severity from 2010 through 2015.
- Erosion is occurring on the Causeway just south of the northern fishing dock. Another area of erosion exists on the marsh side of the Causeway at the southern end of the Causeway.

- Other than depicting site boundaries, the Depot's current Base Master Plan (Parsons 2014) and GIS records do not identify site-specific data, and there are no notifications specific to LUCs.
- A Depot Order does not currently exist to identify the site, the LUC boundary, and the LUCs.

Based on observations made during landfill inspections, maintenance to remove woody vegetation is performed on an as-needed basis.

#### **3.4.4.2 Groundwater Monitoring Program**

As shown on Figure 3-1, four monitoring wells are positioned on the southwest side of the causeway. Three wells (PAI-03-MW-01SR, -03SR, and -04SR) were installed in the shallow zone (ranging in depth from 16.20 to 17.78 feet bgs) and one well (PAI-03-MW-02DR) was installed in a deeper zone (28.20 feet bgs). In accordance with the Groundwater Sampling Work Plan (TerranearPMC, LLC 2009), groundwater is monitored annually for target compound list (TCL) VOCs, TCL SVOCs, non-filtered TCL pesticides, TCL PCBs, and target analyte list metals. Analytical results are compared to both primary and secondary MCLs. Available work plans and groundwater monitoring reports indicate groundwater sampling was conducted annually between 2002 and 2004 and since 2009. Results of groundwater LTM monitoring since the last five-year review are discussed in Section 3.6.2.

### **3.5 Progress Since the Last Five-Year Review**

#### **3.5.1 Protectiveness Statement from the 2010 Five-Year Review**

The following protectiveness statement is from the 2010 Five-Year Review: "The remedy at OUs 1, 3, and 5 are expected to be or is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."

#### **3.5.2 Issues, Recommendations, and Follow-Up Actions**

The following issues were identified in the 2010 Five-Year Review:

- *"Although measures were put in place to preclude unacceptable human exposure at Site 3 (i.e., signage: No subsistence fishing) it was determined by interview that a highly exposed individual does exist. This exposure assumption is being addressed by a post-construction risk assessment Technical Memo being developed in support of a Site 3 Final ROD."*

The 2010 Post-Interim Construction Risk Assessment (TtNUS 2010) addressed the subsistence fishing issue through evaluation of fish tissue and comparison with fish tissue samples collected from a reference location at Generals Landing. This risk evaluation is discussed in Section 3.3.5.3.

- *"The [2010] subsidence incident at Site 3, which is still under review will be addressed in the Site 3 Final ROD and Remedial Design with a requirement to maintain the integrity of the cover, as discussed, and will be further documented in the next Five-Year Review."*

In 2010, subsidence of soil and asphalt in the vicinity of the culverts beneath the causeway was identified during compliance inspections. Subsidence issues have been the subject of ongoing evaluation since the last five-year review, as discussed in Section 3.6.1.1 and Section 3.6.1.2.

No other issues or recommendations for follow-up actions were identified at Site 3, during the 2010 Five-Year Review.

## **3.6 2015 Five-Year Review Process**

### **3.6.1 Document Review**

This five-year review included review of relevant documents generated after March 2010, the end review period date for the 2010 Five-Year Review, and applicable information from previous documents including the RI/RFI, IROD, IRA, Final ROD, annual groundwater monitoring reports, and the 2010 Five-Year Review. This five-year review also included review of annual LUC compliance certificates completed between July 2010 and June 2015.

#### **3.6.1.1 Underwater Culvert Inspection Report**

A dive inspection was conducted of the causeway's culverts to identify any structural deficiencies that could be linked to the subsidence visible from the causeway surface. Open lifting holes, intended to assist placement of the concrete culverts at the time of construction, were observed along the top of each culvert pipe segment. Such holes should have been filled immediately following placement of the culverts. The dive inspection noted evidence of soil washing down through the holes and into the culverts. Although there was no excessive buildup of soil directly beneath the holes, the Underwater Culvert Inspection Report (Infrastructure Engineers 2011) concluded that overlying fill material could be gradually lost through the open lifting holes. The report also indicated that the locations of some open holes correspond to a subsidence area (i.e., sinkhole) visible at the surface.

Some marine growth and a small amount of sediment build-up were observed at the bottom of each culvert pipe. Excessive build-up of sediment that extended approximately 25 linear feet was observed near the midway point of the middle barrel of the southernmost set of culverts.

### **3.6.1.2 Limited Pre-Design Investigation and Topographical Survey**

In April 2014, a limited pre-design investigation was conducted to provide additional information necessary to evaluate repair options and move forward with development of a conceptual design package for sinkholes in the vicinity of the culverts. This investigation included a geophysical survey, utilizing ground penetrating radar, to provide information on the extent of voids near the culverts and additional information on the location of buried waste and a geotechnical investigation to verify the findings of the geophysical survey and provide information with regards to the lithology and geotechnical/hydraulic properties of overlying backfill, landfill materials, and soils beneath the culvert study areas. Details associated with field activities, along with findings, are documented in the *Report of Subsurface Investigation Culvert Stabilization, Remedial Site 3, Marine Corps Recruit Depot Parris Island, South Carolina* (Environmental and Geotechnical Specialists, Inc. 2015), which is an appendix to the *Final Conceptual Design for Culvert Rehabilitation, Site 3 Causeway Landfill* (Resolution Consultants 2015).

During the investigation, sinkholes and significant subsurface anomalies (indicative of void space where future sinkholes are likely to develop) were determined to be limited to areas in the immediate vicinity of the culverts. The pre-design investigation concluded that very loose soils above and adjacent to the culverts are the primary cause of the sinkholes. These loose soils are attributed to a combination of vertical migration of soils into void space created by buried debris and the loss of soil/debris through open lifting holes.

In May 2014, a topographical survey of the two culvert areas was performed by Forsberg Engineering and Surveying, Inc. The survey was conducted in order to obtain horizontal and vertical definition at the site, and also establish control to be used during forthcoming repair efforts.

The Navy, in conjunction with the MCRD Parris Island Partnering Team, is currently planning for necessary sinkhole repairs to maintain the integrity of the landfill cover. Prior to rehabilitation efforts, final design specifications will be submitted for regulatory approval.



### **3.6.2 Data Review**

Annual groundwater LTM results from 2010 through 2014 were evaluated during this five-year review.<sup>27</sup> Table 3-5 summarizes analytical data from annual groundwater LTM events completed since the last five-year review.

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<sup>27</sup> Figures showing groundwater results and flow directions may be found in the latest annual groundwater sampling report and are not reproduced herein.

Table 3-5 Summary of Groundwater Analytical Results (Detections Only) — Operable Unit 3 (Site 3/SWMU 3) <sup>(1)</sup> (all concentrations presented in µg/L)						
Parameter	U.S. EPA MCL <sup>(2)</sup>	Date	Shallow Wells (PAI-03-MW-)			Deep Well (PAI-03-MW-)
			01SR	03SR	04SR	02DR
<b>Volatile Organic Compounds</b>						
2-butanone	NE	2011	1.3 J	ND <sup>(3)</sup>	0.59 J	ND
Acetone	NE	2010	ND	3.1 J	6.5	4 J
		2011	9	2.4 J	5.9	0.6 J
<b>Benzene</b>	5	2010	<b>20 J</b>	ND	ND	ND
		2011	<b>14</b>	2.4 J	<b>5.9</b>	0.6 J
		2012	<b>8.3 J</b>	1.3 J	1 J	1.4 J
		2013	<b>9.7 J</b>	3.7 J	<b>6.3</b>	1.6 J
		2014	<b>8.5 J</b>	<11	<11	<11
Carbon disulfide	NE	2010	55 B	0.87 JB	0.32 JB	0.29 JB
		2014	<2.0	<2.0	<2.0	0.24 J
<b>Chlorobenzene</b>	100	2010	<b>800</b>	ND	ND	ND
		2011	<b>770</b>	ND	ND	ND
		2012	<b>690</b>	ND	ND	ND
		2013	<b>750</b>	ND	ND	ND
		2014	<b>808</b>	<0.24	<0.24	<0.24
Ethylbenzene	700	2011	0.25 J	ND	ND	ND
Isopropylbenzene	NE	2011	0.69 J	ND	ND	ND
<b>Methylene chloride</b>	5	2013	<b>23 J</b>	ND	ND	ND
<b>Semi-Volatile Organic Compounds</b>						
Butylbenzylphthalate	NE	2011	ND	ND	0.25 J	ND
		2013	ND	0.32 J	ND	ND
1,2-Dichlorobenzene	600	2011	0.37 J	ND	ND	ND
1,3-Dichlorobenzene	NE	2011	0.13 J	ND	ND	ND
1,4-Dichlorobenzene	75	2011	4.5	ND	ND	ND
		2014	2.9 J	<0.48	<0.48	<0.48
2-Chlorophenol	NE	2010	4.3			
		2011	3.8	ND	ND	ND
		2012	3.1	ND	ND	ND
		2013	3.7	ND	ND	ND
		2014	7.0	<0.49	<0.49	<0.49
2-methylnaphthalene	NE	2013	0.042 J	ND	ND	ND
Acenaphthene	NE	2010	ND	ND	0.29	ND
		2011	0.2 J	ND	ND	ND
		2013	0.21	ND	ND	ND
Anthracene	NE	2010	ND	ND	0.21	ND
		2011	0.14 J	ND	ND	ND
		2013	0.12 J	ND	ND	ND
Benzo(a)anthracene	NE	2010	ND	ND	0.29	ND
<b>Benzo(a)pyrene</b>	0.2	2010	ND	ND	<b>0.24</b>	ND
Benzo(b)fluoranthene	NE	2010	ND	ND	0.39	ND
Benzo(ghi)perylene	NE	2010	ND	ND	0.41	ND
Benzo(k)fluoranthene	NE	2010	ND	ND	0.33	ND
Benzaldehyde	NE	2011	0.91 J	0.86 J	1.1	ND
		2012	ND	ND	0.19 J	ND
Chrysene	NE	2010	ND	ND	0.34	ND
Di-n-octyl phthalate	NE	2010	ND	ND	0.4 J	ND

<b>Table 3-5 Summary of Groundwater Analytical Results (Detections Only) — Operable Unit 3 (Site 3/SWMU 3) <sup>(1)</sup> (all concentrations presented in µg/L)</b>						
<b>Parameter</b>	<b>U.S. EPA MCL <sup>(2)</sup></b>	<b>Date</b>	<b>Shallow Wells (PAI-03-MW-)</b>			<b>Deep Well (PAI-03-MW-)</b>
			<b>01SR</b>	<b>03SR</b>	<b>04SR</b>	<b>02DR</b>
Dibenz(a,h)anthracene	NE	2010	ND	ND	0.43	ND
Fluoranthene	NE	2010	ND	ND	0.25	ND
		2011	ND	ND	0.069 J	ND
		2013	ND	ND	0.067 J	ND
Fluorene	NE	2011	ND	ND	0.1 J	ND
		2013	ND	ND	0.046 J	ND
Indeno(1,2,3-cd)pyrene	NE	2010	ND	ND	0.16 J	ND
n-Nitrosodiphenylamine	NE	2010	0.5 J	ND	0.41	ND
		2011	0.45 J	ND	ND	ND
		2013	0.39 J	ND	ND	ND
		2014	1.5 J	<0.51	<0.51	<0.51
Naphthalene	NE	2011	0.14 J	ND	ND	ND
		2012	4.3 J	0.081 J	0.081 J	ND
		2013	0.11 J	ND	ND	ND
Phenanthrene	NE	2010	ND	ND	0.25	ND
		2011	ND	ND	0.18 J	ND
		2013	ND	ND	0.052 J	ND
Phenol	NE	2010	0.32	ND	ND	ND
		2012	0.23	ND	ND	ND
Pyrene	NE	2010	ND	ND	0.13 J	ND
		2011	ND	ND	0.054 J	ND
<b>Pesticides and PCBs</b>						
gamma-BHC (Lindane)	0.2	2014	0.0038 J	<0.00099	<0.00098	<0.0010
alpha-Chlordane	2	2014	0.0064 J	<0.0019	<0.0018	<0.0019
Dichlorodiphenyldichloroethane	NE	2014	0.0082 J	<0.0024	<0.0024	<0.0025
Dichlorodiphenyldichloroethene	NE	2014	0.014 J	<0.0035	<0.0034	<0.0036
Dichlorodiphenyltrichloroethane	NE	2011	ND	0.042 J	ND	ND
Methoxychlor	40	2010	0.4	ND	ND	ND
		2011	0.15	ND	ND	ND
Aroclor-1242	0.5	2014	0.38	<0.038	<0.038	<0.040
<b>Inorganic Compounds (Metals)</b>						
Aluminum	200 <sup>(4)</sup>	2010	ND	ND	53.5 J	ND
		2011	66 J	42 J	84 J	ND
		2013	ND	ND	44 J	ND
		2014	121 J	165 J	140 J	165 J
Antimony	6	2010	1.6 J	ND	ND	ND
		2013	ND	ND	1.3 J	2.1 J
		2014	2.3 J	2.9 J	<2.3	3.9 J
Arsenic	10	2010	ND	ND	2.8 J	ND
		2011	3.6 J	ND	ND	3.8 J
		2012	ND	ND	ND	4.1 J
		2013	4 J	ND	ND	4.3 J
Barium	2,000	2010	51.1 J	76.8 J	442	83.3 J
		2011	63 J	150 J	660	83 J
		2012	61 J	120 J	490	81 J
		2013	72 J	72 J	460	83 J
		2014	85.3 J	76.4 J	305	91.9 J



Table 3-5 Summary of Groundwater Analytical Results (Detections Only) — Operable Unit 3 (Site 3/SWMU 3) <sup>(1)</sup> (all concentrations presented in µg/L)						
Parameter	U.S. EPA MCL <sup>(2)</sup>	Date	Shallow Wells (PAI-03-MW-)			Deep Well (PAI-03-MW-)
			01SR	03SR	04SR	02DR
Calcium	NE	2010	127,000	128,000	208,000	225,000
		2011	120,000	140,000	240,000	240,000
		2012	150,000	180,000	230,000	290,000
		2013	140,000	140,000	220,000	280,000
		2014	146,000	165,000	176,000	255,000
Chromium	100	2010	0.81 J	ND	2.6 J	ND
		2011	ND	ND	0.64 J	ND
		2012	0.79 J	ND	1.4 J	ND
		2013	ND	ND	1.1 J	ND
Cobalt	NE	2010	0.93 J	0.56 J	0.69 J	ND
		2012	0.54 J	ND	ND	ND
		2013	0.66 J	ND	0.54 J	ND
Copper	1,000 <sup>(4)</sup>	2014	<1.0	1.9 J	<1.0	<1.0
<b>Iron</b>	300 <sup>(4)</sup>	2010	<b>30,000</b>	<b>19,800</b>	<b>6,110</b>	<b>9,600</b>
		2011	<b>12,000 J</b>	<b>15,000</b>	<b>6,200</b>	<b>9,900</b>
		2012	<b>22,000</b>	<b>15,000</b>	<b>3,700</b>	<b>9,600</b>
		2013	<b>19,000 J</b>	<b>5,700</b>	<b>4,000</b>	<b>7,800</b>
		2014	<b>23,800</b>	<b>8,610</b>	<b>17,200</b>	<b>9,180</b>
Magnesium	NE	2010	15,500	41,900	281,000	973,000
		2011	16,000	59,000	380,000	910,000
		2012	19,000	61,000	310,000	1,000,000
		2013	17,000	35,000	270,000	1,100,000
		2014	18,300	30,200	161,000	1,010,000
<b>Manganese</b>	50 <sup>(4)</sup>	2010	<b>369</b>	<b>451</b>	<b>383</b>	<b>189</b>
		2011	<b>350</b>	<b>360</b>	<b>430</b>	<b>190</b>
		2012	<b>370</b>	<b>380</b>	<b>380</b>	<b>180</b>
		2013	<b>290</b>	<b>250</b>	<b>370</b>	<b>190</b>
		2014	<b>321</b>	<b>471</b>	<b>489</b>	<b>207</b>
Mercury	2	2010	0.053 JB	0.054 B	ND	0.052 JB
		2013	ND	0.047 J	ND	ND
Nickel	NE	2010	ND	ND	2.1 J	ND
		2012	ND	2.3 J	ND	ND
		2013	ND	5.4 J	ND	ND
		2014	<0.50	0.70 J	<0.50	<0.50
Potassium	NE	2010	7,760	22,900	160,000 J	339,000
		2011	14,000	36,000	250,000	290,000
		2012	11,000	32,000	200,000	280,000
		2013	8,700	21,000	180,000	280,000
		2014	8,700 J	17,000	77,800	220,000
Selenium	50	2014	<2.3	<2.3	3.1 J	8.0 J
Sodium	NE	2010	34,600	64,000	2,370,000	135,000
		2011	47,000	120,000	3,400,000	7,100,000
		2012	43,000	110,000	3,000,000	7,600,000
		2013	41,000	73,000	2,500,000	8,200,000
		2014	37,500	34,000	1,430,000	8,410,000

Parameter	U.S. EPA MCL <sup>(2)</sup>	Date	Shallow Wells (PAI-03-MW-)			Deep Well (PAI-03-MW-)
			01SR	03SR	04SR	02DR
Vanadium	NE	2010	2.1 J	2 J	6.6 J	6.9 J
		2011	3.1 J	2.7 J	6.1 J	4 J
		2012	2.1 J	3.5 J	7.1 J	6.7 J
		2013	ND	ND	6.3 J	6.3 J
		2014	0.50 J	<0.50	1.0 J	<0.50
Zinc	5,000 <sup>(4)</sup>	2010	ND	7 J	ND	ND
		2011	11 J	25	6.5 J	ND
		2012	ND	25	ND	15 J
		2013	7.3	190	ND	9.5 J
		2014	6.0 J	15.2 J	3.7 J	5.4 J

**Notes:**

µg/L = Micrograms per liter

U.S. EPA = United States Environmental Protection Agency

MCL = Maximum containment levels

NE = Not established

ND = Parameter not detected above the laboratory detection limit

SWMU = Solid Waste Management Unit

J Analyte detected between the laboratory method detection limit and reporting limit; the value was estimated by the laboratory

B Analyte detected in method blank

(1) If an analyte was not detected during a particular year, the year is not shown

(2) United States Environmental Protection Agency Primary Drinking Water Standards Maximum Contaminant Levels (MCL) (U.S. EPA 2014)

(3) Summary tables in previous reports did not indicate the method detection limit or reporting limit

(4) Criteria cited is a secondary MCL (U.S. EPA 2014)

Values in **bold** exceed its corresponding screening criteria

LTM data collected to date indicate that concentrations of most constituents routinely detected above U.S. EPA MCLs are decreasing or stable.<sup>28</sup> Benzene and chlorobenzene have been detected at concentrations above their respective MCLs in well PAI-03-MW-01SR since initiation of the LTM program. Benzene concentrations have fluctuated during this five-year review period between 8.3 and 20 µg/L and chlorobenzene concentrations have fluctuated between 690 and 808 µg/L.

Chlorobenzene has typically not been detected in samples collected from other Site 3 monitoring wells. Iron and manganese are routinely detected in Site 3 monitoring wells at concentrations above their respective screening criteria. Both parameters remain present within their historical ranges.

<sup>28</sup> Trend evaluations were performed through visual inspection of data and are based on best professional judgment.

In general, SVOCs, PCBs, pesticides, and the remaining VOCs and inorganic compounds have not been detected since the last five-year review; sporadically detected concentrations of these constituents have been below U.S. EPA MCLs. Trend graphs showing contaminant concentrations in site wells are included in Appendix H.

In the 5 November 2014 comments, associated with the 2014 Long-Term Monitoring Report (S-IES 2014), SCDHEC identified concerns regarding analytical detection limits used during the LTM.<sup>29</sup> Such concerns will be reviewed prior to the next LTM groundwater event to ensure that methods are capable of achieving screening values. In the same set of comments, SCDHEC expressed concern that well PAI-03-MW-01SR may be impacted by an adjacent plume originating at Sites 9, 16, 27, and 55. SCDHEC requested the Navy discuss the potential for migration of similar constituents from those sites as part of the five-year review. In support of that request, the Feasibility Study Report for Site 9 — Former Paint Waste Storage Area, Site 16 — Pesticide Rinsate Area, Site 27 — Motor Transportation Facility, and Site 55 — Fiber Optic Vault (Tetra Tech 2013) for those sites was reviewed as part of this five-year review. Located approximately 1,500 feet east of Site 3 wells PAI-03-MW-01SR and PAI-03-MW-02DR, groundwater beneath Sites 9, 16, 27, and 55 has been impacted by benzene, chlorobenzene, lead, and manganese in addition to other constituents. Information on the extent of contamination and estimated groundwater flow direction included in the Sites 9, 16, 27, and 55 FS indicates that the groundwater plume is well defined within the boundary of these sites (i.e., Site 27 wells, which are below MCLs, are present between these sites and the causeway) and is therefore, unlikely to be in contact with Site 3 groundwater. Pertinent figures from the Sites 9, 16, 27, and 55 FS are included in Appendix I.

### **3.6.3 Site Walkover**

On 14 January 2015, Resolution Consultants, accompanied by Ms. Donohoe (MCRD Parris Island Environmental Restoration Program Manager), conducted the five-year review site walkover at Site 3. Findings associated with the site visit were documented via an inspection form, drawing, and photographs included as Appendix A-3. Signs prohibiting digging and/or fishing, shrimping, crabbing, boating, wading, or swimming were noted during the site inspection. There was no evidence of residential use. Vegetation was mowed and maintained from the edge of the roadway to the top of the rip rap along the shoreline; no woody plants were evident in the grass cover. An inspection of the shoreline indicated that rip rap was stable and in good condition, with no visible signs of washouts, scouring, or shear failure. Ms. Donohoe said the woody growth is removed from the rip rap periodically. Gabions used to reinforce the wing walls of the culvert outlets appeared to be intact.

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<sup>29</sup> Amick, M. to Owens, D. and Harrington, T. 5 November 2014.

Several open sinkholes were observed along the grass covered slopes on both sides of the paved road in the vicinity of the two culvert sections. This issue has been well documented and repairs are in the planning stages (see Sections 3.4.4.1, 3.6.1.1, and 3.6.1.2). In addition to sinkholes, which are confined to the immediate vicinity of the culverts, dips and depressions have developed in other parts of the causeway. At this time there is no reason to suspect that the dips and depressions impact the protectiveness of the remedy; however, additional study may be necessary to allow for further evaluation. Following further review and discussions by the MCRD Parris Island Partnering Team, additional geotechnical testing and/or other investigations may be proposed to further evaluate the dips/depressions.

Evidence of surficial erosion was noted on the slope of the causeway just south of the northern fishing dock. Additionally, geotextile was observed along the slope of the causeway near the northern fishing dock, indicating that erosion has occurred in this area. Both erosion areas are in the vicinity of the northern culverts, where sinkhole repairs are planned. It is anticipated that sinkhole repairs, which will involve restoration of the base and surface materials along the slopes of the causeway, will serve to adequately repair these erosion areas near the northern culverts. Another area of erosion reportedly exists on the marsh side of the Causeway at the southern end of the Causeway. This area of erosion is outside of the planned area for sinkhole repairs, and thus will require further evaluation and possible repairs.

Interviews and site inspections identified consensus between the NAVFAC Remedial Project Manager and MCRD Parris Island for reassessing field inspection and documentation procedures relative to annual landfill inspections and LUC compliance activities performed by MCRD Parris Island. At this time, inspection activities are performed by MCRD Parris Island; NAVFAC contractors sample groundwater and provide ancillary support. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.

### **3.7 Technical Assessment**

#### **3.7.1 Question A: Is the Remedy Functioning as Intended by Decision Documents?**

The remedy at Site 3 included: source control (slope stabilization and erosion control, soil cover, and roadway construction), the implementation of LUCs (to prevent exposures which may occur through activities such as fishing, crabbing, wading, etc.), and landfill cover maintenance, and groundwater monitoring. This five-year review finds that the remedy is functioning as intended by the Final ROD.

**3.7.1.1 Remedial Action Performance**

The remedial actions for the source control alternative are being implemented as designed; they provide effective containment of the fill material within the causeway and prevent both human and ecological receptor exposure. Based on available LTM data, the migration of contaminants from the fill material to groundwater appears to have been eliminated in the vicinity of PAI-03-MW-02DR and PAI-03-MW-03SR. LUCs have been effective to date, with no record of groundwater extraction or fish consumption at Site 3. The MCRD Parris Island Partnering Team is unaware of any unauthorized intrusive activity breaches since the last five-year review.

<b>OU 3 (Site 3/SWMU 3)</b>	
<b>Remedy Status</b>	
Slope stabilization/erosion control (completed during the IRA)	Complete
Soil cover (completed during the IRA)	Complete
Sediment cover (completed during the IRA)	Complete
Roadway construction (completed during the IRA)	Complete
Cover maintenance	Ongoing
LUCs	Ongoing
LTM — groundwater	Ongoing

**3.7.1.2 Inspections and Maintenance**

Observations made during quarterly LUC inspections, which include an evaluation of the integrity of the landfill cover and visual observations of monitoring wells, are documented in annual LUC compliance certificates. Sinkholes, dips and depressions, and surface erosion were identified during these quarterly inspections, thus demonstrating the effectiveness of Site 3 inspection procedures. Cracks observed in the concrete headwalls at the northern and southern culverts are limited to surficial shrinkage cracks associated with concrete curing, which do not penetrate through the headwall. These surficial cracks are not indicative of a protectiveness issue. The presence of woody vegetation is also identified during LUC inspections and is removed on an as-needed basis. A program of routine maintenance needs to be established and implemented. The monitoring well network at Site 3 remains in good condition.

As a result of five-year review interviews and site inspections, the Navy identified the need to ensure the Base Master Plan is updated to document requirements and restrictions outlined in the LUC RD and the Remedial Action Completion Report. As a result of five-year review interviews and site inspections, NAVFAC Mid-Atlantic and MCRD Parris Island will reassess field inspection and documentation procedures relative to landfill inspections and LUC compliance activities. At this time, inspection activities are performed by MCRD Parris Island; NAVFAC contractors sample groundwater and provide ancillary support. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.

### **3.7.1.3 Opportunities for Optimization**

Per Section 3.6.2, analytical methods will be reviewed prior to the next field event to ensure that methods are capable of achieving project screening levels. Based on the limited number of original HHRA COCs, review of RAOs, and review of LTM data generated during this five-year review, there are additional opportunities for optimization of the groundwater monitoring program. The program will be evaluated further, with recommendations for optimization presented to the MCRD Parris Island Partnering Team, during forthcoming LTM efforts.

### **3.7.1.4 Implementation of LUCs and Institutional/Engineering Controls**

LUCs, including institutional and engineering controls, have been implemented as described in Section 3.4.3.2. Site 3 LUC compliance inspections have been completed quarterly by MCRD Parris Island personnel with annual compliance certificates submitted to the U.S. EPA and SCDHEC in accordance with the LUC RD. No issues affecting short-term protectiveness were identified in 2010 through 2015 Annual LUC compliance certificates submitted to U.S. EPA and SCDHEC in accordance with the LUC RD. Site inspections performed as part of this five-year review confirmed LUC compliance certificate findings.

Current conditions for LUCs at Site 3, as required by OSWER Directive 9355.7-18 Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance, are summarized in Table 3-6.

<b>Table 3-6 Land Use Control Current Condition Summary – Operable Unit 3 (Site 3/SWMU 3)</b>		
<b>Objective</b>	<b>Requirement</b>	<b>Current Conditions</b>
Clarity of Use Restrictions and Exposure Pathways	Decision documents and Land Use Controls (LUCs) should clearly articulate the restrictions needed to achieve Remedial Action Objectives. Assumptions made as part of remedy decisions should still be accurate.	<p>The Final ROD and LUC RD articulate restrictions needed to achieve Remedial Action Objectives. Assumptions made as part of remedy decisions remain accurate.</p> <p>During this five-year review, it was noted that the Base Master Plan, GIS, and Depot Order do not fully institutionalize site-specific LUC restrictions as prescribed in the LUC RD. While the Base Master Plan and GIS include IRP site boundaries, they do not include notifications of site-specific LUCs and do not depict LUC boundaries. Furthermore, a Depot Order does not currently exist to identify the site, the LUC boundary, and the LUCs. While the protectiveness of the remedy is not affected in the short term, it is recommended that these documents/systems be revised to clarify processes and procedures necessary to fully institutionalize LUC RD requirements.</p>
Accuracy of Property Information and Mapping	All physical areas that do not support unrestricted use/ unlimited exposure should be identified and the administrative record should have information regarding LUC mechanisms/ footprint.	<p>LUC mechanisms and footprints are documented in the LUC RD, which is part of the administrative record.</p> <p>While the Base Master Plan, GIS, and Depot Order do not fully institutionalize site-specific LUC restrictions as prescribed in the LUC RD and do not depict LUC boundaries, procedures are in place to identify areas which do not support UU/UE. Authorization is required from the NREAO prior to any excavation, construction, or intrusive activities at IRP Sites. Furthermore, signs have been posted to provide notification of unauthorized activities.</p> <p>During this five-year review, a discrepancy was noted regarding the LUC boundary at Site 3. During an 18 November 2015 meeting, the MCRD Parris Island Partnering Team collectively agreed that the LUC RD should be revised to include text necessary to clarify that that LUC boundary includes sediment within 200 feet of both northeast and southwest sides of the causeway.</p> <p>Also during the 18 November 2015 MCRD Parris Island Partnering Team meeting, MCRD Parris Island informed the team that a no fishing restriction is not currently enforced for waters within 200 feet of the southwest (marsh) side of the causeway. The MCRD Parris Island Partnering Team agreed that additional efforts should be made to enforce the no fishing restriction for waters within 200 feet of the southwest side of the causeway.</p>
Adequacy of Long-term Stewardship of LUCs	Planning documents should be in place and detail long-term roles and responsibilities for implementing, maintaining, and enforcing LUCs.	<p>The LUC RD details long-term roles and responsibilities for implementing, maintaining, and enforcing LUCs at Site 3.</p> <p>During this five-year review, it was noted that LUC compliance inspection and reporting procedures are not clearly established. While protectiveness of the remedy is not impacted, in the short term, it is recommended that specifications for LUC compliance inspections be established to clarify roles, responsibilities, schedules, and deliverables.</p>

**Notes:**

GIS	=	Geographic Information Systems	RD	=	Remedial Design
IRP	=	Installation Restoration Program	ROD	=	Record of Decision
UU/UE	=	Unrestricted use/Unlimited exposure	SWMUI	=	Solid Waste Management Unit
NREAO	=	Natural Resources and Environmental Affairs Office	MCRD	=	Marine Corps Recruit Depot

### **3.7.1.5 Early Indicators of Potential Remedy Problems**

During the last five-year review, inspections identified sinkholes in the vicinity of culverts beneath the causeway. Since that time, the Navy has conducted a dive inspection and pre-design investigation necessary to plan corrective measures. In addition to the sinkholes, surface erosion is also occurring at Site 3. Repair options, which will address sinkholes and erosion near the northern culvert, are currently under evaluation by the MCRD Parris Island Partnering Team. Additional evaluation is necessary to determine the need for repairs related to erosion away from the area planned for sinkhole repair. These potential problems do not affect current protectiveness, but may affect future protectiveness.

### **3.7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the time of the remedy selection still valid?**

#### **3.7.2.1 Changes in Chemical-, Location-, and Action-Specific ARARs and TBC Criteria**

Site 3 groundwater is not used as a potable water supply, nor is it expected to be used as such in the future. LUCs prohibit groundwater use. LTM groundwater data is compared to MCLs as ARARs to ensure the landfill cover is effective in preventing contaminant leaching. The ARAR list is updated during each LTM event to reflect current MCLs. A summary table reflecting the full analyte list analyzed every five years at Site 3 is included as Appendix E, and compares reference limits from 2011 versus 2015.

Benzene, chlorobenzene, methylene chloride, iron, and manganese are the only parameters which exceed MCLs or secondary MCLs; MCLs for these parameters have not changed since issuance of the Final ROD in 2011.

Changes in action- and location-specific ARARs are shown in Appendix F.

#### **3.7.2.2 Expected Progress towards Meeting RAOs**

RAOs for Site 3 were based on the presumptive remedy for municipal landfills, which calls for landfill wastes to be contained and covered, groundwater within the landfill to be monitored, and LUCs to be applied to ensure protectiveness. Because no unacceptable exposure pathways remain at Site 3, due to the landfill cover, future detailed evaluation of site risk will not be necessary unless exposure scenarios change.

The RAOs for the site are still valid: control human exposure; control exposure of ecological receptors; eliminate migration of COCs; comply with ARARs; control exposure to COCs in fish via consumption. RAOs outlined in Section 3.4.1 have been met, and are assessed routinely through inspections and LTM sampling. Quarterly inspections identified sinkholes present along the causeway, and corrective measures are planned, with repair options currently under evaluation by the MCRD Parris Island Partnering Team. LTM data suggest that groundwater concentrations are stable or decreasing. LUCs have eliminated primary exposure pathways by prohibiting fishing, shrimping, crabbing, boating, wading, swimming, and digging along or adjacent to the causeway.

### **3.7.2.3 Changes in Exposure Pathways**

The exposure pathways at Site 3 have not changed. Site 3 is a closed landfill which has been covered by clean fill and has an asphalt road and exercise path on it. LUCs (discussed in Section 3.4.3.2) prohibit future residential, commercial, agricultural, and recreational use (including wading, swimming, and fishing), as well as intrusive activities.

### **3.7.2.4 Changes in Land Use**

No change to land use, as discussed in Section 3.3.2, is anticipated based on review of the 2014 Base Master Plan. LUCs are discussed in Section 3.4.3.2.

### **3.7.2.5 New/Emerging Contaminants and Contaminant Sources**

No emerging contaminants were identified at Site 3; no new contaminant sources have been identified.

### **3.7.2.6 Changes in Toxicity, Risk Assessment Methods, and Cleanup Levels**

Exposure assumptions in risk assessment models changed in 2014. Additionally, toxicity data changes along with the exposure model changes could result in changes to cleanup levels. Exposure risk and hazard were also estimated based on fish tissue data, as discussed in Section 3.3.5.3. Changes in models and toxicity inputs could change the risk and hazard estimates, but would not be expected to affect the protectiveness of the remedy. Risks and hazards reported in 2010 for Site 3 were comparable to those identified in a reference location (Generals Landing) (TtNUS 2010). Furthermore, LUCs (prohibiting future residential, commercial, agricultural, and recreational use [including wading, swimming, and fishing], as well as intrusive activities) remain protective regardless of changes in risk assessment methodology by limiting exposure.

As noted in the ROD, following the IRA there was no human health or ecological risk associated with surface water or sediment; therefore, no risk evaluation is required.

### **3.7.2.7 Summary**

While exposure assumptions, risk assessment models, and toxicity values changed in 2014, LUCs designed to mitigate exposure and risk remain protective. Consequently, the approach used is not expected to impact the conclusions of the risk assessment or protectiveness of the selected remedy. RAOs for Site 3 were based on the presumptive remedy for municipal landfills, which calls for landfill wastes to be contained and covered, groundwater within the landfill to be monitored, and LUCs to be applied to ensure protectiveness. Because no unacceptable exposure pathways remain at Site 3, due to the landfill cover, future detailed evaluation of site risk will not be necessary unless exposure scenarios change.

### **3.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?**

In addition to sinkholes, which are confined to the immediate vicinity of the culverts, depressions and dips have developed in other parts of the causeway. At this time there is no reason to suspect that the dips and depressions impact the protectiveness of the remedy; however, additional study may be necessary to allow for further evaluation. Following further review and discussions by the MCRD Parris Island Partnering Team, additional geotechnical testing and/or other investigations may be proposed to further evaluate the dips/depressions.

## **3.8 Issues, Recommendations, and Follow-Up Actions**

Issues and recommendations for follow-up actions identified during this five-year review are summarized in Table 3-7.

## **3.9 Protectiveness Statement**

The remedy at OU 3 (Site 3/SWMU 3) currently protects human health and the environment because the cover components of the remedy eliminated direct contact with waste, soil, and sediment and minimized migration of contamination to environmental media. Groundwater monitoring ensures contamination is not migrating offsite. The Navy has implemented land use controls which currently prevent disturbance of wastes, unacceptable soil and groundwater exposures, and ingestion of fish. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness: for sinkholes finalize Addendum to Remedial Action Work Plan and establish an Site Management Plan schedule to complete the work plan requirements by September 2019; address the eroded surface areas in the vicinity of the northern culverts in the Addendum to Remedial Action Work Plan for Site 3; evaluate erosion on the marsh side of the causeway at the southern end of the causeway to determine the need for repairs; establish a routine maintenance program and implement accordingly; reassess and clarify process and procedures to fully institutionalize LUC RD requirements.

<b>Table 3-7 Issues and Recommendations/Follow-Up Actions at Operable Unit 3 (Site 3/SWMU 3)</b>							
<b>Issue Number</b>	<b>Issue</b>	<b>Recommendations and Follow-up Actions</b>	<b>Party Responsible</b>	<b>Oversight Agency</b>	<b>Milestone Date<sup>[1]</sup></b>	<b>Affects Protectiveness (Y/N)</b>	
						<b>Current</b>	<b>Future</b>
1	Sinkholes in the vicinity of the culverts have been identified in the causeway landfill cover.	Finalize Addendum to Remedial Action Work Plan and establish an SMP schedule to complete the work plan requirements by September 2019.	Navy	U.S. EPA, SCDHEC	1 MARCH 2017	N	Y
2	Surface erosion and exposed geotextile has been noted along the slope (near the northern fishing dock) in the vicinity of the northern culverts.	Address eroded surface areas in the vicinity of the northern culverts in the Addendum to Remedial Action Work Plan for Site 3 (see above).	Navy	U.S. EPA, SCDHEC	1 MARCH 2017	N	Y
3	Erosion has also been observed on the marsh side of the Causeway at the southern end of the Causeway.	Evaluate erosion on the marsh side of the Causeway at the southern end of the Causeway to determine the need for repairs.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	Y
4	Maintenance is currently implemented on an as-needed basis. A routine maintenance program does not currently exist.	Establish a routine maintenance program and implement accordingly.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	Y
5	Dips and depressions have developed along the causeway.	Further discussion by MCRD Parris Island Partnering Team to determine if additional evaluation is necessary.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
6	A discrepancy was noted regarding the LUC boundary in the Site 3 LUC RD.	A LUC RD addendum should be prepared to clarify the LUC boundary.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
7	The no fishing restriction is not currently enforced for waters within 200 feet of the southwest (marsh) side of the causeway.	Implement additional efforts to ensure that the no fishing restriction is enforced for waters within 200 feet of the southwest (marsh) side of the causeway.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
8	Field inspection and LUC compliance inspection and reporting procedures are not clearly established.	Reassess field inspection and documentation procedures relative to O&M landfill inspections and LUC compliance activities. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
9	The Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully institutionalize site-specific LUC restrictions.	Reassess and clarify process and procedures to fully institutionalize LUC RD requirements.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	Y



**Notes:**

<sup>[1]</sup> Proposed milestones dates are contingent upon funding.

GIS	=	Geographical information system
LUC	=	Land use control
LUC RD	=	LUC Remedial Design
N	=	No
O&M	=	Operations and maintenance
SCDHEC	=	South Carolina Department of Health and Environmental Control
SEPT	=	September
U.S. EPA	=	United States Environmental Protection Agency
MCRD	=	Marine Corp Recruit Depot
SMP	=	Site Management Plan
Y	=	Yes



## 4.0 OPERABLE UNIT 5 (SITE 12/SWMU 10)

### 4.1 Introduction

OU 5 (Site 12/SWMU 10), the Jericho Island Disposal Area, northwest of Horse Island, is accessible by foot via private property from Port Royal or by boat via Archers Creek. The Navy acquired Jericho Island in 1968 to extend the SDZ needed down-range of the Depot’s small arms firing ranges. Prior to acquisition by the Navy, local residents reportedly disposed domestic refuse to this area, resulting in randomly scattered surface debris piles up to approximately 30 feet in diameter and 5 feet in height. The causeway connecting Jericho Island to the mainland was also constructed using soil and domestic waste.

**OU 5 (Site 12/SWMU 10) — Current Conditions**

- Former landfill
- Waste excavation in 2005/2006
- Was the RAO to meet UU/UE? — **No**
- Remedy: excavate wastes, LUCs, site restoration, and annual marsh grass inspections

### 4.2 Site Chronology

Historical events and relevant dates in Site 12 chronology are listed in Table 4-1.

<b>Table 4-1 Chronology of Site Events at Operable Unit 5 (Site 12/SWMU 10)</b>	
<b>Event</b>	<b>Date</b>
Initial Assessment Study	September 1986
Interim Resource Conservation and Recovery Act (RCRA) Facility Assessment	April 1990
High-Resolution Vertical Magnetic Gradient Survey	1998
Remedial Investigation/RCRA Facility Investigation Report	June 2001
Feasibility Study/Corrective Measures Study Report	May 2004
Proposed Plan for Waste, Soil, and Sediment Remedial Action	July 2005
Record of Decision signed by MCRD Parris Island Commanding General	16 September 2006
Final Post Remedial Action Report	September 2007
Land Use Control Remedial Design	October 2008
Annual Marsh Grass Monitoring; since the last five-year review, monitoring has been documented in the following reports: <ul style="list-style-type: none"> <li>• Annual Marsh Grass Monitoring Report, October 2011, Site 12/SWMU 10 Jericho Island, Marine Corps Recruit Depot, Parris Island, South Carolina (S-IES, 19 December 2011).</li> <li>• Annual Marsh Grass Monitoring Report, October 2012, Site 12/SWMU 10 Jericho Island, Marine Corps Recruit Depot, Parris Island, South Carolina (S-IES, 26 November 2012).</li> <li>• Annual Marsh Grass Monitoring Report. October 2013, Site 12/SWMU 10 Jericho Island, Marine Corps Recruit Depot, Parris Island, South Carolina (S-IES, 20 January 2014).</li> </ul>	2011 to 2013; marsh grass inspections were suspended in 2014

<b>Table 4-1 Chronology of Site Events at Operable Unit 5 (Site 12/SWMU 10)</b>	
<b>Event</b>	<b>Date</b>
Annual Land Use Control compliance certification; since the last five-year review, the following certificates have been issued by MCRD Parris Island for Site 12/SWMU 10: <ul style="list-style-type: none"> <li>• 2010-2011 — 2 August 2012</li> <li>• 2011-2012 — 2 August 2012</li> <li>• 2012-2013 — 13 January 2014</li> <li>• 2013-2014 — 2 June 2015</li> <li>• 2014-2015 — 11 August 2015</li> </ul>	2010 to 2015

**Notes:**

SWMU = Solid Waste Management Unit

MCRD = Marine Corp Recruit Depot

Resolution Consultants, the Navy, and SCDHEC have been unable to locate records associated with a 2010 marsh grass monitoring event.

### **4.3 Background**

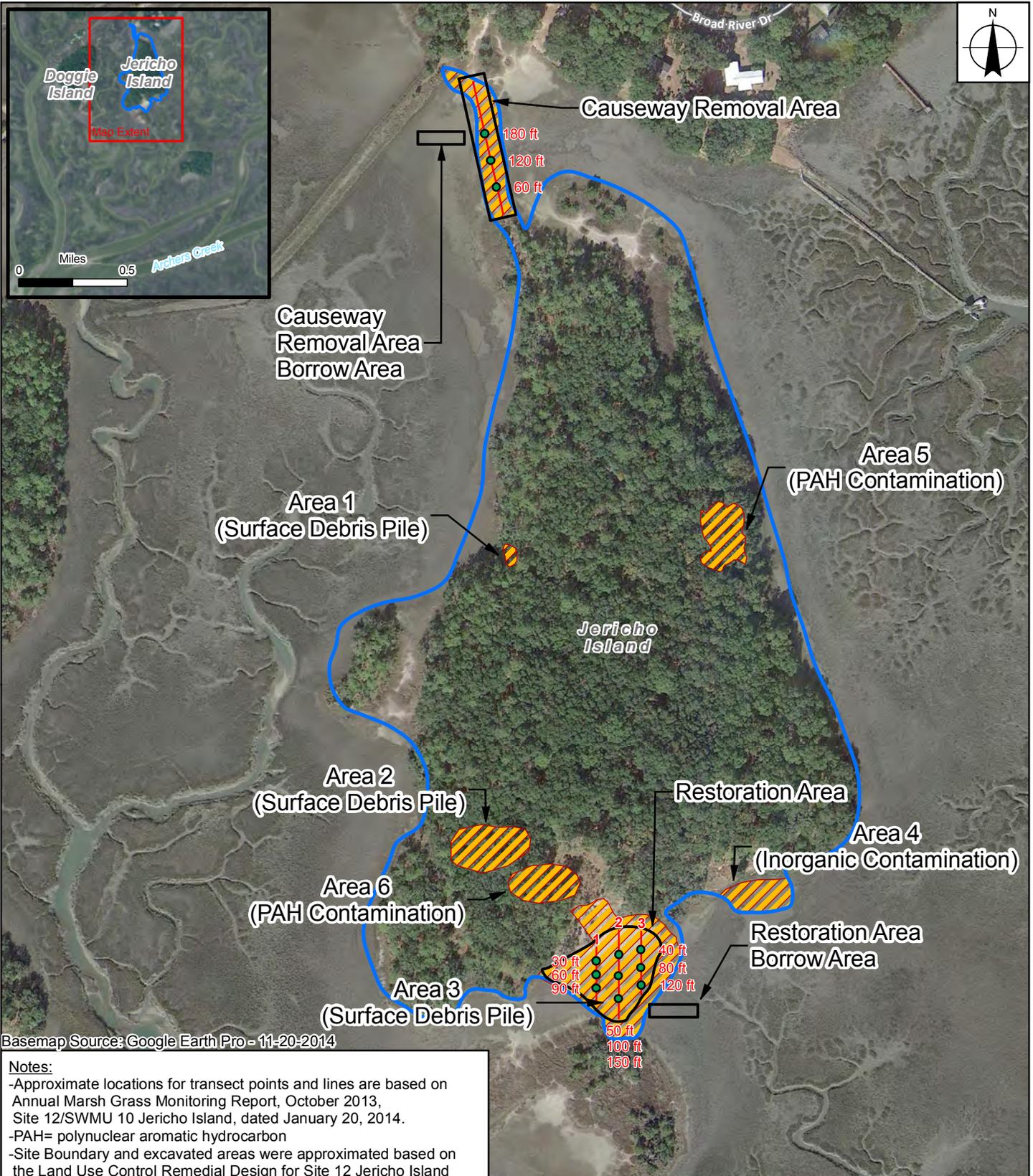
#### **4.3.1 Physical Characteristics**

Jericho Island is a 25-acre, relatively flat island with minimal topographic relief. The upland area of the island is vegetated by plant and tree species commonly associated with southeastern maritime forests, and is dominated by slash pine, loblolly pine, live oak, and laurel oak. Figure 4-1 shows the layout of Site 12.

#### **Geology and Hydrogeology**

Soils at Site 12 typically consist of fine to medium sands, with varying silt content. A sandy clay layer was encountered between depths of 8 to 17 feet bgs at the southern end of Jericho Island. Due to the limited areal extent, the clay unit most likely does not act as a local confining unit within the surficial aquifer beneath the site. Historical soil borings were terminated when auger refusal was encountered at depths ranging from 26 to 39.5 feet bgs, which was interpreted to be the top of the Hawthorne Formation. In general, sediments consist of fine to coarse sand with a varying silt and clay content. In general, the water table at Site 12 is tidally influenced, with depth to water ranging from 0.28 to 1.9 feet bgs (TtNUS 2001). The upper surficial aquifer is approximately 20 to 30 feet thick across the site and recharge occurs primarily through infiltration of precipitation. Historical data suggests an overall groundwater flow pattern from the interior and southern end of the island towards the marshes and open water located to the east and west. Downward vertical gradients were measured at wells positioned in the southern portion of the island, while an overall upward gradient was measured in wells at the northern end, suggesting the south portion of the site is a local recharge area for groundwater.<sup>30</sup> During historical studies, salinity was measured between 0.05 and 3.03 percent, indicating groundwater is brackish; TDS averaged 1.3 percent.

<sup>30</sup> Note that no wells remain onsite at Site 12; all wells were abandoned during remedial actions.



Basemap Source: Google Earth Pro - 11-20-2014

**Notes:**

- Approximate locations for transect points and lines are based on Annual Marsh Grass Monitoring Report, October 2013, Site 12/SWMU 10 Jericho Island, dated January 20, 2014.
- PAH= polynuclear aromatic hydrocarbon
- Site Boundary and excavated areas were approximated based on the Land Use Control Remedial Design for Site 12 Jericho Island Disposal Area, MCRD Parris Island, SC, as prepared by CH2M Hill and dated October 1, 2008.
- LUCs Boundary not specified in Land Use Control Remedial Design for Site 12 Jericho Island Disposal Area, MCRD Parris Island, SC, as prepared by CH2M Hill and dated October 1, 2008.

- Transect Point
- ▨ Excavated Area
- Transect Line
- ▭ Site Boundary



**FIGURE 4-1  
SITE LAYOUT  
OPERABLE UNIT 5 (SITE 12/SWMU 10)  
MCRD PARRIS ISLAND, SOUTH CAROLINA**

REQUESTED BY: D. WARREN	DATE: 8/7/2015		
DRAWN BY: M. SENNE	TASK ORDER NUMBER: JM38		

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## **Surface Water Hydrology**

During storm events, precipitation infiltrates sandy soils or migrates radially as sheet flow toward the surrounding marsh and into the adjacent tidal channels. Surface water and surface water channels are not present on the island. From the tidal channels, surface water flows to the south and into Archers Creek. Site 12 is within a 100-year floodplain.

### **4.3.2 Land and Resource Use**

Site 12 was acquired by the Navy to extend MCRD Parris Island's SDZ. The site is undeveloped and covered by native trees, shrubs, and grasses. The anticipated future land use of Jericho Island is that it remain undeveloped as part of the SDZ. Surface water is not used as a potable water supply. Except during high tide, is too shallow to allow access by boat; thus surface water is of limited recreational value. Groundwater is unsuitable for human consumption, due to high salinity and TDS (U.S. EPA 1986).

### **4.3.3 History of Contamination**

Local residents reportedly used Jericho Island as a disposal area for domestic refuse from 1955 to 1968, prior to acquisition by the Navy. The wastes disposed to the site were routine domestic trash (including small rusted cans, beer and soda bottles, hubcaps, tires, buckets, cinder blocks, children's toys, rusted 5-gallon cans, sheet metal, paper, plastic, and wood). Upon acquisition by the Navy, three surface debris piles were identified, as depicted on Figure 4-1. The surface debris pile at the southern edge of the island extended into the adjacent sediment/tidal marsh. On an unknown date prior to the Navy's acquisition, a manmade causeway was constructed using soil and domestic waste to provide access from Port Royal to the north end of Jericho Island.

### **4.3.4 Initial Response**

No initial remedial response actions were conducted between the time the disposal activities ceased and the 1986 IAS.

### **4.3.5 Basis for Taking Action**

Based on the risk assessment for Site 12, wastes, soils, sediments, and groundwater posed a potential risk to human health and the environment.

#### **4.3.5.1 Remedial Investigation Findings**

A preliminary screening identified analytes to be carried forth to risk assessment for the following media (details can be found in the ROD, Section 2.6):

- Surface Soil — Benzo(a)pyrene, arsenic, iron, and lead were detected above preliminary human health screening criteria in surface soil samples collected at the Site.<sup>31</sup> Concentrations of chloroform, 13 SVOCs, 4,4'-DDE, and 10 inorganic compounds were noted above ecological screening criteria.
- Subsurface Soil — In general, subsurface soil was not impacted, with the exception of soil at two locations on the southern end of the island where debris was encountered to depths of 4 feet bgs.
- Sediment — In sampling events performed 1998 and 1999, arsenic, iron, lead, and Aroclor-1254 were reported above human health screening criteria.<sup>32</sup> Additionally, acenaphthene, benzo(b)fluoranthene, di-n-octyl phthalate, bis(2 ethylhexyl)phthalate, 7 pesticides, and 10 inorganic compounds exceeded ecological screening criteria.
- Groundwater — Acetone, chloroform, arsenic, cadmium, iron, manganese and thallium exceeded human health screening criteria.<sup>33</sup> As stated in the ROD, Site 12 groundwater does not pose unacceptable risks to ecological receptors. Subsequent Partnering Team review determined that iron and manganese were likely attributable to naturally occurring sources, and both acetone and chloroform were from lab sample processing.
- Surface Water — Concentrations of bis(2-ethylhexyl)phthalate, arsenic, iron, and manganese exceeded a human health screening criteria.<sup>34</sup>

#### **4.3.5.2 Human Health Risk Assessment**

Maximum detected concentrations were compared to risk- and health-based screening criteria; any analytes with exceedances were retained as a human health COPC. The HHRA (TtNUS 2001) evaluated the following exposure pathways: direct contact and ingestion of soil, sediment, groundwater, and surface water; and inhalation of groundwater vapors. Receptors evaluated during

<sup>31</sup> Reference ROD Tables 2-1 and 2-2 (TtNUS 2006)

<sup>32</sup> Reference ROD Tables 2-6 and 2-7 2 (TtNUS 2006)

<sup>33</sup> Reference ROD Table 2-4 2 (TtNUS 2006)

<sup>34</sup> Reference ROD Table 2-5 2 (TtNUS 2006)

the RI/RFI consisted of construction workers, adolescent trespassers, adolescent and adult recreational users, and hypothetical future onsite residents. Those situations represented the most conservative of potential human receptor exposure scenarios and associated risk assumptions for Site 12.

Ingestion of soil and groundwater by hypothetical future residents resulted in estimated ILCRs above U.S. EPA's acceptable risk range. Potential ingestion of sediment, waste, soil, and groundwater by hypothetical future residents also resulted in HIs greater than 1.0. Concentrations of inorganic compounds and the PCB Aroclor-1254 were the main contributors to the noncarcinogenic risk. Under non-residential exposure scenarios, cancer and non-cancer risks were within or better than acceptable ranges. The following chemicals with an estimated ILCR greater than 1.0E-06 or HI greater than 1.0 were retained as human health COCs to be carried forward in the FS/CMS:

- Surface Soil: carcinogenic PAHs, arsenic, and iron.
- Sediment/Sediment Waste: Aroclor-1254 and arsenic.<sup>35</sup>
- Groundwater: cadmium, arsenic, and thallium. Other COPCs that exceeded MCLs or Region 3 Tapwater Risk Based Concentrations (RBCs) were attributed to laboratory artifacts (acetone and chloroform) or natural sources (iron and manganese), and were not carried forward as human health or ecological COCs.

#### 4.3.5.3 Ecological Risk Assessment

The SLERA, Site 12 completed as part of the RI/RFI (TtNUS 2001), evaluated potential risks from chemical concentrations detected in surface soil, sediment, groundwater, and surface water samples. The SLERA considered potential impacts for benthic receptors, soil invertebrates, terrestrial and aquatic plants, terrestrial receptors, and aquatic receptors. Table 4-2 lists ecological assessment and measurement endpoints evaluated in the SLERA.

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<sup>35</sup> Sediment waste is sediment collected from a waste pile area (TtNUS 2001).

<b>Table 4-2 Ecological Assessment and Measurement Endpoints at Operable Unit 5 (Site 12/SWMU 10)</b>			
<b>Assessment Endpoint</b>	<b>Measurement Endpoint</b>	<b>Media</b>	<b>Approach</b>
Benthic Invertebrate Communities	Benthic Invertebrate Communities	Sediment Surface Water	Comparison to marine sediment and surface water ecological screening values
Fish Communities (forage fish and higher trophic level fish)	Mummichog, Red drum	Sediment	Food chain evaluation; Comparison of fish tissue concentrations to tissue guidelines
Piscivorous birds	Green heron, Osprey	Sediment Surface water (heron only)	Food chain evaluation
Vermivorous birds	American woodcock	Surface soil	Food chain evaluation
Omnivorous birds	American robin	Surface soil	Food chain evaluation
Carnivorous birds	Red-tailed hawk	Surface soil	Food chain evaluation
Carnivorous mammals	Red fox	Surface soil	Food chain evaluation
Piscivorous mammals	Mink	Sediment Surface water	Food chain evaluation
Herbivorous mammals	Cotton mouse	Surface soil	Food chain evaluation
Mammals that feed on soil invertebrates	Short-tailed shrew	Surface soil	Food chain evaluation
Terrestrial and aquatic vegetation	Terrestrial and aquatic vegetation	Groundwater Surface water	Comparison to marine surface water screening values

**Note:**  
SWMU = Solid Waste Management Unit

The SLERA identified the following ecological COCs:

- Surface Soil — total PAHs, 4,4'-DDE, antimony, arsenic, cadmium, chromium, copper, lead, iron, manganese, mercury, nickel, and zinc
- Sediment — bis(2-ethylhexyl)phthalate, 4,4'-DDT, gamma chlordane, antimony, arsenic, cadmium, chromium, copper, mercury, nickel, lead, and zinc
- Sediment Waste — bis(2-ethylhexyl)phthalate, 4,4'-DDE, 4,4'-DDT, dieldrin, endrin, antimony, arsenic, cadmium, copper, chromium, lead, silver, nickel, and zinc

#### **4.4 Remedial Actions**

After the Proposed Plan (TtNUS 2001) was published and public comments received, negotiations between the Navy and U.S. EPA with respect to post-remedial action activities (particularly LUCs) delayed finalization of the ROD. However, both entities agreed upon implementing the field activity components of the selected remedy.<sup>36</sup> The ROD for Site 12 was signed by MCRD Parris Island on 16 September 2006 (TtNUS 2006).

<sup>36</sup> The remedial action conducted prior to finalization of the ROD under the Final Remedial Action Work Plan for Soil and Sediment Remediation, Site 12 — Jericho Island (ECC 2005) was not treated as an IRA.

#### **4.4.1 Remedial Action Objectives**

Based on the RI/RFI and additional groundwater data analysis, the following RAOs were developed for protection of human health and the environment at Site 12:

- Eliminate contact with debris and impacted surface soils by human and ecological receptors.
- Eliminate migration of COCs from the source material (debris and impacted soils) to downgradient media (i.e., sediment, surface water, and groundwater).
- Eliminate human exposure (i.e., direct exposure to construction workers, adolescent trespassers, adolescent and adult recreational users, adult recreational users, child and adult residents, and lifelong residents) to COCs in sediment and sediment waste at concentrations in excess of remediation levels. Remediation levels took into consideration an ILCR of 1.0E-06 for individual COCs and a Hazard Quotient of 1.0 where noncarcinogenic effects would be expected. Elimination of COCs in sediment would also address human health concerns identified from chemicals detected in surface water.
- Eliminate exposure of ecological receptors to COCs in sediment/sediment waste at concentrations greater than remediation levels. The sediment remediation levels took into account direct contact with COCs by macroinvertebrates and were expected to be protective of upper-food-chain receptors. Remediation levels addressed risks where "low effects" were anticipated by ecological receptors and considered site background concentrations.
- Eliminate human exposure to COCs (thallium, arsenic, and cadmium) in groundwater.

Tables 4-3 and 4-4 list the selected human health and ecological remediation levels for surface soil and sediment, respectively. Human health remediation levels were determined using U.S. EPA Region 9 PRGs (U.S. EPA 2000) and background concentrations (TtNUS 2000). Ecological remediation levels were determined using U.S. EPA Region 4 ESVs (U.S. EPA 2000). It should be noted that remediation levels for soil removal actions were residential; however, because groundwater would remain onsite at concentrations which exceeded UU/UE standards, five-year reviews are applicable to the remedy.

A determination has been made that the groundwater beneath Site 12 is unsuitable for human consumption due to high salinity and TDS in excess of 13,000 mg/L. Therefore, since the groundwater is naturally unusable because of the characteristics mentioned above, drinking water standards are not considered ARARs for this action and the groundwater will not be actively remediated (TtNUS September 2006).

**Table 4-3  
Record of Decision Remediation Levels for Surface Soil Contaminants of Concern at Operable Unit 5 (Site 12/SWMU 10)**

<b>Contaminant of Concern</b>	<b>Maximum Concentration</b>	<b>Background<sup>(1)</sup> (TtNUS 2001)</b>	<b>Region 9 Preliminary Remediation Goals (2000)</b>	<b>Selected Human Health Remediation Level<sup>(1)</sup></b>	<b>Region 4 Ecological Screening Value (1998)</b>	<b>Selected Ecological Remediation Level<sup>(2)</sup></b>
Benzo(a)pyrene Equivalents <sup>(3)</sup>	3,286 µg/kg	Not Established	434 µg/kg <sup>(4)</sup>	434 µg/kg	Not Established	Not Applicable
Total PAHs <sup>(5)</sup>	16,888 µg/kg	Not Established	Not Established	Not Established	1,000 µg/kg	1,000 µg/kg
4,4'-DDE	43 µg/kg	31.6 µg/kg	1,700 µg/kg	Not Applicable	2.07 µg/kg	31.6 µg/kg
Chloroform	7.5 µg/kg	Not Established	240 µg/kg	Not Applicable	1 µg/kg	Not Applicable
Bis(2-ethylhexyl) phthalate	480 µg/kg	Not Established	35,000 µg/kg	Not Applicable	Not Established	Not Applicable
Pentachloro-phenol	240 µg/kg	Not Established	3,000 µg/kg	Not Applicable	2 µg/kg	Not Applicable
Antimony	8 mg/kg	Not Detected	31 mg/kg	Not Applicable	3.5 mg/kg	3.5 mg/kg
Arsenic	50.8 mg/kg	1.44 mg/kg	0.39 mg/kg	1.83 mg/kg <sup>(6)</sup>	10 mg/kg	10 mg/kg
Cadmium	3.2 mg/kg	Not Established	37 mg/kg	Not Applicable	1.6 mg/kg	1.6 mg/kg
Chromium	18.1 mg/kg	6.23 mg/kg	210 mg/kg	Not Applicable	10 mg/kg	10 mg/kg
Copper	189 mg/kg	1.52 mg/kg	2,900 mg/kg	Not Applicable	40 mg/kg	40 mg/kg
Iron	99,700 mg/kg	3,920 mg/kg	23,000 mg/kg	23,000 mg/kg	200 mg/kg	3,920 mg/kg
Lead	1,100 mg/kg	12.5 mg/kg	400 mg/kg <sup>(7)</sup>	400 mg/kg	50 mg/kg	50 mg/kg
Manganese	522 mg/kg	129 mg/kg	1,800 mg/kg	Not Applicable	100 mg/kg	129 mg/kg
Mercury	0.89 mg/kg	0.11 mg/kg	23 mg/kg	Not Applicable	0.1 mg/kg	0.1 mg/kg
Nickel	26.5 mg/kg	1.8 mg/kg	1,600 mg/kg	Not Applicable	30 mg/kg	30 mg/kg
Zinc	1,020 mg/kg	9.7 mg/kg	23,000 mg/kg	Not Applicable	50 mg/kg	50 mg/kg

**Notes:**

µg/kg = Micrograms per kilogram                      SWMU = Solid Waster Management Unit

mg/kg = Milligrams per kilograms                      TtNUS = Tectra Tech NUS, Inc.

(1) When maximum concentrations were less than background or Region 9 preliminary remediation goals, no goal was selected, as indicated by "not applicable"

(2) When ecological screening values were less than background, background concentrations were selected as the remediation level

(3) Benzo(a)pyrene Equivalents = benzo(a)anthracene(0.1) + benzo(a)pyrene(1.0) + benzo(b)fluoranthene(0.1) + benzo(k)fluoranthene(0.01) + chrysene(0.001) + dibenzo(a,h)anthracene(1.0) + indeno(1,2,3-cd)pyrene(0.1)

(4) Calculated as 7X the benzo(a)pyrene Region 9 residential preliminary remediation goal

(5) Total PAHs = Low Molecular Weight PAHs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) + High Molecular Weight PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, and pyrene)

(6) Remedial goal is the Risk Based Concentration plus Background (U.S. EPA guidance)

(7) OSWER Soil Screening Level for Residential Land Use (U.S. EPA 1994)

**Table 4-4  
Record of Decision Remediation Levels for Sediment Contaminants of Concern at Operable Unit 5 (Site 12/SWMU 10)**

<b>Contaminant of Concern</b>	<b>Maximum Concentration (Sediment)</b>	<b>Maximum Concentration (Sediment Waste)</b>	<b>Background<sup>(1)</sup> (2000)</b>	<b>Region 9 Preliminary Remediation Goals (2000)</b>	<b>Selected Human Health Remediation Levels<sup>(1)</sup></b>	<b>Region 4 Ecological Screening Value (1998)</b>	<b>Selected Ecological Remediation Levels<sup>(2)</sup></b>
Benzo(a)pyrene Equivalents <sup>(3)</sup>	113 µg/kg	Not Detected	Not Established	434 µg/kg <sup>(4)</sup>	Not Applicable	Not Established	Not Applicable
Total PAHs <sup>(5)</sup>	1,878 µg/kg	Not Detected	Not Established	Not Established	Not Applicable	1,684 µg/kg	1,684 µg/kg
Bis(2-ethylhexyl) Phthalate	440 µg/kg	10,000 µg/kg	Not Established	35,000 µg/kg	Not Applicable	182 µg/kg	182 µg/kg
Di-n-octylphthalate	63 µg/kg	900 µg/kg	Not Established	1,200,000 µg/kg	Not Applicable	Not Established	Not Established
Pentachlorophenol	180 µg/kg	Not Detected	Not Established	3,000 µg/kg	Not Applicable	Not Established	Not Established
4,4'-DDE	Not Detected	520 µg/kg	31.6 µg/kg	1,700 µg/kg	Not Applicable	2.07 µg/kg	31.6 µg/kg
4,4'-DDT	66 µg/kg	38 µg/kg	34.5 µg/kg	1,700 µg/kg	Not Applicable	1.19 µg/kg	34.5 µg/kg
alpha-Chlordane	12 µg/kg	Not Detected	13.9 µg/kg	1,600 µg/kg <sup>(6)</sup>	Not Applicable	0.5 µg/kg <sup>(6)</sup>	Not Applicable
Aroclor-1254	Not Detected	24,000 µg/kg	Not Established	220 µg/kg	220 µg/kg	Not Established	Not Applicable
Dieldrin	Not Detected	6.2 µg/kg	Not Detected	30 µg/kg	Not Applicable	0.02 µg/kg	0.02 µg/kg
Endrin	Not Detected	1,200 µg/kg	Not Detected	18,000 µg/kg	Not Applicable	0.02 µg/kg	0.02 µg/kg
gamma-Chlordane	14 µg/kg	Not Detected	13.2 µg/kg	1,600 µg/kg <sup>(6)</sup>	Not Applicable	0.5 µg/kg <sup>(6)</sup>	13.2 µg/kg
Antimony	6.8 mg/kg	9.4 mg/kg	Not Detected	31 mg/kg	Not Applicable	2 mg/kg	2 mg/kg
Arsenic	18.5 mg/kg	49.7 mg/kg	12.2 mg/kg	0.39 mg/kg	12.59 mg/kg <sup>(7)</sup>	7.24 mg/kg	12.2 mg/kg
Cadmium	0.84 mg/kg	4.7 mg/kg	0.278 mg/kg	37 mg/kg	Not Applicable	0.676 mg/kg	0.676 mg/kg
Chromium	75 mg/kg	119 mg/kg	35.2 mg/kg	210 mg/kg	Not Applicable	52.3 mg/kg	52.3 mg/kg
Hexavalent Chromium	Not Detected	Not Applicable	Not Established	30 mg/kg <sup>(8)</sup>	Not Established	0.4 mg/kg	Not Applicable
Copper	113 mg/kg	489 mg/kg	10.1 mg/kg	2,900 mg/kg	Not Applicable	18.7 mg/kg	18.7 mg/kg
Iron	43,100 mg/kg	307,000 mg/kg	21,450 mg/kg	23,000 mg/kg	23,000 mg/kg	Not Established	Not Applicable
Lead	203 mg/kg	2,930 mg/kg	20.6 mg/kg	400 mg/kg	400 mg/kg	30.2 mg/kg	30.2 mg/kg
Manganese	210 mg/kg	1,480 mg/kg	186 mg/kg	1,800 mg/kg	Not Applicable	Not Established	Not Applicable
Mercury	0.35 mg/kg	Not Detected	0.09 mg/kg	23 mg/kg	Not Applicable	0.13 mg/kg	0.13 mg/kg
Nickel	1,060 mg/kg	86.9 mg/kg	5.95 mg/kg	1,600 mg/kg	Not Applicable	15.9 mg/kg	15.9 mg/kg
Silver	Not Detected	1.2 mg/kg	Not Detected	390 mg/kg	Not Applicable	0.733 mg/kg	0.733 mg/kg
Zinc	197 mg/kg	1,520 mg/kg	45 mg/kg	23,000 mg/kg	Not Applicable	124 mg/kg	124 mg/kg



**Notes:**

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilograms

SWMU = Solid Waste Management Unit

- (1) When maximum concentrations were less than background or Region 9 preliminary remediation goals, no goal was selected, as indicated by "not applicable"
- (2) When ecological screening values were less than background, background concentrations were selected as the remediation level
- (3) Benzo(a)pyrene Equivalents = benzo(a)anthracene(0.1) + benzo(a)pyrene(1.0) + benzo(b)fluoranthene(0.1) + benzo(k)fluoranthene(0.01) + chrysene(0.001) + dibenzo(a,h)anthracene(1.0) + indeno(1,2,3-cd)pyrene(0.1)
- (4) Calculated as 7X the benzo(a)pyrene Region 9 residential preliminary remediation goal
- (5) Total PAHs = Low Molecular Weight PAHs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) + High Molecular Weight PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, and pyrene)
- (6) Based on total chlordane
- (7) Remedial goal is the Risk Based concentration plus Background (U.S. EPA guidance)
- (8) Strictest value for Region 3 hexavalent chromium

#### **4.4.2 Remedy Selection**

The selected remedy included the following components:

- Excavation of sediment with concentrations of inorganic chemicals and PAHs above remediation levels for protection of human and ecological receptors; soil with concentrations of PAHs above remediation levels for protection of human and ecological receptors; and waste materials and impacted soil and sediment in the debris pile areas
- Post-remedial sampling and analysis of groundwater, soil, and sediment for cleanup verification; and soil and sediment for waste disposal determination
- Excavated material transport and disposal at an approved offsite disposal facility
- Site restoration in accordance with a Marshland Restoration Plan Alternative Approach: Addendum to Marshland Restoration Plan for Jericho Island, Beaufort County, South Carolina (Newkirk Environmental 2006)<sup>37</sup>
- Implementation and maintenance of LUCs

#### **4.4.3 Remedy Implementation**

##### **4.4.3.1 Excavation and Offsite Disposal of Surface Debris, Soil, and Sediment**

Between 28 November 2005 and 13 January 2006, three surface debris piles from Areas 1 through 3 were removed, along with approximately 2,300 cubic yards of underlying soil and sediment (Environmental Chemical Company [ECC] 2007). The average depth of excavation was 2 feet below surface grade, with a maximum depth reaching 3 feet in localized areas. Approximately 1,700 cubic yards of PAH-contaminated soil (Areas 5 and 6) and 370 cubic yards of inorganic compound-contaminated sediment (Area 4) were also excavated. Between 15 and 21 February 2006, approximately 800 cubic yards (1,392.71 tons) of soil, sediment, and waste/debris that comprised the causeway were also removed. Following dewatering, approximately 650 loads of combined debris and excavated material were transported to an approved offsite disposal facility based on characterization results.<sup>38</sup>

<sup>37</sup> The addendum is the final work plan used for marsh grass restoration; multiple plans were developed during the remedial design process.

<sup>38</sup> Lead was the only constituent to exceed the Toxicity Characteristic Leaching Procedure limit of 5 mg/L in 10 of 31 pre-excavation samples (ranging from 5.4 to 59 mg/L); therefore, waste soil was disposed of with RCRA Waste Code D008.

#### **4.4.3.2 Verification Sampling and Analysis**

Confirmation samples were collected to ensure excavation activities achieved remediation levels; all surface debris piles were removed from the site; debris encountered during excavation of the causeway was also removed. Results from confirmatory soil sampling indicated excavations achieved remediation levels (e.g., residential and/or ecological benchmarks identified in Tables 4-3 and 4-4). Following remediation activities, groundwater samples were collected to verify the short-term effectiveness of the remedy and that soil removal efforts had not resulted in a release to groundwater. Ten temporary wells were installed to approximately 4 feet bgs and samples were collected using a discrete grab sampler. Groundwater results were compared to U.S. EPA MCLs; arsenic and cadmium concentrations and the laboratory detection limit for thallium exceeded MCLs (ECC 2007). However, as discussed in Section 4.7.2.1, drinking water standards (MCLs) are not considered ARARs because groundwater is unsuitable for use as potable water.

#### **4.4.3.3 Site Restoration**

##### **Upland Areas**

Restoration in upland areas involved backfill to original grade, followed by seeding and mulching, as detailed in the Final Remedial Action Report (ECC 2007).

##### **Marshland**

Upon completion of excavation activities, 1.6 acres of disturbed salt marsh were restored (ECC 2007). Areas where sediment had been removed from the marsh were filled with clean sand and re-vegetated with native plant materials.<sup>39</sup> Those areas, in the southern portion of Jericho Island, collectively referred to as the Restoration Area (RA), were stabilized to minimize future erosion (ECC 2007). The causeway, referred to as the Causeway Removal Area [CRA], was re-established as a salt marsh (ECC 2007). Native plant material was obtained from healthy adjacent marsh areas — referred to as the Restoration Area Borrow Area (RABA) and Causeway Removal Area Borrow Area (CRABA). Planting of restoration areas was accomplished by hand-planting the harvested sprigs on 2-foot centers throughout each of the restoration areas. Restoration and borrow areas are shown on Figure 4-1. Monitoring and establishment of success criteria for restoration efforts were developed as part of a Final Restoration Work Plan Addendum (ECC 2006), Marshland Restoration Plan and Marshland Restoration Plan Alternative Approach (Newkirk Environmental 2006). Implementation of contingencies for the salt marsh restoration will occur if success criteria in either restored area are not satisfied. Contingencies include replacing plants with the same species, replanting with other

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<sup>39</sup> Clean sand used for backfilling was sampled at the rate of one sample for every 1,000 tons of material; a total of five backfill samples were collected to assess fill materials.

salt marsh species, or replanting with other type of plant stock (i.e., plants from adjacent marshes, nursery plant stock, combination of harvested and nursery stock, etc.). Inspections of marsh grasses performed by NAVFAC's contractor are documented in annual marsh grass monitoring reports.

#### **4.4.3.4 Land Use Controls**

As specified in the Land Use Control Remedial Design (herein referred to as the LUC RD) (CH2M Hill 2008b), the LUC performance objective for Site 12 is to prohibit the extraction or use of shallow groundwater beneath the site. The LUCs at Site 12 preclude unacceptable future human health risk(s) from consumption of groundwater containing thallium, arsenic, and cadmium above their respective MCLs. The following institutional controls were implemented to ensure that the LUC performance objective was met and is maintained:

- The LUC RD was to be filed in the MCRD Parris Island Information Repository located at the Beaufort County Public Library's Headquarters at 311 Scott Street, Beaufort, South Carolina 29902.
- The following base planning and environmental management documents were to be updated to identify the prohibited groundwater use or extraction consistent with the Site 12 ROD and to depict the LUC boundaries as specified in the LUC RD:
  - Base Master Plan — The Base Master Plan was to include an appendix detailing the LUC RD requirements and figures identifying areas subject to LUC restrictions. The Base Master Plan should be prepared to serve as a reference document available through the EMS.
  - Geographic Information System — GIS should serve as a live version of all IRP site data, which is updated at irregular intervals based on the need to incorporate new site investigation data. Sites should be made visible as shaded polygons, with sampling data tied to monitoring wells and sampling locations. LUC data and restrictions should be added to each site as LUCs are implemented.

- Environmental Management System — MCRD Parris Island shall maintain the LUCs by assuring unauthorized breaches are prohibited and any necessary construction is designed and approved prior to implementation. To accomplish this MCRD Parris Island should establish SOPs, which will serve as enforceable compliance assurance measures. These compliance assurance measures should include the following:
  - Depot Order prohibiting unauthorized disturbances.
  - SOPs that detail the inspection, repair, and prohibitions and outline requirements for necessary construction approval in the areas.
  - Inspection record keeping, that in addition to inspection documentation, will describe any required repair and note repair completion date.
  - Training plans and schedules that will explain to key facilities' staff the SOPs, updated site information, and approvals required. The training plan should include a course outline and a roster of key facilities' personnel that require annual training.
- MCRD Parris Island was to ensure that the LUCs for Site 12 were incorporated into a Depot Order governing ground disturbing activities across MCRD Parris Island.
- Appropriate notification was to be provided to U.S. EPA and SCDHEC in advance of any changes to LUC management procedures, which could interfere with or negatively impact the effectiveness of the LUCs.
- MCRD Parris Island was to conduct annual physical inspections of Site 12 to confirm continued compliance with LUC performance objectives and to verify the Base Master Plan, GIS, EMS, and Depot Order governing ground disturbing activities correctly describe the prohibited uses and restrictions at Site 12. The Commanding General was to provide to U.S. EPA and SCDHEC an annual LUC Compliance Certificate for Site 12. Should any deficiencies be found, MCRD Parris Island was to separately notify U.S. EPA and SCDHEC within 10 business days of the deficiencies being discovered.

- Any activity that is inconsistent with the LUC objectives or land use restrictions, or any other action that may interfere with the effectiveness of the LUCs, should be addressed by MCRD Parris Island as soon as practicable, but in no case will the process be initiated later than 10 business days after MCRD Parris Island becomes aware of the breach.
- MCRD Parris Island shall notify U.S. EPA and SCDHEC at least 45 days in advance of any proposed land use changes at Site 12 that would be inconsistent with the LUC performance objectives or the selected remedy. If changes are proposed for any area of land within the boundaries of the site where restrictions apply, such changes should not be implemented without the approval of the U.S. EPA and SCDHEC.
- Notice should be provided to U.S. EPA and SCDHEC at least six months prior to any transfer or sale of Site 12 property, so that U.S. EPA and SCDHEC can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for the facility to notify U.S. EPA and SCDHEC at least six months prior to any transfer or sale, then the facility will notify U.S. EPA and SCDHEC as soon as possible, but no later than 60 days prior to the transfer or sale of any property subject to LUCs.
- Prior to conveyance of the real property encompassing all or a portion of Site 12, U.S. EPA and SCDHEC representatives should be given reasonable opportunity to review and concur on the applicable deed language related to all LUCs and associated rights of entry. U.S. EPA and SCDHEC should be provided with a copy of any executed deeds.
- LUCs at Site 12 should be maintained until the concentration of hazardous substances in groundwater is at such levels as to allow for unrestricted use and unlimited exposure. LUCs and associated implementation actions should not be terminated or modified without approval by U.S. EPA and SCDHEC. The Navy shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

During this five-year review, a discrepancy was noted regarding LUCs termination statements in the LUC RD and ROD. The LUC RD incorrectly states that "LUCs at Site 12 should be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels as to allow for unrestricted use and unlimited exposure." Text in the ROD correctly states that "LUCs will be

maintained until the concentration of hazardous substances in groundwater is at such levels to allow for unrestricted use and unlimited exposure.” This discrepancy was discussed with the MCRD Parris Island Partnering Team during a meeting on 18 November 2015. The MCRD Parris Island Partnering Team determined that the reference to soil should not have been included in the LUCs termination statement in the LUC RD and recommended that an addendum be prepared to correct the LUCs termination statement in the LUC RD.

MCRD Parris Island has implemented various policies and procedures to ensure that the LUC performance objective continues to be met and that implementation actions are maintained. IRP sites have been included in a Depot Order titled *Land Use Control Standard Operating Procedure* (MCRD Parris Island, 19 July 2012), which governs ground-disturbing activities across MCRD Parris Island. IRP site boundaries have been included in the Base Master Plan. In addition to incorporating IRP site boundaries, MCRD Parris Island’s GIS included NREAO contact information tied to each IRP site. Authorization is required from the NREAO prior to any excavation, construction, or intrusive activities.

MCRD Parris Island completes quarterly inspections to confirm continued compliance with the LUC performance objective. Annual LUC compliance certificates, which evaluate the status of the institutional controls and identify any deficiencies or inconsistent uses, are submitted to U.S. EPA and SCDHEC. The certificates provide an update on the current status of marsh grass vegetation based on visual observations made during the inspection and document compliance with groundwater use restrictions and confirm institutional controls are documented via the Base Master Plan, GIS, EMS, and Depot Order.

Key findings of Site 12 compliance inspections from 2010 through 2015 are as follows:

- The RA and CRA remain largely barren, with slow *Spartina* recovery.
- Other than depicting site boundaries, the Depot’s current Base Master Plan (Parsons 2014) and GIS records do not identify site-specific data, and there are no notifications specific to LUCs.
- A Depot Order does not currently exist to identify the site, the LUC boundary, and the LUCs.

Copies of annual LUC compliance certificates are included in Appendix C.

## **4.5 Progress Since the Last Five-Year Review**

### **4.5.1 Protectiveness Statement from the 2010 Five-Year Review**

The following protectiveness statement is from the 2010 Five-Year Review: “The remedy at OUs 1, 3, and 5 are expected to be or is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.”

### **4.5.2 Issues, Recommendations, and Follow-Up Actions**

No issues or recommendations for follow-up actions were identified during the 2010 Five-Year Review.

## **4.6 2015 Five-Year Review Process**

### **4.6.1 Document Review**

This five-year review included review of relevant documents generated after March 2010, the end review period date for the 2010 Five-Year Review, and applicable information from previous documents including the RI/RFI, ROD, and the prior five-year review report. This five-year review also included review of the 2010 to 2015 annual LUC compliance certificates.

### **4.6.2 Data Review**

The annual marsh grass monitoring at Site 12 includes a *Spartina* stem count survey of the two primary restoration areas (the RA and the CRA) and the two borrow areas (the RABA and the CRABA), in accordance with methodology specified in previous reports and approved work plans. To assess marsh grass restoration in the RA, three transects of varying lengths are used to establish nine inventory locations. In the CRA, a single transect created down the centerline of the original causeway is used to establish three inventory locations. To assess re-growth in the borrow areas, three plot locations were selected from both the RABA and CRABA. The transects and inventory locations are shown on Figure 4-1. Table 4-5 summarizes vegetation counts for Site 12 marsh grasses since the last (2010) five-year review.



Table 4-5 Marsh Grass Stem Counts at Operable Unit 5 (Site 12/SWMU 10)				
Date	Transect 1	Transect 2	Transect 3	Average Number of Stems/Plot
<b>Restoration Area<sup>[1]</sup></b>				
2011	0/0/6	0/0/0	0/0/0	1
2012	0/0/9	0/0/10	0/0/0	2
2013	0/0/9	0/0/6	0/0/71	10
2014	Suspended per MCRD Parris Island Partnering Team review			
<b>Causeway Restoration Area</b>				
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	Suspended per MCRD Parris Island Partnering Team review			
<b>Restoration Area Borrow Area</b>				
2011	23	31	17	24
2012	147	128	128	134
2013	198	172	120	163
2014	Suspended per MCRD Parris Island Partnering Team review			
<b>Causeway Restoration Area Borrow Area</b>				
2011	66	81	62	70
2012	238	240	200	226
2013	254	191	194	213
2014	Suspended per MCRD Parris Island Partnering Team review			

**Notes:**

<sup>[1]</sup> In the Restoration Area, three plots are assessed per transect.

SWMU = Solid Waste Management Unit

MCRD = Marine Corps Recruit Depot

Resolution Consultants, the Navy, and SCDHEC have been unable to locate records associated with a 2010 marsh grass monitoring event.

While the *Spartina* in the RA and CRA has not fully re-vegetated, stem counts in the RABA and the CRABA are high; compared to the provisional reference marsh grass count estimate for Site 1, restoration in these locations exceeds the 75 percent restoration threshold.<sup>40</sup> However, the October 2013 inventory noted that the *Spartina* in the CRABA was short and somewhat browned compared to other locations. Given that this is regrowth in a borrow area (as opposed to planted stems), marsh grass conditions in this area may reflect natural conditions.

Groundwater LTM is not required at Site 12, as groundwater is unsuitable for potable purposes and the implemented LUCs prohibit withdrawal, any use(s), and/or consumption of groundwater.

<sup>40</sup> A reference location has not been selected for Site 12 as of this five-year review; see Section 2.6.2.1 for a discussion of the requirements associated with reference marsh grass counts.



### 4.6.3 Site Walkover

On 14 January 2015, Resolution Consultants, accompanied by Ms. Donohoe (MCRD Parris Island Environmental Restoration Program Manager), conducted a site walkover of Site 12. Findings associated with the site visit were documented via an inspection form, drawing, and photographs included as Appendix A-4. A sign on the landward (north) side of the island advises any trespassers that the property is controlled by MCRD Parris Island and provides the phone number for the NREAO.

The five-year review inspection team walked across the CRA then south approximately 1,500 feet to the debris removal areas and marsh grass RA. The upland area of Jericho Island was observed to be covered with plant and tree species commonly associated with southeastern maritime forests. The debris removal areas were observed to be covered with thin marsh grass and upland woody vegetation. Limited marsh grass was noted in the RA and CRA; however, neither area showed signs of erosion, settlement, or intrusive activities. There was no evidence of residential use of the island. Interviews and site inspections identified consensus between NAVFAC and MCRD Parris Island for reassessing field inspection and documentation procedures relative to site inspections and LUC compliance activities. At this time, inspection activities are performed by MCRD Parris Island; NAVFAC contractors provide marsh grass restoration support and other ancillary support. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.

## 4.7 Technical Assessment

### 4.7.1 Question A: Is the Remedy Functioning as Intended by Decision Documents?

The remedy at Site 12 included source control (excavation and removal of surface debris, soil, and sediment), restoration (re-vegetation of excavated areas), LUCs, and LTM of areas re-vegetated with native marsh grasses. Based on this five-year review, marsh grass restoration is the only component of the remedy that is not functioning as intended by the ROD.

#### 4.7.1.1 Remedial Action Performance

The expected outcome of the selected remedy (source removal) was that future direct contact with and exposure to COCs in source material, soil, and sediment by human and ecological receptors would be eliminated, as would future migration of COCs to downgradient media.

<b>OU 5 (Site 12/SWMU 10)</b>	
<b>Remedy Status</b>	
Debris removal	Complete
Soil/sediment excavation	Complete
Confirmation sampling	Complete
Site restoration	Ongoing
LTM — native marsh grass	Ongoing

The remedial actions for the source control component have been implemented as designed, eliminating COC source material and associated exposure pathways, and preventing further environmental impacts. As COCs have been removed from the site, LTM and LUCs have been implemented as designed. Upon remedial action completion, the two areas designated for re-vegetation, the RA and the CRA, were re-vegetated using nearby marsh grasses in an effort to restore portions of the site disturbed during excavation activities. The 2010 Five-Year Review, and subsequent annual marsh grass monitoring, reported re-vegetation at Site 12 was incomplete. Contingency measures/alternatives for marsh restoration have not been assessed at this time.

The 2009 NCSU study indicated the following concerns at the RA:

- Salinity in Port Royal Sound was, generally, too high for optimal growth of *Spartina*, and salinity effects were influenced more by (a) the Atlantic Ocean (due to tidal ranges) and (b) evaporative effects during drought years. Salinity at Site 12 was reported at 40 parts per thousand.
- Fill material at Site 12 was fine- to very fine-grained sand which drained easily, and was too dry to support *Spartina alterniflora* growth.
- The elevation of the restoration areas was too high in elevation, relative to the surrounding marshland. The fill area was photographed above the high tide line. Growth of this species would require regrading of the restoration area; alternatively, replanting with *Spartina patens* would be possible.
- Low nutrients (nitrogen and phosphorous) were noted at Site 12.

The NCSU concluded that the CRA restoration was compromised by continued traffic through the area, resulting in soil compaction and damage to the plants, as well as the elevation and tidal issues described for the RA.

As discussed in Section 4.6.2, borrow areas (RABA and CRABA) appear to have been restored when compared to provisional numbers currently being used for the Site 1 reference location, although the *Spartina* counts will need to be compared against Jericho Island-specific background/reference locations. Comparing the *Spartina* density to the provisional reference value used for Site 1, the borrow area marsh grass counts at Site 12 have exceeded the 75 percent threshold. However, the absence of growth in the RA and CRA requires further evaluation as part of future LTM efforts. Annual marsh grass monitoring has been suspended pending results of this review.<sup>41</sup>

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<sup>41</sup> Marsh grass was not planted in Area 4 at Site 12 because the excavated area was an unvegetated tidal mudflat. The evaluation proposed above will consider whether shoreline conditions have changed since the 2006 excavation (e.g., due to deposition caused by hurricanes, storms, or changes in tidal patterns) and are no longer amenable to *Spartina* growth.

#### **4.7.1.2 Inspections and Maintenance**

There are no active remediation systems or other infrastructure (e.g., monitoring wells) that require operations and maintenance at Site 12. As a result of five-year review interviews and site inspections, NAVFAC Mid-Atlantic and MCRD Parris Island will reassess field inspection and documentation procedures relative to annual site inspections and LUC compliance activities performed by MCRD Parris Island. At this time, inspection activities are performed by MCRD Parris Island; NAVFAC contractors provide marsh grass restoration support and other ancillary support. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.

#### **4.7.1.3 Opportunities for Optimization**

The MCRD Parris Island Partnering Team has agreed to suspend annual marsh grass monitoring pending further evaluation during forthcoming LTM efforts; the evaluation will consider the 2009 NCSU study recommendations and reassess Site 12 findings given current conditions. Following such evaluation, findings and recommendations on any optimization will be presented to the MCRD Parris Island Partnering Team. A review of site RAOs during this five-year review suggests that there are additional opportunities for optimization. The program will be evaluated and recommendations presented to the MCRD Parris Island Partnering Team, during future LTM efforts.

#### **4.7.1.4 Implementation of LUCs and Institutional Controls**

Annual LUC compliance certificates reviewed did not indicate noncompliance, breaches, or violations in connection with LUCs, land-use restrictions, or other institutional controls which would affect short-term protectiveness. LUCs remain in place, and no evidence of groundwater withdrawal has been observed. In accordance with the LUC Implementation Plan and LUC RD, quarterly inspections are conducted by MCRD Parris Island personnel and are submitted to U.S. EPA and SCDHEC. Site inspections performed as part of this five-year review confirmed LUC compliance certificate findings. Current conditions for LUCs at Site 12, as required by OSWER Directive 9355.7-18 Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance, are summarized in Table 4-6.



<b>Table 4-6 Land Use Control Current Condition Summary – Operable Unit 5 (Site 12/SWMU 10)</b>		
<b>Objective</b>	<b>Requirement</b>	<b>Current Conditions</b>
Clarity of Use Restrictions and Exposure Pathways	Decision documents and Land Use Controls (LUCs) should clearly articulate the restrictions needed to achieve Remedial Action Objectives. Assumptions made as part of remedy decisions should still be accurate.	<p>The ROD and LUC RD articulate restrictions needed to achieve Remedial Action Objectives. Assumptions made as part of remedy decisions remain accurate.</p> <p>During this five-year review, it was noted that the Base Master Plan, GIS, and Depot Order do not fully institutionalize site-specific LUC restrictions as prescribed in the LUC RD. While the Base Master Plan and GIS include IRP site boundaries, they do not include notifications of site-specific LUCs and do not depict LUC boundaries. Furthermore, a Depot Order does not currently exist to identify the site, the LUC boundary, and the LUCs. While the protectiveness of the remedy is not affected in the short term, it is recommended that these documents/systems be revised to clarify processes and procedures necessary to fully institutionalize LUC RD requirements.</p>
Accuracy of Property Information and Mapping	All physical areas that do not support unrestricted use/ unlimited exposure should be identified and the administrative record should have information regarding LUC mechanisms/footprint.	<p>LUC mechanisms and footprints are documented in the LUC RD, which is part of the administrative record.</p> <p>While the Base Master Plan, GIS, and Depot Order do not fully institutionalize site-specific LUC restrictions as prescribed in the LUC RD and do not depict LUC boundaries, procedures are in place to identify areas which do not support UU/UE. Authorization is required from the NREAO prior to any excavation, construction, or intrusive activities at IRP Sites.</p>
Adequacy of Long-term Stewardship of LUCs	Planning documents should be in place and detail long-term roles and responsibilities for implementing, maintaining, and enforcing LUCs.	<p>The LUC RD details long-term roles and responsibilities for implementing, maintaining, and enforcing LUCs. During this five-year review, a discrepancy was noted regarding the LUCs termination statement in the LUC RD and ROD for Site 12. The LUC RD incorrectly states that “LUCs at Site 12 should be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels as to allow for unrestricted use and unlimited exposure.” Text in the ROD correctly states that “LUCs will be maintained until the concentration of hazardous substances in groundwater is at such levels to allow for unrestricted use and unlimited exposure.” An addendum should be prepared to correct the LUCs termination statement in the LUC RD.</p> <p>During this five-year review, it was noted that LUC compliance inspection and reporting procedures are not clearly established. While protectiveness of the remedy is not impacted in the short term, it is recommended that specifications for LUC compliance inspections be established to clarify roles, responsibilities, schedules, and deliverables.</p>

**Notes:**

- GIS = Geographic Information Systems
- IRP = Installation Restoration Program
- RD = Remedial Design
- ROD = Record of Decision
- UU/UE = Unrestricted use/Unlimited exposure
- NREAO = Natural Resources and Environmental Affairs Office
- SWMU = Solid Waste Management Unit
- MCRD = Marine Corps Recruit Depot

#### **4.7.1.5 Early Indicators of Potential Remedy Problems**

The remedy has been implemented in accordance with the ROD, and there are no indications or problems with key elements of the remedy (removal, backfill, LUCs). Marsh grass restoration issues in the RA and CRA, discussed in Section 4.7.1.1, require further evaluation to determine corrective actions. However, no exposure issues are occurring due to marsh grass restoration issues.

#### **4.7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the time of the remedy selection still valid?**

##### **4.7.2.1 Changes in Chemical-, Location-, and Action-Specific ARARs and TBC Criteria**

During the RI/RFI, MCLs and Region 3 Tapwater RBCs were used to screen groundwater data, with cadmium, arsenic, and thallium the only constituents to exceed a drinking water standard. Because groundwater is naturally unsuitable for human consumption (due to elevated salinity and TDS), drinking water standards were not considered ARARs and the ROD did not require active groundwater remediation; instead, the selected remedy included LUCs to prevent exposure to groundwater contamination remaining onsite above levels that allow for UU/UE. There are no monitoring wells at Site 12, as the ROD did not prescribe LTM of groundwater. Changes in action- and location-specific ARARs are shown in Appendix F.

##### **4.7.2.2 Expected Progress towards Meeting RAOs**

The RAOs for the site are still valid: eliminate contact with debris and surface soil; eliminate migration of COCs; eliminate human exposure to COCs in sediment and sediment waste; eliminate exposure of ecological receptors in sediment/sediment waste; and eliminate human exposure to COCs in groundwater. The RAOs related to eliminating direct contact with and exposure to COCs in sediment and sediment waste by humans and ecological receptors have been met through implementation of the excavation remedy. The groundwater RAO is addressed through LUCs that prohibit consumption, extraction, or use of groundwater.

##### **4.7.2.3 Changes in Exposure Pathways**

The exposure pathways at Site 12 have not changed. Land use is undeveloped, due to Jericho Island being within the SDZ of the small arms munitions training range.

##### **4.7.2.4 Changes in Land Use**

Jericho Island is within the SDZ of the small arms munitions training range. No changes to land use are anticipated.

#### **4.7.2.5 New/Emerging Contaminants and Contaminant Sources**

No emerging contaminants were identified at Site 12.

#### **4.7.2.6 Changes in Toxicity, Risk Assessment Methods, and Cleanup Levels**

Results from confirmatory soil and sediment sampling indicated excavations achieved remediation levels (e.g., residential and/or ecological benchmarks identified in Tables 4-3 and 4-4); therefore, no unacceptable risk remained for sediments or soils at Site 12 following remedial actions. Therefore, risk was not reassessed for these media at Site 12.

Groundwater is the only medium which still exceeds UU/UE criteria. The surface water adjacent to Site 12 is not used as a potable water supply and, except during high tide, is too shallow for recreational use. As noted in the Site 12 ROD, Site 12 groundwater is unsuitable for human consumption (Tetra Tech NUS, September 2006).

#### **4.7.2.7 Summary**

Risk was not reassessed for soil or sediment at Site 12, as remedial actions achieved remedial goals. LUCs restrict groundwater use at the Site. Future receptors will be limited to Depot personnel assigned to activities associated with the former disposal area. LUCs prohibit use of groundwater. Any changes in risk assessment methodology are unlikely to impact the protectiveness of the selected remedy.

#### **4.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?**

No other information has come to light that could call into question the protectiveness of the remedy.

### **4.8 Issues, Recommendations, and Follow-Up Actions**

Issues and recommendations for follow-up actions identified during this five-year review are summarized in Table 4-7.

### **4.9 Protectiveness Statement**

The remedy at OU 5 (Site 12/SWMU 10) currently protects human health and the environment because the removal components of the remedy eliminated direct contact and contaminant migration pathways. The Navy has implemented land use controls which currently prevent unacceptable groundwater exposure. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure long-term protectiveness: reassess and clarify process and procedures to fully institutionalize LUC RD requirements.

**Table 4-7  
Issues and Recommendations/Follow-Up Actions at Operable Unit 5 (Site 12/SWMU 10)**

Issue Number	Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date <sup>[1]</sup>	Affects Protectiveness (Y/N)	
						Current	Future
1	Marsh grass restoration may be incomplete in the Restoration Area and Causeway Removal Area. Background/reference values needed to facilitate evaluation of marsh grass restoration.	Evaluate conditions in the Restoration Area and Causeway Removal Area to determine whether <i>Spartina</i> re-vegetation is necessary. Review findings and recommendations with MCRD Parris Island Partnering Team. Develop background/reference values for marsh grass counts and evaluate remedy progress.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N
2	The Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully institutionalize site-specific LUC restrictions.	Reassess and clarify process and procedures to fully institutionalize LUC RD requirements.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	Y
3	A discrepancy was noted regarding the LUCs termination statements in the LUC RD and ROD.	Prepare addendum to correct the LUCs termination statement in the LUC RD, by removing the incorrect reference to soil.	Navy	U.S. EPA, SCDHEC	17 SEPT 2017	N	N

**Notes:**

<sup>[1]</sup> Proposed milestones dates are contingent upon funding.

GIS	=	Geographical information system
LUC	=	Land use control
LUC RD	=	Land use control Remedial Design
N	=	No
O&M	=	Operations and maintenance
ROD	=	Record of Decision
SCDHEC	=	South Carolina Department of Health and Environmental Control
SEPT	=	September
U.S. EPA	=	United States Environmental Protection Agency
SWMUI	=	Solid Waste Management Unit
MCRD	=	Marine Corps Recruit Depot
Y	=	Yes



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**Appendix A**  
**Site Visit Documentation**

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**Appendix A1**  
**Site Inspection Roster**

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**Roster of Site Inspections — Five-Year Review**  
**Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41), Operable Unit 3 (Site 3/SWMU 3),**  
**Operable Unit 5 (Site 12/SWMU 10)**  
**Marine Corps Recruit Depot Parris Island, South Carolina**  
**14 January 2015 and 5 February 2015**

**Site Inspection Roster — 14 January 2015:**

- David Warren, Project Manager, Resolution Consultants, Mount Pleasant, South Carolina
- David Criswell, Project Engineer, Resolution Consultants, Mount Pleasant, South Carolina
- Lisa Donohoe, Environmental Restoration Program Manager, Marine Corps Recruit Depot Parris Island, South Carolina
- John Holloway, Natural Resources Manager, Marine Corps Recruit Depot Parris Island, South Carolina (Operable Unit 1 Inspection Only)

**Site Inspection Roster — 5 February 2015:**

- Adam Freeze, Environmental Scientist, Resolution Consultants, Mount Pleasant, South Carolina

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**Appendix A2**  
**Operable Unit 1 (Site 1/SWMU 1 and Site 41/SWMU 41)**

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SITE INSPECTION CHECKLIST			
<b>III. ONSITE DOCUMENTS &amp; RECORDS VERIFIED</b> (Check all that apply)			
General Note: <b><u>There are no structures present at Operable Unit 1 (Site 1 and Site 41) where documents and records can be maintained onsite. Pertinent documents are maintained in the Naval Installation Restoration Information Solution (NIRIS) database and in the administrative record for MCRD Parris Island. The administrative record is accessible via NAVFAC's public website for MCRD Parris Island at the following link: <a href="http://go.usa.gov/36SzJ">http://go.usa.gov/36SzJ</a> Environmental Restoration Program reports and other documents are also maintained in the information repository at Beaufort County Public Library Headquarters, 311 Scott Street, Beaufort, South Carolina 29902. It is noted that not all pertinent historical documents were retrievable via NIRIS and the administrative record at the time of this Five-Year Review. NAVFAC will work with the MCRD Parris Island Partnering Team to identify missing documents and bring NIRIS and the administrative record up to date.</u></b>			
<b>1. O&amp;M Documents</b>			
O&M manuals	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
As-built drawings	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Maintenance logs	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>All pertinent historical documents are not currently in NIRIS or the administrative record. See General Note under Section III above.</u></b>			
<b>2. Site-Specific Health and Safety Plan</b>			
Contingency plan/emergency response plan:	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>NAVFAC contractors are required to prepare and carry up-to-date site-specific health and safety plans onsite during each field activity. Health and safety plans are not typically included in NIRIS or as part of the administrative record.</u></b>			
<b>3. O&amp;M and OSHA Training Records</b>			
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>NAVFAC contractors are required to maintain up to date O&amp;M and OSHA training records; however, such records are not typically included in NIRIS.</u></b>			
<b>4. Permits and Service Agreements</b>			
<input type="checkbox"/> Air discharge permit	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Effluent discharge	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Waste disposal, POTW	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Other permits	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<b>5. Gas Generation Records</b>			
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<b>6. Settlement Monument Records</b>			
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<b>7. Groundwater Monitoring Records</b>			
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>Groundwater monitoring records are documented via long-term monitoring reports maintained in NIRIS. With the exception of the 2010 report, which could not be located, groundwater monitoring reports from 2009 through 2014 were reviewed during this Five-Year Review. During the review, it was noted that not all pertinent historical documents are currently available via NIRIS. NAVFAC will work with the MCRD Parris Island Partnering Team to develop a list of missing documents and update NIRIS accordingly.</u></b>			
<b>8. Leachate Extraction Records</b>			
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<b>9. Discharge Compliance Records</b>			
<input type="checkbox"/> Air	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Water (effluent)	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<b>10. Daily Access/Security Logs</b>			
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<b>IV. O&amp;M COSTS</b>			
<b>1. O&amp;M Organization</b>			
<input type="checkbox"/> State in-house		<input type="checkbox"/> Contractor for State	
<input type="checkbox"/> PRP in-house		<input type="checkbox"/> Contractor for PRP	
<input checked="" type="checkbox"/> Federal Facility in-house		<input type="checkbox"/> Contractor for Federal Facility	





SITE INSPECTION CHECKLIST			
<b>VI. GENERAL SITE CONDITIONS</b>			
<b>A. Roads</b>	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
1. <b>Roads damaged</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Roads adequate	<input type="checkbox"/> N/A
<b>B. Other Site Conditions</b>			
<b>VII. LANDFILL COVERS</b>			
		<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>A. Landfill Surface</b>			
1. <b>Settlement (Low spots)</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Settlement not evident	
2. <b>Cracks</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Cracking not evident	
3. <b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Significant erosion not evident	
Remarks: <b>Minor erosion and bare spots have been noted during annual inspections; however, all such areas were deemed insignificant and, per the SWMU 1 LTM Work Plan, do not require corrective action.</b>			
4. <b>Holes</b>	<input checked="" type="checkbox"/> Location shown on site map	<input type="checkbox"/> Holes not evident	
Remarks: <b>A burrow was observed near the northeast revetment.</b>			
5. <b>Vegetative Cover</b>	<input checked="" type="checkbox"/> Grass <input checked="" type="checkbox"/> Trees/Shrubs	<input checked="" type="checkbox"/> Cover properly established	<input type="checkbox"/> No signs of stress
Remarks: <b>Trees/shrubs with trunks or stems of less than 3-inches in diameter were observed in the rip rap. This woody vegetation was removed by MCRD Parris Island on 31 January 2015.</b>			
6. <b>Alternative Cover (armored rock, concrete, etc.)</b>	<input checked="" type="checkbox"/> N/A		
7. <b>Bulges</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Bulges not evident	
8. <b>Wet Areas/Water Damage</b>	<input checked="" type="checkbox"/> Wet areas/water damage not evident		
<input type="checkbox"/> Wet areas	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Ponding	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Seeps	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Soft subgrade	<input type="checkbox"/> Location shown on site map	Areal extent _____	
Remarks: <b>Over one inch of rain had fallen 48 hours previous with no observable standing water.</b>			
9. <b>Slope Instability</b>	<input type="checkbox"/> Slides	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> No evidence of slope instability
<b>B. Benches</b>			
		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Flows Bypass Bench</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay	
2. <b>Bench Breached</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay	
3. <b>Bench Overtopped</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay	
<b>C. Letdown Channels</b>			
		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of settlement	
2. <b>Material Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of degradation	
3. <b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of erosion	
4. <b>Undercutting</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of undercutting	
5. <b>Obstructions</b>	Type _____		
<input type="checkbox"/> No obstructions	<input type="checkbox"/> Location shown on site map	Areal extent _____	
6. <b>Excessive Vegetative Growth</b>	Type _____		
<input type="checkbox"/> No evidence of excessive growth	<input type="checkbox"/> Vegetation in channels does not obstruct flow		
<input type="checkbox"/> Location shown on site map	Areal extent _____		



SITE INSPECTION CHECKLIST			
<b>D. Cover Penetrations</b> <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A			
1. <b>Gas Vents</b>	<input type="checkbox"/> Active	<input type="checkbox"/> Passive	
<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled	<input type="checkbox"/> Good condition
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance		<input checked="" type="checkbox"/> N/A
2. <b>Gas Monitoring Probes</b>	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A	
3. <b>Monitoring Wells</b> (within surface area of landfill)	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A	
4. <b>Leachate Extraction Wells</b>	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A	
5. <b>Settlement Monuments</b>	<input checked="" type="checkbox"/> Located	<input type="checkbox"/> Routinely surveyed	<input type="checkbox"/> N/A
<b>E. Gas Collection and Treatment</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1. <b>Gas Treatment Facilities</b>	<input type="checkbox"/> Flaring	<input type="checkbox"/> Thermal destruction	<input type="checkbox"/> Collection for reuse
<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance		
2. <b>Gas Collection Wells, Manifolds and Piping</b>	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	
3. <b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings)	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A
<b>F. Cover Drainage Layer</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1. <b>Outlet Pipes Inspected</b>	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A	
2. <b>Outlet Rock Inspected</b>	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A	
<b>G. Detention/Sedimentation Ponds</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1. <b>Siltation</b>	Areal extent _____	Depth _____	<input checked="" type="checkbox"/> N/A <input type="checkbox"/> Siltation not evident
2. <b>Erosion</b>	Areal extent _____	Depth _____	<input type="checkbox"/> Erosion not evident
3. <b>Outlet Works</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A	
4. <b>Dam</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A	
<b>H. Retaining Walls</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1. <b>Deformations</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Deformation not evident	
2. <b>Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Degradation not evident	
<b>I. Perimeter Ditches/Off-Site Discharge</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1. <b>Siltation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Siltation not evident	
2. <b>Vegetative Growth</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A	
	<input type="checkbox"/> Vegetation does not impede flow		
3. <b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Erosion not evident	
4. <b>Discharge Structure</b>	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A	
<b>VIII. VERTICAL BARRIER WALLS</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1. <b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident	
2. <b>Performance Monitoring</b>	Type of monitoring _____	<input type="checkbox"/> Performance not monitored	



SITE INSPECTION CHECKLIST			
<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>		<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>A. Groundwater Extraction Wells, Pumps, and Pipelines</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>1. Pumps, Wellhead Plumbing, and Electrical</b>			
<input type="checkbox"/> Good condition		<input type="checkbox"/> All required wells properly operating	
		<input type="checkbox"/> Needs Maintenance	
<b>2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b>			
<input type="checkbox"/> Good condition		<input type="checkbox"/> Needs Maintenance	
<b>3. Spare Parts and Equipment</b>			
<input type="checkbox"/> Readily available		<input type="checkbox"/> Good condition	<input type="checkbox"/> Requires upgrade
		<input type="checkbox"/> Needs to be provided	
<b>B. Surface Water Collection Structures, Pumps, and Pipelines</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>1. Collection Structures, Pumps, and Electrical</b>			
<input type="checkbox"/> Good condition		<input type="checkbox"/> Needs Maintenance	
<b>2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b>			
<input type="checkbox"/> Good condition		<input type="checkbox"/> Needs Maintenance	
<b>3. Spare Parts and Equipment</b>			
<input type="checkbox"/> Readily available		<input type="checkbox"/> Good condition	<input type="checkbox"/> Requires upgrade
		<input type="checkbox"/> Needs to be provided	
<b>C. Treatment System</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>1. Treatment Train (Check components that apply)</b>			
<input type="checkbox"/> Metals removal		<input type="checkbox"/> Oil/water separation	<input type="checkbox"/> Bioremediation
<input type="checkbox"/> Air stripping		<input type="checkbox"/> Carbon adsorbers	
<input type="checkbox"/> Filters _____			
<input type="checkbox"/> Additive (e.g., chelation agent, flocculent) _____			
<input type="checkbox"/> Others _____			
<input type="checkbox"/> Good condition		<input type="checkbox"/> Needs Maintenance	
<input type="checkbox"/> Sampling ports properly marked and functional			
<input type="checkbox"/> Sampling/maintenance log displayed and up to date			
<input type="checkbox"/> Equipment properly identified			
<input type="checkbox"/> Quantity of groundwater treated annually _____			
<input type="checkbox"/> Quantity of surface water treated annually _____			
<b>2. Electrical Enclosures and Panels (properly rated and functional)</b>			
<input type="checkbox"/> N/A		<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
<b>3. Tanks, Vaults, Storage Vessels</b>			
<input type="checkbox"/> N/A		<input type="checkbox"/> Good condition	<input type="checkbox"/> Proper secondary containment
		<input type="checkbox"/> Needs Maintenance	
<b>4. Discharge Structure and Appurtenances</b>			
<input type="checkbox"/> N/A		<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
<b>5. Treatment Building(s)</b>			
<input type="checkbox"/> N/A		<input type="checkbox"/> Good condition (esp. roof and doorways)	<input type="checkbox"/> Needs repair
<input type="checkbox"/> Chemicals and equipment properly stored			
<b>6. Monitoring Wells (pump and treatment remedy)</b>			
<input type="checkbox"/> Properly secured/locked		<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled
<input type="checkbox"/> All required wells located		<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> Good condition
		<input type="checkbox"/> N/A	
<b>D. Monitoring Data</b>			
<b>1. Monitoring Data</b>			
<input checked="" type="checkbox"/> Is routinely submitted on time		<input checked="" type="checkbox"/> Is of acceptable quality	
<b>2. Monitoring data suggests:</b>			
<input checked="" type="checkbox"/> Groundwater plume is effectively contained		<input checked="" type="checkbox"/> Contaminant concentrations are declining	



SITE INSPECTION CHECKLIST		
<b>E. Monitored Natural Attenuation</b>		
1. <b>Monitoring Wells</b> (natural attenuation remedy)	<input type="checkbox"/> Properly secured/locked <input type="checkbox"/> All required wells located	<input type="checkbox"/> Functioning <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> N/A
<b>X. OTHER REMEDIES</b>		
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.		
<b>XI. OVERALL OBSERVATIONS</b>		
<b>A. Implementation of the Remedy</b>		
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). <b>Remedy is effective and functioning as designed to contain waste materials and prevent exposure to contaminated media.</b>		
<b>B. Adequacy of O&amp;M</b>		
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. <b>O&amp;M is adequate to ensure the remedy remains protective of human health and the environment.</b>		
<b>C. Early Indicators of Potential Remedy Problems</b>		
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. <b>None</b>		
<b>D. Opportunities for Optimization</b>		
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. <u>As documented in the Five-Year Review Report, marsh grass restoration performed as part of the remedy may be incomplete along the eastern/southeastern perimeter of the landfill. Background/reference values are needed to facilitate evaluation of marsh grass restoration. Further assessment is necessary to evaluate conditions in areas where marsh grass restoration may be incomplete; develop background/reference marsh grass counts and evaluate remedy progress. Once these actions are complete, findings and recommendations will be reviewed with the MCRD Parris Island Partnering Team.</u>  <u>An assessment should be performed to further evaluate impacts due to an isolated burrow observed during the January 2015 five-year review site visit. Once completed, findings and recommendations will be reviewed with the MCRD Parris Island Partnering Team.</u>  <u>Maintenance is currently performed on an as-needed basis. A routine maintenance program should be established and implemented.</u>  <u>Additional investigation is necessary to determine the extent of debris outside of Site 1 and Site 41 and evaluate presence/absence and nature of any associated contamination.</u>  <u>Furthermore, the Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully document Site 1 and Site 41 restrictions. Field inspection and documentation procedures relative to site inspections and LUC compliance activities should be re-assessed. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.</u>		



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Aerial Imagery Date: 11-20-2014

**Notes:**  
 - All locations are approximate  
 - Site, LUC, and cap membrane boundaries were approximated based on figures included in the Land Use Control Remedial Design for Site 1 Incinerator Landfill and Site 41 Former Incinerator, MCRD Parris Island, SC, as prepared by CH2M Hill and dated October 1, 2008.  
 - Approximate locations for transect origins and lines are as documented in the Annual Groundwater Sampling, Marsh Grass Monitoring and O&M Report, October 2013, Site 1/SWMU 1 Incinerator Landfill, dated January 20, 2014.  
 - Former Incinerator Location was approximated per Figure 2-8 included in the Record of Decision Site 1/SWMU 1 - Incinerator Landfill and SWMU 41 - Former Incinerator, dated August 2006.

- Transect Origin
- Transect Lines
- ⊕ Monitoring Well
- 140 ft Radius
- ⬡ Cap Membrane Boundary
- ⬡ Site/LUC Boundary
- ⬡ Area of Erosion and Newly Discovered Debris
- ⬡ Approximate Area of Potentially Incomplete Marsh Grass Restoration

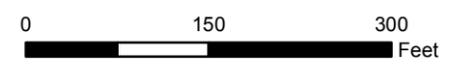


FIGURE A-1  
 14 JANUARY 2015 AND 5 FEBRUARY 2015  
 SITE VISIT MAP  
 OPERABLE UNIT 1 (SITE 1/SWMU 1 AND SITE 41/SWMU 41)  
 MCRD PARRIS ISLAND, SOUTH CAROLINA

REQUESTED BY: D. WARREN	DATE: 1/25/2016		
DRAWN BY: M. SENNE	TASK ORDER NUMBER: JM38		

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**Five-Year Review**  
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**Photo 1:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Sign located on the landward (south) side of the site advising the reader that any excavation activity must be authorized in advance.



**Photo 2:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Area to south of the landfill, facing west at the wooded recreation area.

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**Photo 3:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Monitoring well PAI-01-MW-24.



**Photo 4:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Monitoring well PAI-01-MW-24, facing north.

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**Photo 5:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — South side of landfill cap, facing west.



**Photo 6:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — South side of landfill cap, facing northwest.

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**Photo 7:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — South side of landfill cap, facing east.



**Photo 8:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — South side of landfill cap, facing northeast.

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**Photo 9:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Landfill cap surface showing vegetation mix (typical throughout).



**Photo 10:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Landfill cap surface showing vegetation mix (typical throughout).

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**Photo 11:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Runoff from Horse Island near western revetment, western revetment, southern terminus, facing west.



**Photo 12:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Rip rap on the western revetment, southern terminus, northwest side, facing north. Note: Photo taken following removal of woody growth in the rip rap during 5 February 2015, follow-up visit.

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**Photo 13:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Monitoring well PAI-01-MW-20, facing northwest.



**Photo 14:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Monitoring well PAI-01-MW-20, facing northwest, showing clear tidal surface water.

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**Photo 15:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Raccoon track in the mud near the top of the revetment.



**Photo 16:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Top of rip rap revetment showing vegetation.

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**Photo 17:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Western revetment, near MW-21, facing southwest. Note: Photo taken following removal of woody growth in the rip rap during 5 February 2015, follow-up visit.



**Photo 18:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Small area of erosion/bare soil near top of rip rap, northernmost terminus of revetment. This bare spot is considered insignificant and does not impact remedial protectiveness.

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**Photo 19:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Evidence of surface borrowing near the top of revetment, northeast side of landfill.



**Photo 20:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Benchmark monument on landfill surface, eastern side, at the top of revetment.

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**Photo 21:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Near eastern side of revetment, south of MW-23, facing north. Note: Photo taken following removal of woody growth in the rip rap during 5 February 2015, follow-up visit.



**Photo 22:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Eastern revetment, south terminus, facing north. Note: Photo taken following removal of woody growth in the rip rap during 5 February 2015, follow-up visit.

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**Photo 23:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Eastern revetment, near MW-22, facing east.



**Photo 24:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Eastern revetment, south of MW-23, facing northeast.

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**Photo 25:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Eastern revetment, top of berm adjacent to Malecon Drive, facing northwest. Note: Photo taken following removal of woody growth in the rip rap during the 5 February 2015, follow-up visit.



**Photo 26:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Eastern revetment, 100' east in marsh, facing southwest. Note: Photo taken following removal of woody growth in the rip rap during 5 February 2015, follow-up visit.

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**Photo 27:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Live Oak tree with eroded root system near Malecon Drive, soil beneath root network observed to contain debris (ceramic plates, glass, metal, construction debris, keys, etc.). Photo taken on 5 February 2015.



**Photo 28:** OU 1 (Site 1/SWMU 1 and Site 41/SWMU 41) — Erosion to surface near Malecon Drive, eastern revetment, at southern terminus, facing southeast. Photo taken on 5 February 2015.

**Appendix A3**  
**Operable Unit 3 (Site 3/SWMU 3)**

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SITE INSPECTION CHECKLIST				
<b>III. ONSITE DOCUMENTS &amp; RECORDS VERIFIED</b> (Check all that apply)				
General Note: <b><u>There are no structures present at Operable Unit 3 (Site 3/SWMU 3) where documents and records can be maintained onsite. Pertinent documents are maintained in the Naval Installation Restoration Information Solution (NIRIS) database and in the administrative record for MCRD Parris Island. The administrative record is accessible via NAVFAC's public website for MCRD Parris Island at the following link: <a href="http://go.usa.gov/36SzJ">http://go.usa.gov/36SzJ</a> Environmental Restoration Program reports and other documents are also maintained in the information repository at Beaufort County Public Library Headquarters, 311 Scott Street, Beaufort, South Carolina 29902. It is noted that not all pertinent historical documents were retrievable via NIRIS and the administrative record at the time of this Five-Year Review. NAVFAC will work with the MCRD Parris Island Partnering Team to identify missing documents and bring NIRIS and the administrative record up to date.</u></b>				
1. <b>O&amp;M Documents</b>	O&M manuals	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	As-built drawings	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	Maintenance logs	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>All pertinent historical documents are not currently in NIRIS. See General Note under Section III above.</u></b>				
2. <b>Site-Specific Health and Safety Plan</b>		<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	Contingency plan/emergency response plan:	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>NAVFAC contractors are required to prepare and carry up-to-date site-specific health and safety plans onsite during each field activity. Health and safety plans are not typically included in NIRIS.</u></b>				
3. <b>O&amp;M and OSHA Training Records</b>		<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>NAVFAC contractors are required to maintain up-to-date O&amp;M and OSHA training records; however, such records are not typically included in NIRIS.</u></b>				
4. <b>Permits and Service Agreements</b>				
	<input type="checkbox"/> Air discharge permit	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Effluent discharge	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Waste disposal, POTW	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Other permits	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
5. <b>Gas Generation Records</b>		<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
6. <b>Settlement Monument Records</b>		<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
7. <b>Groundwater Monitoring Records</b>		<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <b><u>Groundwater monitoring records are documented via long-term monitoring reports maintained in NIRIS. Groundwater monitoring reports from 2009 through 2014 were reviewed during this Five-Year Review. During the review, it was noted that not all pertinent historical documents are currently available via NIRIS. NAVFAC will work with the MCRD Parris Island Partnering Team to develop a list of missing documents and update NIRIS accordingly.</u></b>				
8. <b>Leachate Extraction Records</b>		<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
9. <b>Discharge Compliance Records</b>				
	<input type="checkbox"/> Air	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Water (effluent)	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
10. <b>Daily Access/Security Logs</b>		<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A



SITE INSPECTION CHECKLIST			
<b>IV. O&amp;M COSTS</b>			
<b>1.</b>	<b>O&amp;M Organization</b>		
	<input type="checkbox"/> State in-house	<input type="checkbox"/> Contractor for State	
	<input type="checkbox"/> PRP in-house	<input type="checkbox"/> Contractor for PRP	
	<input checked="" type="checkbox"/> Federal Facility in-house	<input type="checkbox"/> Contractor for Federal Facility	
<b>2.</b>	<b>O&amp;M Cost Records</b>		
	<input type="checkbox"/> Readily available <input type="checkbox"/> Up to date		
	<input checked="" type="checkbox"/> Funding mechanism/agreement in place		
	Original O&M cost estimate _____ <input type="checkbox"/> Breakdown attached		
	Remarks: <b><u>No routine maintenance program has been established. Maintenance, including clearing of vegetation, is currently performed on an as-needed basis.</u></b>		
	Total annual cost by year for review period if available		
	From _____ attached Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown Total Cost
	From _____ attached Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown Total Cost
	From _____ attached Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown Total Cost
	From _____ attached Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown Total Cost
	From _____ attached Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown Total Cost
<b>3.</b>	<b>Unanticipated or Unusually High O&amp;M Costs During Review Period</b>		
	Describe costs and reasons: <b><u>There has been additional cost associated with the sinkhole investigations and repairs during this review period.</u></b>		
<b>V. ACCESS AND INSTITUTIONAL CONTROLS</b>		<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>A. Fencing</b>			
1.	<b>Fencing damaged</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Gates secured <input checked="" type="checkbox"/> N/A
<b>B. Other Access Restrictions</b>			
1.	<b>Signs and other security measures</b>		<input type="checkbox"/> Location shown on site map <input type="checkbox"/> N/A
	Remarks: <b><u>Signs are posted at the entry point of the fishing dock and on most of the utility poles along the causeway. See photos 1, 4, 21, and 24 (pages A3-10 through A3-21).</u></b>		





SITE INSPECTION CHECKLIST			
4. <b>Holes</b>	<input checked="" type="checkbox"/> Location shown on site map	<input type="checkbox"/> Holes not evident	
Remarks <b>Sinkholes have formed along the sides of the road in the vicinity of the culverts. One of the sinkholes is undercutting the asphalt road surface at the north culverts on the marsh side of the road.</b>			
5. <b>Vegetative Cover</b>	<input checked="" type="checkbox"/> Grass <input type="checkbox"/> Trees/Shrubs	<input checked="" type="checkbox"/> Cover properly established	<input type="checkbox"/> No signs of stress
6. <b>Alternative Cover (armored rock, concrete, etc.)</b>	<input type="checkbox"/> N/A		
Remarks: <b>Asphalt Roadway</b>			
7. <b>Bulges</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Bulges not evident	
8. <b>Wet Areas/Water Damage</b>	<input checked="" type="checkbox"/> Wet areas/water damage not evident		
<input type="checkbox"/> Wet areas	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Ponding	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Seeps	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Soft subgrade	<input type="checkbox"/> Location shown on site map	Areal extent _____	
Remarks: <b>Over one inch of rain had fallen 48 hours previous with no observable standing water.</b>			
9. <b>Slope Instability</b>	<input type="checkbox"/> Slides	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> No evidence of slope instability
<b>B. Benches</b>	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
1. <b>Flows Bypass Bench</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay	
2. <b>Bench Breached</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay	
3. <b>Bench Overtopped</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay	
<b>C. Letdown Channels</b>	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
1. <b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of settlement	
2. <b>Material Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of degradation	
3. <b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of erosion	
4. <b>Undercutting</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of undercutting	
5. <b>Obstructions</b>	Type _____		
<input type="checkbox"/> No obstructions	<input type="checkbox"/> Location shown on site map	Areal extent _____	
6. <b>Excessive Vegetative Growth</b>	Type _____		
<input type="checkbox"/> No evidence of excessive growth	<input type="checkbox"/> Vegetation in channels does not obstruct flow		
<input type="checkbox"/> Location shown on site map	Areal extent _____		
<b>D. Cover Penetrations</b>	<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A	
1. <b>Gas Vents</b>	<input type="checkbox"/> Active	<input type="checkbox"/> Passive	
<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled	<input type="checkbox"/> Good condition
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A	
2. <b>Gas Monitoring Probes</b>	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A	
3. <b>Monitoring Wells (within surface area of landfill)</b>	<input checked="" type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> Routinely sampled
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> N/A	
4. <b>Leachate Extraction Wells</b>	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A	
5. <b>Settlement Monuments</b>	<input type="checkbox"/> Located	<input type="checkbox"/> Routinely surveyed	<input type="checkbox"/> N/A



SITE INSPECTION CHECKLIST			
<b>E. Gas Collection and Treatment</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Gas Treatment Facilities</b>			
<input type="checkbox"/> Flaring	<input type="checkbox"/> Thermal destruction	<input type="checkbox"/> Collection for reuse	
<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance		
2. <b>Gas Collection Wells, Manifolds and Piping</b>			
<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance		
3. <b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings)			
<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A	
<b>F. Cover Drainage Layer</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Outlet Pipes Inspected</b>			
<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A		
2. <b>Outlet Rock Inspected</b>			
<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A		
<b>G. Detention/Sedimentation Ponds</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Siltation</b>	Areal extent _____	Depth _____	<input type="checkbox"/> Siltation not evident
2. <b>Erosion</b>	Areal extent _____	Depth _____	<input type="checkbox"/> Erosion not evident
3. <b>Outlet Works</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A	
4. <b>Dam</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A	
<b>H. Retaining Walls</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Deformations</b>			
<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Deformation not evident		
2. <b>Degradation</b>			
<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Degradation not evident		
<b>I. Perimeter Ditches/Off-Site Discharge</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Siltation</b>			
<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Siltation not evident		
2. <b>Vegetative Growth</b>			
<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A		
<input type="checkbox"/> Vegetation does not impede flow			
3. <b>Erosion</b>			
<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Erosion not evident		
4. <b>Discharge Structure</b>			
<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A		
<b>VIII. VERTICAL BARRIER WALLS</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Settlement</b>			
<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident		
2. <b>Performance Monitoring</b>			
Type of monitoring _____	<input type="checkbox"/> Performance not monitored		
<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>		<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>A. Groundwater Extraction Wells, Pumps, and Pipelines</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1. <b>Pumps, Wellhead Plumbing, and Electrical</b>			
<input type="checkbox"/> Good condition	<input type="checkbox"/> All required wells properly operating	<input type="checkbox"/> Needs Maintenance	
2. <b>Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b>			
<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance		
3. <b>Spare Parts and Equipment</b>			
<input type="checkbox"/> Readily available	<input type="checkbox"/> Good condition	<input type="checkbox"/> Requires upgrade	<input type="checkbox"/> Needs to be provided



SITE INSPECTION CHECKLIST	
<b>B. Surface Water Collection Structures, Pumps, and Pipelines</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A	
1. <b>Collection Structures, Pumps, and Electrical</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
2. <b>Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
3. <b>Spare Parts and Equipment</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Good condition <input type="checkbox"/> Requires upgrade <input type="checkbox"/> Needs to be provided	
<b>C. Treatment System</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A	
1. <b>Treatment Train</b> (Check components that apply) <input type="checkbox"/> Metals removal <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Bioremediation <input type="checkbox"/> Air stripping <input type="checkbox"/> Carbon adsorbers <input type="checkbox"/> Filters _____ <input type="checkbox"/> Additive (e.g., chelation agent, flocculent) _____ <input type="checkbox"/> Others _____ <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> Sampling ports properly marked and functional <input type="checkbox"/> Sampling/maintenance log displayed and up to date <input type="checkbox"/> Equipment properly identified <input type="checkbox"/> Quantity of groundwater treated annually _____ <input type="checkbox"/> Quantity of surface water treated annually _____	
2. <b>Electrical Enclosures and Panels</b> (properly rated and functional) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
3. <b>Tanks, Vaults, Storage Vessels</b> <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance	
4. <b>Discharge Structure and Appurtenances</b> <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
5. <b>Treatment Building(s)</b> <input type="checkbox"/> N/A <input type="checkbox"/> Good condition (esp. roof and doorways) <input type="checkbox"/> Needs repair <input type="checkbox"/> Chemicals and equipment properly stored	
6. <b>Monitoring Wells</b> (pump and treatment remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A	
<b>D. Monitoring Data</b>	
1. Monitoring Data <input checked="" type="checkbox"/> Is routinely submitted on time <input checked="" type="checkbox"/> Is of acceptable quality	
2. Monitoring data suggests: <input type="checkbox"/> Groundwater plume is effectively contained <input checked="" type="checkbox"/> Contaminant concentrations are declining	
<b>E. Monitored Natural Attenuation</b>	
1. <b>Monitoring Wells</b> (natural attenuation remedy) <input checked="" type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A	
<b>X. OTHER REMEDIES</b>	
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.	



SITE INSPECTION CHECKLIST	
<b>XI. OVERALL OBSERVATIONS</b>	
<b>A. Implementation of the Remedy</b>	<p>Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).</p> <p><b><u>Remedy is effective and functioning as designed to contain waste materials and prevent exposure to contaminated media.</u></b></p>
<b>B. Adequacy of O&amp;M</b>	<p>Describe issues and observations related to the implementation and scope of O&amp;M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.</p> <p><b><u>Sinkholes and erosion were identified during LUC compliance inspections. Repairs are currently in planning stages. The lifting holes and any voids between the joints in the culvert pipe sections should be filled, the sinkholes and the affected surrounding area(s) should be repaired to ensure no additional sinkholes develop. Sinkhole repairs should be designed to also address surface erosion in the vicinity of the northern culverts. Additional evaluation is necessary to determine if repairs are necessary to mitigate erosion on the marsh side at the southern end of the Causeway.</u></b></p> <p><b><u>In addition to sinkholes, which are confined to the immediate vicinity of the culverts, depressions and dips have developed in other parts of the causeway. At this time there is no reason to suspect that the dips and depressions impact the protectiveness of the remedy; however, additional study may be necessary to allow for further evaluation. Following further review and discussions by the MCRD Parris Island Partnering Team, additional geotechnical testing and/or other investigations may be proposed to further evaluate the dips/depressions.</u></b></p>
<b>C. Early Indicators of Potential Remedy Problems</b>	<p>Describe issues and observations such as unexpected changes in the cost or scope of O&amp;M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.</p> <p><b><u>During the last five-year review, inspections identified sinkholes in the vicinity of culverts beneath the causeway. Since that time, the Navy has conducted a dive inspection and pre-design investigation necessary to plan corrective measures. In addition to the sinkholes, surface erosion has also been observed in the vicinity of the northern culverts. Repair options, which will address sinkholes and erosion near the northern culvert, are currently under evaluation by the MCRD Parris Island Partnering Team.</u></b></p>
<b>D. Opportunities for Optimization</b>	<p>Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.</p> <p><b><u>Maintenance is currently performed on an as-needed basis. A routine maintenance program should be established and implemented.</u></b></p> <p><b><u>The Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully document Site 3 restrictions. Field inspection and documentation procedures relative to site inspections and LUC compliance activities should be re-assessed. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.</u></b></p>



X:\NavalParrisIsland\FigureA-2SiteLayout.mxd

◆ Approximate Monitoring Well Location  
 444 Building Number



FIGURE A-2 14 JANUARY 2015  
 SITE VISIT MAP  
 OPERABLE UNIT 3 (SITE 3/SWMU 3)  
 MCRD PARRIS ISLAND, SOUTH CAROLINA

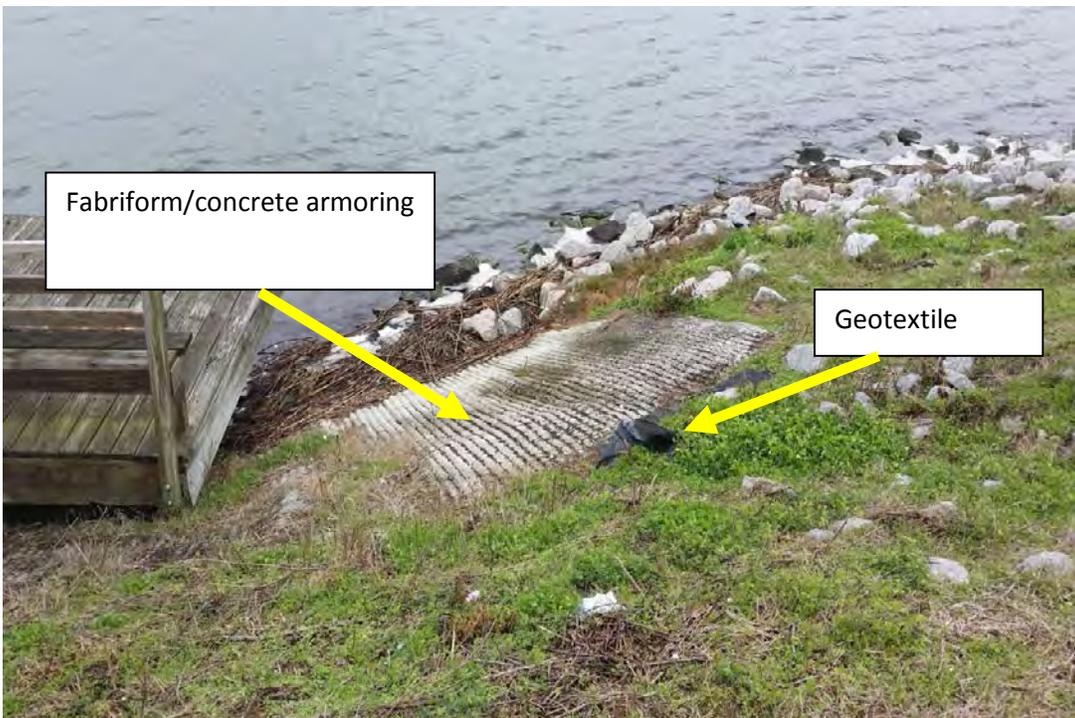
REQUESTED BY: D. WARREN	DATE: 11/9/2015		
DRAWN BY: M. SENNE	TASK ORDER NUMBER: JM38		

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**Photo 1:** OU 3 (Site 3/SWMU 3) — Notice and warning signs at the northern culvert and dock, facing north.



**Photo 2:** OU 3 (Site 3/SWMU 3) — Fabriform/concrete armoring and exposed geotextile at the northern dock, facing north.

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**Photo 3:** OU 3 (Site 3/SWMU 3) — North face of revetment showing covered sediment area facing east.



**Photo 4:** OU 3 (Site 3/SWMU 3) — North face of revetment showing covered sediment area near northern dock facing east.

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**Photo 5:** OU 3 (Site 3/SWMU 3) — Fabriform/concrete armoring at the northern dock, facing north.



**Photo 6:** OU 3 (Site 3/SWMU 3) — Northern dock facing northwest.

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**Photo 7:** OU 3 (Site 3/SWMU 3) — Erosion in soil near (just south of) north culvert at top of slope.



**Photo 8:** OU 3 (Site 3/SWMU 3) — Erosion near covered sediment area at top of slope.

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**Photo 9:** OU 3 (Site 3/SWMU 3) — Vegetative cover near north culvert at top of slope facing north.



**Photo 10:** OU 3 (Site 3/SWMU 3) — North face of landfill showing northern dock facing northwest.

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**Photo 11:** OU 3 (Site 3/SWMU 3) — Erosion over north culvert (just south of northern fishing dock) at top of slope.



**Photo 12:** OU 3 (Site 3/SWMU 3) — Sinkhole over north culvert at top of slope near northern dock.

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**Photo 13:** OU 3 (Site 3/SWMU 3) — North face of revetment showing covered sediment area near northern dock facing northeast.



**Photo 14:** OU 3 (Site 3/SWMU 3) — Fabriform/concrete armoring (see arrow) at the northern dock, facing north.

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**Photo 15:** OU 3 (Site 3/SWMU 3) — Sinkhole repaired with flowable concrete at top of slope near north culvert.



**Photo 16:** OU (Site 3/SWMU 3) — Top of headwall on southern terminus of north culvert. Surficial cracks and discoloration noted in concrete headwalls during Land Use Control inspections are not indicative of protectiveness issues.

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**Photo 17:** OU 3 (Site 3/SWMU 3) — Southern terminus of north culvert showing weirs in pipe outlet.



**Photo 18:** OU 3 (Site 3/SWMU 3) — North culvert showing wire gabion structures.

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**Photo 19:** OU 3 (Site 3/SWMU 3) — South face of revetment near north culvert facing northwest.



**Photo 20:** OU 3 (Site 3/SWMU 3) — South face of revetment near north culvert facing northwest.

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**Photo 21:** OU 3 (Site 3/SWMU 3) — Notice sign as posted on most utility poles along the causeway.



**Photo 22:** OU 3 (Site 3/SWMU 3) — South dock near south culvert.

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**Photo 23:** OU 3 (Site 3/SWMU 3) — Sinkhole repaired with flowable concrete on top of slope at south culvert.



**Photo 24:** OU 3 (Site 3/SWMU 3) — Notice and no trespassing signs at south dock.

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**Photo 25:** OU 3 (Site 3/SWMU 3) — Photo taken near southern dock facing east showing north face of revetment and covered sediment area in background.

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**Appendix A4**  
**Operable Unit 5 (Site 12/SWMU 10)**

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SITE INSPECTION CHECKLIST			
<b>III. ONSITE DOCUMENTS &amp; RECORDS VERIFIED</b> (Check all that apply)			
General Note: <b><u>There are no structures present at Operable Unit 5 (Site 12/SWMU 10) where documents can be maintained onsite. Pertinent documents are maintained in the Naval Installation Restoration Information Solution (NIRIS) database and in the administrative record for MCRD Parris Island. The administrative record is accessible via NAVFAC's public website for MCRD Parris Island at the following link: <a href="http://go.usa.gov/36SzJ">http://go.usa.gov/36SzJ</a> Environmental Restoration Program reports and other documents are also maintained in the information repository at Beaufort County Public Library Headquarters, 311 Scott Street, Beaufort, South Carolina 29902. It is noted that not all pertinent historical documents were retrievable via NIRIS and the administrative record at the time of this Five-Year Review. NAVFAC will work with the MCRD Parris Island Partnering Team to identify missing documents and bring NIRIS and the administrative record up to date.</u></b>			
<b>1. O&amp;M Documents</b> O&M manuals <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A As-built drawings <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A Maintenance logs <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
Remarks: <b><u>All pertinent historical documents are not currently in NIRIS. See General Note under Section III above.</u></b>			
<b>2. Site-Specific Health and Safety Plan</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A Contingency plan/emergency response plan: <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
Remarks: <b><u>NAVFAC contractors are required to prepare and carry up-to-date site-specific health and safety plans onsite during each field activity. Health and safety plans are not typically included in NIRIS.</u></b>			
<b>3. O&amp;M and OSHA Training Records</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
Remarks: <b><u>NAVFAC contractors are required to maintain up to date O&amp;M and OSHA training records; however, such records are not typically included in NIRIS.</u></b>			
<b>4. Permits and Service Agreements</b> <input type="checkbox"/> Air discharge permit <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Effluent discharge <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Waste disposal, POTW <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Other permits <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
<b>5. Gas Generation Records</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
<b>6. Settlement Monument Records</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
<b>7. Groundwater Monitoring Records</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
<b>8. Leachate Extraction Records</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
<b>9. Discharge Compliance Records</b> <input type="checkbox"/> Air <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Water (effluent) <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
<b>10. Daily Access/Security Logs</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A			
<b>IV. O&amp;M COSTS</b>			
<b>1. O&amp;M Organization</b> <input type="checkbox"/> State in-house <input type="checkbox"/> Contractor for State <input type="checkbox"/> PRP in-house <input type="checkbox"/> Contractor for PRP <input checked="" type="checkbox"/> Federal Facility in-house <input type="checkbox"/> Contractor for Federal Facility			



SITE INSPECTION CHECKLIST			
<b>2.</b>	<b>O&amp;M Cost Records</b>		
	<input type="checkbox"/> Readily available <input type="checkbox"/> Up to date		
	<input type="checkbox"/> Funding mechanism/agreement in place		
	Original O&M cost estimate _____	<input type="checkbox"/> Breakdown attached	
	Total annual cost by year for review period if available		
	From: _____ Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown attached Total Cost
	From: _____ Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown attached Total Cost
	From: _____ Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown attached Total Cost
	From: _____ Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown attached Total Cost
	From: _____ Date	To: _____ Date	_____ <input type="checkbox"/> Breakdown attached Total Cost
<b>3.</b>	<b>Unanticipated or Unusually High O&amp;M Costs During Review Period</b>	Describe costs and reasons: <u>None</u>	
<b>V. ACCESS AND INSTITUTIONAL CONTROLS</b>		<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>A. Fencing</b>			
1.	<b>Fencing damaged</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Gates secured <input checked="" type="checkbox"/> N/A
<b>B. Other Access Restrictions</b>			
1.	<b>Signs and other security measures</b>	<input checked="" type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A
Remarks: <b>See Figure A-3 (page A4-8) and Photo 5 (page A4-11)</b>			
<b>C. Institutional Controls (ICs)</b>			
1.	<b>Implementation and enforcement</b>		
	Site conditions imply ICs not properly implemented:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
	Site conditions imply ICs not being fully enforced:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
	Type of monitoring (e.g., self-reporting, drive by): <u>Inspections</u>		
	Frequency: <u>Quarterly</u>		
	Responsible party/agency: <u>NREA MCRD Parris Island</u>		
	Contact: <u>Lisa Donohoe</u>	<u>Environmental Restoration Program Manager</u>	<u>1/14/2015</u> <u>(843) 228-2779</u>
	Name	Title	Date    Phone no.
	Reporting is up-to-date:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
	Reports are verified by the lead agency:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
	Specific requirements in deed or decision documents have been met:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
	Violations have been reported:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
	Other problems or suggestions:	<input type="checkbox"/> Report attached	
2.	<b>Adequacy</b>	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate <input type="checkbox"/> N/A
<b>D. General</b>			
1.	<b>Vandalism/trespassing</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> No vandalism evident
2.	<b>Land use changes on site</b>	<input checked="" type="checkbox"/> N/A	
3.	<b>Land use changes off site</b>	<input checked="" type="checkbox"/> N/A	



SITE INSPECTION CHECKLIST			
<b>VI. GENERAL SITE CONDITIONS</b>			
<b>A. Roads</b>	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
1. <b>Roads damaged</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Roads adequate	<input type="checkbox"/> N/A
<b>B. Other Site Conditions</b>			
<b>VII. LANDFILL COVERS</b>			
		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>A. Landfill Surface</b>			
1. <b>Settlement</b> (Low spots)	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident	
2. <b>Cracks</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Cracking not evident	
3. <b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Significant erosion not evident	
4. <b>Holes</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Holes not evident	
5. <b>Vegetative Cover</b>	<input type="checkbox"/> Grass	<input type="checkbox"/> Cover properly established	<input type="checkbox"/> No signs of stress
	<input type="checkbox"/> Trees/Shrubs (indicate size and locations on a diagram)		
6. <b>Alternative Cover (armored rock, concrete, etc.)</b>	<input checked="" type="checkbox"/> N/A		
7. <b>Bulges</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Bulges not evident	
8. <b>Wet Areas/Water Damage</b>	<input type="checkbox"/> Wet areas/water damage not evident		
<input type="checkbox"/> Wet areas	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Ponding	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Seeps	<input type="checkbox"/> Location shown on site map	Areal extent _____	
<input type="checkbox"/> Soft subgrade	<input type="checkbox"/> Location shown on site map	Areal extent _____	
9. <b>Slope Instability</b>	<input type="checkbox"/> Slides	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of slope instability
<b>B. Benches</b>			
		<input type="checkbox"/> Applicable	<input type="checkbox"/> N/A
1. <b>Flows Bypass Bench</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
2. <b>Bench Breached</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
3. <b>Bench Overtopped</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
<b>C. Letdown Channels</b>			
		<input type="checkbox"/> Applicable	<input type="checkbox"/> N/A
1. <b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of settlement	
2. <b>Material Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of degradation	
3. <b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of erosion	
4. <b>Undercutting</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of undercutting	
5. <b>Obstructions</b>	Type _____		
<input type="checkbox"/> No obstructions	<input type="checkbox"/> Location shown on site map	Areal extent _____	
6. <b>Excessive Vegetative Growth</b>	Type _____		
<input type="checkbox"/> No evidence of excessive growth	<input type="checkbox"/> Vegetation in channels does not obstruct flow		
<input type="checkbox"/> Location shown on site map	Areal extent _____		
<b>D. Cover Penetrations</b>			
		<input type="checkbox"/> Applicable	<input type="checkbox"/> N/A
1. <b>Gas Vents</b>	<input type="checkbox"/> Active	<input type="checkbox"/> Passive	
<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled	<input type="checkbox"/> Good condition
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> N/A	
2. <b>Gas Monitoring Probes</b>	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> N/A	<input type="checkbox"/> Good condition
3. <b>Monitoring Wells</b> (within surface area of landfill)	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled
<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> N/A	<input type="checkbox"/> Good condition



SITE INSPECTION CHECKLIST			
<b>4.</b>	<b>Leachate Extraction Wells</b>		
	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled
	<input type="checkbox"/> Evidence of leakage at penetration	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> Good condition
<b>5.</b>	<b>Settlement Monuments</b>	<input type="checkbox"/> Located	<input type="checkbox"/> Routinely surveyed
			<input type="checkbox"/> N/A
<b>E.</b>	<b>Gas Collection and Treatment</b>	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>1.</b>	<b>Gas Treatment Facilities</b>		
	<input type="checkbox"/> Flaring	<input type="checkbox"/> Thermal destruction	<input type="checkbox"/> Collection for reuse
	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	
<b>2.</b>	<b>Gas Collection Wells, Manifolds and Piping</b>		
	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	
<b>3.</b>	<b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings)		
	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> N/A
<b>F.</b>	<b>Cover Drainage Layer</b>	<input type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>1.</b>	<b>Outlet Pipes Inspected</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
<b>2.</b>	<b>Outlet Rock Inspected</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
<b>G.</b>	<b>Detention/Sedimentation Ponds</b>	<input type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>1.</b>	<b>Siltation</b>	Areal extent _____ Depth _____	<input type="checkbox"/> N/A <input type="checkbox"/> Siltation not evident
<b>2.</b>	<b>Erosion</b>	Areal extent _____ Depth _____	<input type="checkbox"/> Erosion not evident
<b>3.</b>	<b>Outlet Works</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
<b>4.</b>	<b>Dam</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
<b>H.</b>	<b>Retaining Walls</b>	<input type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>1.</b>	<b>Deformations</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Deformation not evident
<b>2.</b>	<b>Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Degradation not evident
<b>I.</b>	<b>Perimeter Ditches/Off-Site Discharge</b>	<input type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>1.</b>	<b>Siltation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Siltation not evident
<b>2.</b>	<b>Vegetative Growth</b>	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Vegetation does not impede flow	<input type="checkbox"/> N/A
<b>3.</b>	<b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Erosion not evident
<b>4.</b>	<b>Discharge Structure</b>	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A
<b>VIII. VERTICAL BARRIER WALLS</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>1.</b>	<b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident
<b>2.</b>	<b>Performance Monitoring</b>	Type of monitoring _____	<input type="checkbox"/> Performance not monitored
<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>		<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
<b>A.</b>	<b>Groundwater Extraction Wells, Pumps, and Pipelines</b>	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>1.</b>	<b>Pumps, Wellhead Plumbing, and Electrical</b>	<input type="checkbox"/> Good condition	<input type="checkbox"/> All required wells properly operating
			<input type="checkbox"/> Needs Maintenance
<b>2.</b>	<b>Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b>	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
<b>3.</b>	<b>Spare Parts and Equipment</b>	<input type="checkbox"/> Readily available	<input type="checkbox"/> Good condition
		<input type="checkbox"/> Requires upgrade	<input type="checkbox"/> Needs to be provided



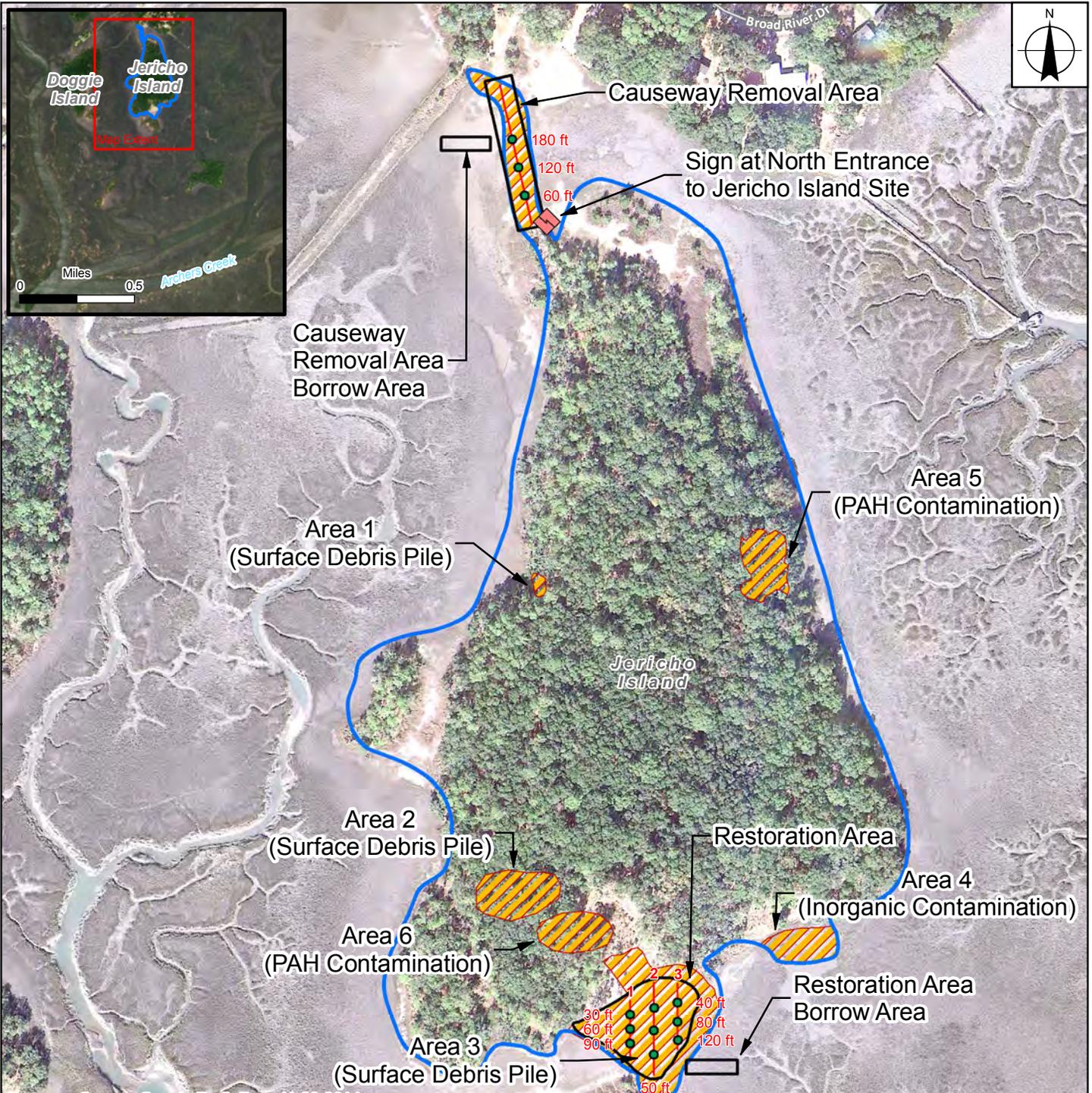
<b>SITE INSPECTION CHECKLIST</b>	
<b>B. Surface Water Collection Structures, Pumps, and Pipelines</b>	<input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A
1. <b>Collection Structures, Pumps, and Electrical</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
2. <b>Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
3. <b>Spare Parts and Equipment</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Good condition <input type="checkbox"/> Requires upgrade <input type="checkbox"/> Needs to be provided	
<b>C. Treatment System</b>	<input type="checkbox"/> Applicable <input type="checkbox"/> N/A
1. <b>Treatment Train</b> (Check components that apply) <input type="checkbox"/> Metals removal <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Bioremediation <input type="checkbox"/> Air stripping <input type="checkbox"/> Carbon adsorbers <input type="checkbox"/> Filters _____ <input type="checkbox"/> Additive (e.g., chelation agent, flocculent) _____ <input type="checkbox"/> Others _____ <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> Sampling ports properly marked and functional <input type="checkbox"/> Sampling/maintenance log displayed and up to date <input type="checkbox"/> Equipment properly identified <input type="checkbox"/> Quantity of groundwater treated annually _____ <input type="checkbox"/> Quantity of surface water treated annually _____	
2. <b>Electrical Enclosures and Panels</b> (properly rated and functional) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
3. <b>Tanks, Vaults, Storage Vessels</b> <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance	
4. <b>Discharge Structure and Appurtenances</b> <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance	
5. <b>Treatment Building(s)</b> <input type="checkbox"/> N/A <input type="checkbox"/> Good condition (esp. roof and doorways) <input type="checkbox"/> Needs repair <input type="checkbox"/> Chemicals and equipment properly stored	
6. <b>Monitoring Wells</b> (pump and treatment remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A	
<b>D. Monitoring Data</b>	
1. Monitoring Data <input type="checkbox"/> Is routinely submitted on time <input type="checkbox"/> Is of acceptable quality	
2. Monitoring data suggests: <input type="checkbox"/> Groundwater plume is effectively contained <input type="checkbox"/> Contaminant concentrations are declining	
<b>E. Monitored Natural Attenuation</b>	
1. <b>Monitoring Wells</b> (natural attenuation remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A	
<b>X. OTHER REMEDIES</b>	
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.	



SITE INSPECTION CHECKLIST	
<b>XI. OVERALL OBSERVATIONS</b>	
<b>A. Implementation of the Remedy</b>	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). <b>Remedy is effective and functioning as designed to prevent groundwater use.</b>
<b>B. Adequacy of O&amp;M</b>	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. <b>O&amp;M is adequate to ensure the remedy remains protective of human health and the environment.</b>
<b>C. Early Indicators of Potential Remedy Problems</b>	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. <b>None</b>
<b>D. Opportunities for Optimization</b>	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. <b><u>As documented in the Five-Year Review Report, marsh grass restoration performed as part of the remedy at the site may be incomplete in the Restoration Area and Causeway Removal Area. Background/reference values are needed to facilitate evaluation of marsh grass restoration; background/reference values for marsh grass counts should be developed to allow further evaluation of the remedy. The Five-Year Review Report recommends that conditions in the Restoration Area and Causeway Removal Area be evaluated to determine whether Spartina re-vegetation is necessary. Findings and recommendations should be reviewed with the MCRD Parris Island Partnering Team.</u></b>  <b><u>Furthermore, the Base Master Plan, Depot Order, and associated records (e.g., GIS) do not fully document Site 12 restrictions. Field inspection and documentation procedures relative to site inspections and LUC compliance activities should be re-assessed. The objective of this review will be to clarify roles, responsibilities, schedules, and deliverables associated with these parallel processes.</u></b>



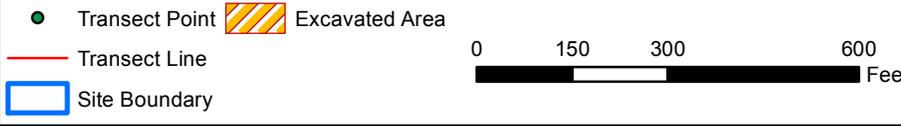
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Basemap Source: Google Earth Pro - 11-20-2014

**Notes:**  
 -Approximate locations for transect points and lines are based on Annual Marsh Grass Monitoring Report, October 2013, Site 12/SWMU 10 Jericho Island, dated January 20, 2014.  
 -PAH= polynuclear aromatic hydrocarbon  
 -Site Boundary and excavated areas were approximated based on the Land Use Control Remedial Design for Site 12 Jericho Island Disposal Area, MCRD Parris Island, SC, as prepared by CH2M Hill and dated October 1, 2008.  
 -LUCs Boundary not specified in Land Use Control Remedial Design for Site 12 Jericho Island Disposal Area, MCRD Parris Island, SC, as prepared by CH2M Hill and dated October 1, 2008.

FIGURE A-3 14 JANUARY 2015  
 SITE VISIT MAP  
 OPERABLE UNIT 5 (SITE 12/SWMU 10)  
 MCRD PARRIS ISLAND, SOUTH CAROLINA



**NAVFAC**  
 Naval Facilities Engineering Command

**RESOLUTION CONSULTANTS**

REQUESTED BY: D. WARREN      DATE: 6/2/2016  
 DRAWN BY: M. SENNE      TASK ORDER NUMBER: JM38

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**Photo 1:** OU 5 (Site 12/SWMU 10) — Access to Jericho Island, residential lot off State Road S-7-287 facing south.



**Photo 2:** OU 5 (Site 12/SWMU 10) — Access to Jericho Island, residential lot off State Road S-7-287 facing north.

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**Photo 3:** OU 5 (Site 12/SWMU 10) — North end of Causeway Removal Area facing south (Causeway Removal Area Borrow Area to the right).



**Photo 4:** OU 5 (Site 12/SWMU 10) — North end of Causeway Removal Area facing north.

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**Photo 5:** OU 5 (Site 12/SWMU 10) — Sign at north entrance to Jericho Island facing south.



**Photo 6:** OU 5 (Site 12/SWMU 10) — Wooded interior of Jericho Island facing south.

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**Photo 7:** OU 5 (Site 12/SWMU 10) — Wooded shoreline of Jericho Island facing west.



**Photo 8:** OU 5 (Site 12/SWMU 10) — Pathway to Restoration Area facing south.

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**Photo 9:** OU 5 (Site 12/SWMU 10) — Restoration Area facing south.



**Photo 10:** OU 5 (Site 12/SWMU 10) — Restoration Area facing southwest.

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**Photo 11:** OU 5 (Site 12/SWMU 10) — Restoration Area facing west.



**Photo 12:** OU 5 (Site 12/SWMU 10) — Restoration Area facing south showing area of discolored sediments.

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**Photo 13:** OU 5 (Site 12/SWMU 10) — Restoration Area showing detail of area of discolored sediments.



**Photo 14:** OU 5 (Site 12/SWMU 10) — Upland portion of Restoration Area facing west.

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14 January 2015**



**Photo 15:** OU 5 (Site 12/SWMU 10) — Upland portion of Restoration Area facing northwest.



**Photo 16:** OU 5 (Site 12/SWMU 10) — Minimal glass fragments observed in upland portion of Restoration Area. These minimal glass fragments are not indicative of a protectiveness issue, since confirmatory sample results illustrate that waste and debris was adequately excavated.

**Appendix B**  
**Public Notice**

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The United States Navy (Navy) and Marine Corps Recruit Depot (MCRD) Parris Island, in coordination with the United States Environmental Protection Agency Region 4 and the South Carolina Department of Health and Environmental Control, will initiate the third Five-Year Review for Operable Unit 1 (Site 1 and Site 41) — Incinerator Landfill and Former Incinerator, Operable Unit 3 (Site 3) — Causeway Landfill, and Operable Unit 5 (Site 12) — Jericho Island Disposal Area at MCRD Parris Island, South Carolina.

This Five-Year Review will be performed by the Navy as part of the Installation Restoration Program for the Department of the Navy, following applicable guidelines under the Comprehensive Environmental Response, Compensation, and Liability Act. The purpose of the Five-Year Review process is to determine whether the remedies selected at each Site are protective of human health and the environment. The Navy will conduct the Five-Year Review with evaluation of pending, completed, and ongoing remedial actions implemented at Operable Unit 1, Operable Unit 3, and Operable Unit 5 to determine whether the selected remedies remain effective. This Five-Year Review will include areas where site-related contaminants remain at levels above those that would allow for unrestricted site use.

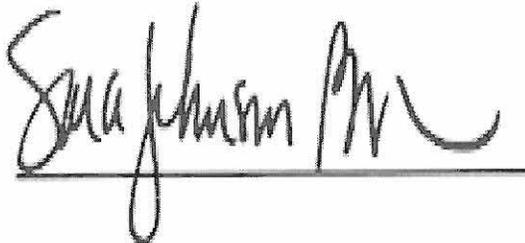
Navy and United States Environmental Protection Agency guidelines call for this review every five years to ensure protection of human and ecological communities in the area. Once completed, the Five-Year Review Report will be maintained in the MCRD Parris Island Information Repository at the Beaufort County Public Library Headquarters, 311 Scott Street, Beaufort, South Carolina, 29902. Questions concerning the Five-Year Review may be directed to:

Commanding General  
Marine Corps Recruit Depot Parris Island  
Attn: Lisa Donohoe, Environmental Restoration Program Manager  
P.O. Box 5028  
Parris Island, South Carolina 29905-0028  
Tel: 843-228-2779  
lisa.donohoe@usmc.mil

**THE ISLAND PACKET**  
**The Beaufort Gazette**

**STATE OF )**  
**SOUTH CAROLINA ) AFFIDAVIT**  
**COUNTY OF BEAUFORT )**

Personally appeared before me a Notary Public, in and for State and County, aforesaid, Sara Johnson Borton who being duly sworn according to law, deposes and says that she is the Publisher and President of The Island Packet and The Beaufort Gazette, newspapers published Sunday through Saturday every week in Beaufort County, **The United States Navy (Navy) and Marine Corps Recruit Depot (MCRD) Parris Island, in coordination with the United States Environmental Protection Agency Region 4 and the SCDHEC will initiate the third Five-Year Review for Operable Unit 1,** was published in the issue(s) of The Island Packet and The Beaufort Gazette on through April 10, 11, 12, 2015.



**Sara Johnson Borton,**  
**Publisher and President**  
**The Island Packet/The Beaufort Gazette**

**Subscribed and sworn to before**  
**me this 13th day of April 2015**

  
**Amy L. Robbins**

**Notary Public for South Carolina**  
**My Commission Expires on November 27, 2022**

The United States Navy (Navy) and Marine Corps Recruit Depot (MCRD) Parris Island, in coordination with the United States Environmental Protection Agency Region 4 and the South Carolina Department of Health and Environmental Control, will initiate the third Five-Year Review for Operable Unit 1 (Site 1 and Site 41)- Incinerator Landfill and Former Incinerator, Operable Unit 3 (Site 3)- Causeway Landfill, and Operable Unit 5 (Site 12)- Jericho Island Disposal Area at MCRD Parris Island, South Carolina.

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Commanding General  
Marine Corps Recruit  
Depot Parris Island  
Attn: Lisa Donohoe,  
Environmental  
Restoration Program  
Manager  
P.O. Box 5028  
Parris Island,  
South Carolina  
29905-0028  
Tel: 843-228-2779  
lisa.donohoe@usmc.mil

**Appendix C**  
**Land Use Control Compliance Certificates**

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**2010-2011  
Land Use Control Compliance Certificates**



## UNITED STATES MARINE CORPS

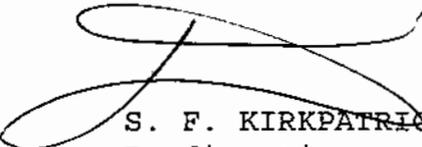
MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
August 2, 2012

From: Commanding General, Marine Corps Recruit Depot, Parris Island SC  
To: Commander, Naval Facilities Engineering Command, Southeast  
Subj: 2010-2011 ANNUAL LAND USE CONTROL COMPLIANCE CERTIFICATES  
Encl: 2010-2011 Annual Land Use Control Compliance Certificates for Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho Island

1. In accordance with MCRD Parris Island Land Use Control documents, the 2010-2011 Annual Land Use Control Compliance Certificates for Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho Island are being submitted to Naval Facilities Engineering Command, Southeast; U.S. Environmental Protection Agency; and South Carolina Department of Health and Environmental Control.

2. Should you have any questions or concerns, please contact Ms. Lisa Donohoe, Installation Restoration & Munitions Response Program Manager at (843) 228-2779 or [lisa.donohoe@usmc.mil](mailto:lisa.donohoe@usmc.mil).

  
S. F. KIRKPATRICK  
By direction

Copy to: Lila Llamas, EPA (original signed letter)  
Meredith Amick, SCDHEC (original signed letter)  
Peggy Churchill, Tetra Tech (electronic copy)





## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
August 2, 2012

Ms. Meredith Amick  
South Carolina Department of Health  
and Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

RE: 2010 - 2011 Annual Land Use Compliance Certificates for  
Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway  
Landfill, and Site 12/SWMU 10 Jericho Island

Dear Ms. Amick:

Enclosed are the Annual Land Use Compliance Certificates  
for the period of 01 JULY 2010 to 30 JUNE 2011 for Site 1/SWMU 1  
Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site  
12/SWMU 10 Jericho Island.

If you have questions, please contact Ms. Lisa Donohoe at  
(843) 228-2779.

Sincerely,

A handwritten signature in black ink, appearing to be "S. F. Kirkpatrick", written in a cursive style.

S. F. KIRKPATRICK  
Colonel, USMC  
Assistant Chief of Staff,  
Installation and Logistics  
By direction of the  
Commanding General

Enclosures

cc: Charles Cook, NAVFAC SE (original signed letter)  
Lila Llamas, EPA (original signed letter)  
Peggy Churchill, Tetra Tech (electronic copy)

**ANNUAL LUC COMPLIANCE CHECKLIST**  
 MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 1 / SWMU 1 – Incinerator Landfill

Site Location (provide nearest road name, GIS coordinates, etc.): Horse Island, Malecon Drive

Date(s) of Inspection/Review: 22 SEPT 2010, 31 DEC 2010, 26 MAR 2011, 01 JUNE 2011

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Land Use Controls**

5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]



**ANNUAL LUC INSPECTION REPORT  
SITE 1 / SWMU 1 INCINERATOR LANDFILL  
2010 - 2011**

**South side of site**



**22 SEPT 2010 Planted line of Spartina on the south side of the site**



**26 MAR 2011 Spartina on the south side of the site**

**South side of site (continued)**



**01 JUN 2011 Spartina on the south side of the site**

**North side of site**



**26 MAR 2011 Spartina on the north side of the site**

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 3 / SWMU 3 – Causeway Landfill

Site Location (provide nearest road name, GIS coordinates, etc.): 3<sup>rd</sup> Battalion Causeway

Date(s) of Inspection/Review: 22 SEPT 2010, 31 DEC 2010, 26 MAR 2011, 01 JUNE 2011

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Land Use Controls**

5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

**See comment box.**



**ANNUAL LUC INSPECTION REPORT  
SITE 3 / SWMU 3 CAUSEWAY LANDFILL  
2010 - 2011**

**Sinkholes**



**JULY 2010 Sinkhole at northern fishing dock**



**JULY 2010 Sinkhole at southern fishing dock**

**Sinkholes (continued)**



**AUGUST 2010 Sinkhole at northern fishing dock**

**Erosion**



**22 SEPT 2010 Erosion on pond side of the Causeway, south of the northern fishing dock**

**Erosion (continued)**



**01 JUNE 2011 Erosion on pond side of the Causeway, south of the northern fishing dock.**

**Vegetation growing in rip rap – Northern fishing dock**



**22 SEPT 2010 Vegetation growing in rip rap.  
Photo taken from northern fishing dock looking north.**

**Vegetation growing in rip rap – Northern fishing dock (continued)**



**22 SEPT 2010 Vegetation growing in rip rap.  
Photo taken from northern fishing dock looking south.**



**26 MARCH 2011 Root growing under fabriform at northern fishing dock.**

**Vegetation growing in rip rap – Southern fishing dock**



**22 SEPT 2010 Vegetation growing in rip rap.  
Photo taken from southern fishing dock looking north.**



**22 SEPT 2010 Vegetation growing in rip rap.  
Photo taken from southern fishing dock looking south.**

**Vegetation growing in rip rap on marsh side of Causeway**



**22 SEPT 2010 Vegetation growing in rip rap on marsh side of Causeway.  
Photo taken from southern end of Causeway looking north.**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : MCRD Parris Island  
 Address : Bldg 151  
 Panama Drive  
 Beaufort, South Carolina 29905  
 Contact: Ms. Lisa Donohoe  
 Project: **Routine Analytical - Donohoe**

Report Date: August 20, 2010

Client Sample ID:	Site 3 IDW	Project:	MCRD00110
Sample ID:	258281001	Client ID:	MCRD001
Matrix:	Soil		
Collect Date:	06-AUG-10 09:03		
Receive Date:	07-AUG-10		
Collector:	Client		
Moisture:	15.4%		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Mercury Analysis-CVAA</b>											
<i>TCLP Hg in Solid "As Received"</i>											
Mercury	U	ND	0.00066	0.002	mg/L	1	ETL	08/13/10	0925	1012894	1
<i>SW846 7471B Mercury in Solid "Dry Weight Corrected"</i>											
Mercury		23.1	4.34	12.8	ug/Kg	1	JXLI	08/11/10	1317	1011775	2
<b>Metals Analysis-ICP</b>											
<i>TCLP ICP Metals - 1311/3010A/6010C "As Received"</i>											
Arsenic	J	0.117	0.050	0.300	mg/L	1	CYLI	08/17/10	1425	1012661	3
Barium		0.147	0.010	0.050	mg/L	1					
Cadmium	U	ND	0.010	0.050	mg/L	1					
Chromium	U	ND	0.010	0.050	mg/L	1					
Lead	U	ND	0.033	0.100	mg/L	1					
Selenium	U	ND	0.050	0.300	mg/L	1					
Silver	U	ND	0.010	0.050	mg/L	1					
<i>SW846 3050B/6010C Solid "Dry Weight Corrected"</i>											
Aluminum		2550000	7770	22900	ug/kg	1	HSC	08/17/10	1152	1011538	4
Antimony	U	ND	377	1140	ug/kg	1					
Arsenic	J	1630	572	3430	ug/kg	1					
Barium		11200	114	572	ug/kg	1					
Beryllium	U	ND	114	572	ug/kg	1					
Cadmium	U	ND	114	572	ug/kg	1					
Calcium		8490000	9150	28600	ug/kg	1					
Chromium		4830	171	572	ug/kg	1					
Cobalt	J	317	171	572	ug/kg	1					
Copper		2790	343	1140	ug/kg	1					
Iron		2910000	9150	28600	ug/kg	1					
Lead		12600	286	1140	ug/kg	1					
Magnesium		2870000	9720	34300	ug/kg	1					
Manganese		29600	229	1140	ug/kg	1					
Nickel		1100	171	572	ug/kg	1					
Potassium		192000	7320	28600	ug/kg	1					
Selenium	U	ND	572	3430	ug/kg	1					
Silver	U	ND	114	572	ug/kg	1					
Sodium		216000	8000	28600	ug/kg	1					
Thallium		ND	572	2290	ug/kg	1					
Vanadium	U	5130	114	572	ug/kg	1					
Zinc		41100	377	1140	ug/kg	1					
<b>Semi-Volatile-GC/MS</b>											

# GEL LABORATORIES LLC

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## Certificate of Analysis

Company : MCRD Parris Island  
 Address : Bldg 151  
 Panama Drive  
 Beaufort, South Carolina 29905  
 Contact: Ms. Lisa Donohoe  
 Project: **Routine Analytical - Donohoe**

Report Date: August 20, 2010

Client Sample ID: Site 3 IDW Project: MCRD00110  
 Sample ID: 258281001 Client ID: MCRD001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Semi-Volatile-GC/MS</b>										
<i>SW846 3550C/8270D Semivolatile Analysis "Dry Weight Corrected"</i>										
1,1'-Biphenyl	U	ND	118	393	ug/kg	1	JLDI 08/12/10	2047	1012518	5
1,2,4,5-Tetrachlorobenzene	U	ND	78.6	393	ug/kg	1				
2,3,4,6-Tetrachlorophenol	U	ND	78.6	393	ug/kg	1				
2,4,5-Trichlorophenol	U	ND	78.6	393	ug/kg	1				
2,4,6-Trichlorophenol	U	ND	78.6	393	ug/kg	1				
2,4-Dichlorophenol	U	ND	78.6	393	ug/kg	1				
2,4-Dimethylphenol	U	ND	137	393	ug/kg	1				
2,4-Dinitrophenol	U	ND	149	786	ug/kg	1				
2,4-Dinitrotoluene	U	ND	39.3	393	ug/kg	1				
2,6-Dinitrotoluene	U	ND	39.3	393	ug/kg	1				
2-Chloronaphthalene	U	ND	13.0	39.3	ug/kg	1				
2-Chlorophenol	U	ND	78.6	393	ug/kg	1				
2-Methyl-4,6-dinitrophenol	U	ND	78.6	393	ug/kg	1				
2-Methylnaphthalene	U	ND	7.86	39.3	ug/kg	1				
2-Nitrophenol	U	ND	78.6	393	ug/kg	1				
3,3'-Dichlorobenzidine	U	ND	118	393	ug/kg	1				
4-Bromophenylphenylether	U	ND	78.6	393	ug/kg	1				
4-Chloro-3-methylphenol	U	ND	78.6	393	ug/kg	1				
4-Chloroaniline	U	ND	78.6	393	ug/kg	1				
4-Chlorophenylphenylether	U	ND	78.6	393	ug/kg	1				
4-Nitrophenol	U	ND	130	393	ug/kg	1				
Acenaphthene	U	ND	13.0	39.3	ug/kg	1				
Acenaphthylene	U	ND	11.8	39.3	ug/kg	1				
Acetophenone	U	ND	78.6	393	ug/kg	1				
Anthracene	U	ND	7.86	39.3	ug/kg	1				
Atrazine	U	ND	118	393	ug/kg	1				
Benzaldehyde	U	ND	118	393	ug/kg	1				
Benzo(a)anthracene	U	ND	11.8	39.3	ug/kg	1				
Benzo(a)pyrene	J	13.7	11.8	39.3	ug/kg	1				
Benzo(b)fluoranthene	J	28.7	11.8	39.3	ug/kg	1				
Benzo(ghi)perylene	U	ND	11.8	39.3	ug/kg	1				
Benzo(k)fluoranthene	U	ND	11.8	39.3	ug/kg	1				
Butylbenzylphthalate	U	ND	78.6	393	ug/kg	1				
Caprolactam	U	ND	78.6	393	ug/kg	1				
Carbazole	U	ND	11.8	39.3	ug/kg	1				
Chrysene	J	14.9	11.8	39.3	ug/kg	1				
Di-n-butylphthalate	U	ND	78.6	393	ug/kg	1				
Di-n-octylphthalate	U	ND	78.6	393	ug/kg	1				
Dibenzo(a,h)anthracene	U	ND	11.8	39.3	ug/kg	1				
Dibenzofuran	U	ND	78.6	393	ug/kg	1				
Diethylphthalate	U	ND	78.6	393	ug/kg	1				
Dimethylphthalate	U	ND	78.6	393	ug/kg	1				



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Report Date: August 20, 2010

Client Sample ID: Site 3 IDW Project: MCRD00110  
 Sample ID: 258281001 Client ID: MCRD001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Semi-Volatiles-Pesticide</b>											
<i>SW846 3550C/8081B Solid "Dry Weight Corrected"</i>											
Dieldrin	U	ND	0.394	1.58	ug/kg	1					
Endosulfan I	U	ND	0.197	0.788	ug/kg	1					
Endosulfan II	U	ND	0.394	1.58	ug/kg	1					
Endosulfan sulfate	U	ND	0.394	1.58	ug/kg	1					
Endrin	U	ND	0.394	1.58	ug/kg	1					
Endrin aldehyde	U	ND	0.394	1.58	ug/kg	1					
Endrin ketone	U	ND	0.394	1.58	ug/kg	1					
Heptachlor	U	ND	0.197	0.788	ug/kg	1					
Heptachlor epoxide	J	0.387	0.246	0.788	ug/kg	1					
Methoxychlor	U	ND	1.97	7.88	ug/kg	1					
Toxaphene	U	ND	6.56	19.7	ug/kg	1					
alpha-BHC	U	ND	0.197	0.788	ug/kg	1					
beta-BHC	U	ND	0.197	0.788	ug/kg	1					
delta-BHC	U	ND	0.197	0.788	ug/kg	1					
gamma-BHC (Lindane)	U	ND	0.197	0.788	ug/kg	1					
<b>Volatile Organics</b>											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
1,1,1-Trichloroethane	U	ND	0.224	0.748	ug/kg	1	AXOI	08/19/10	2004	1015865	9
1,1,2,2-Tetrachloroethane	U	ND	0.224	0.748	ug/kg	1					
1,1,2-Trichloroethane	U	ND	0.224	0.748	ug/kg	1					
1,1-Dichloroethane	U	ND	0.224	0.748	ug/kg	1					
1,1-Dichloroethylene	U	ND	0.224	0.748	ug/kg	1					
1,2-Dichloroethane	U	ND	0.224	0.748	ug/kg	1					
1,2-Dichloropropane	U	ND	0.224	0.748	ug/kg	1					
2-Butanone	U	ND	1.12	3.74	ug/kg	1					
2-Hexanone	U	ND	1.12	3.74	ug/kg	1					
4-Methyl-2-pentanone	U	ND	0.935	3.74	ug/kg	1					
Acetone	BJ	3.16	1.24	3.74	ug/kg	1					
Benzene	U	ND	0.224	0.748	ug/kg	1					
Bromodichloromethane	U	ND	0.224	0.748	ug/kg	1					
Bromoform	U	ND	0.224	0.748	ug/kg	1					
Bromomethane	U	ND	0.224	0.748	ug/kg	1					
Carbon disulfide	U	ND	0.935	3.74	ug/kg	1					
Carbon tetrachloride	U	ND	0.224	0.748	ug/kg	1					
Chlorobenzene	U	ND	0.224	0.748	ug/kg	1					
Chloroethane	U	ND	0.224	0.748	ug/kg	1					
Chloroform	U	ND	0.224	0.748	ug/kg	1					
Chloromethane	U	ND	0.224	0.748	ug/kg	1					
Dibromochloromethane	U	ND	0.224	0.748	ug/kg	1					
Ethylbenzene	U	ND	0.224	0.748	ug/kg	1					
Methylene chloride	U	ND	1.50	3.74	ug/kg	1					

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : MCRD Parris Island  
 Address : Bldg 151  
 Panama Drive  
 Beaufort, South Carolina 29905  
 Contact: Ms. Lisa Donohoe  
 Project: **Routine Analytical - Donohoe**

Report Date: August 20, 2010

Client Sample ID: Site 3 IDW Project: MCRD00110  
 Sample ID: 258281001 Client ID: MCRD001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Volatile Organics</b>											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
Styrene	J	0.254	0.224	0.748	ug/kg	1					
Tetrachloroethylene	U	ND	0.224	0.748	ug/kg	1					
Toluene	U	ND	0.224	0.748	ug/kg	1					
Trichloroethylene	U	ND	0.247	0.748	ug/kg	1					
Vinyl acetate	U	ND	0.935	3.74	ug/kg	1					
Vinyl chloride	U	ND	0.224	0.748	ug/kg	1					
Xylenes (total)	U	ND	0.224	0.748	ug/kg	1					
cis-1,2-Dichloroethylene	U	ND	0.224	0.748	ug/kg	1					
cis-1,3-Dichloropropylene	U	ND	0.224	0.748	ug/kg	1					
trans-1,2-Dichloroethylene	U	ND	0.224	0.748	ug/kg	1					
trans-1,3-Dichloropropylene	U	ND	0.224	0.748	ug/kg	1					
Acetone	U	ND	1.96	5.91	ug/kg	1	AXO1	08/20/10	1445	1015865	10

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
SW846 1311	SW846 1311 TCLP Leaching	EXF1	08/10/10	1331	1011730
SW846 3010A	ICP-TRACE TCLP by SW846 3010A	BXA1	08/11/10	1724	1012660
SW846 3050B	SW846 3050B Prep for 6010C	BXA1	08/11/10	1725	1011537
SW846 3550C	3550C BNA Soil Prep for 8270D	AXV1	08/11/10	2121	1012517
SW846 3550C	3550C PCB Prep Soil	RXH3	08/11/10	1229	1012177
SW846 3550C	3550C Pesticide Prep Soil	JXM2	08/11/10	1240	1012274
SW846 5035	5035/8260B Prep	AXO1	08/06/10	0903	1015862
SW846 7470A Prep	EPA 7470A Mercury Prep TCLP Liquid	TXB3	08/12/10	1115	1012893
SW846 7471B Prep	SW846 7471B Mercury Prep Soil	TXB3	08/10/10	1340	1011774

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	SW846 7470A	
2	SW846 7471B	
3	SW846 3010A/6010C	
4	SW846 3050B/6010C	
5	SW846 3550C/8270D	
6	SW846 3550C/8082A	
7	SW846 3550C/8082A	
8	SW846 3550C/8081B	





Hickory Hill Landfill  
 2621 LOW COUNTRY DRIVE  
 RIDGELAND, SC, 29936  
 Ph: 843-987-4643

Original  
 Ticket# 644665

Customer Name BEAUFORTCOU BEAUFORT COUNTY U Carrier USMC USMC  
 Ticket Date 02/23/2011 Vehicle# 29203920L Volume  
 Payment Type Credit Account Container  
 Manual Ticket# Driver  
 Hauling Ticket# Check#  
 Route Billing # 0000543  
 State Waste Code Gen EPA ID NR  
 Manifest command gne  
 Destination  
 PG  
 Profile 102107SC (SOILS CONTAMINATED w/CERCLA DERIVED WASTE)  
 Generator 126-COMMANDINGGENERALMCRDPARRI COMMANDING GENERAL MCRD PARRIS ISLAND

	Time	Scale	Operator	Gross	55520 lb
In	02/23/2011 11:27:11	scale2	jcofield	Tare	32180 lb
Out	02/23/2011 11:39:03	scale2	jcofield	Net	23340 lb
				Tons	11.67

Comments

Product	LD%	Qty	UOM	Rate	Fee	Amount	Origin
1	Special Misc-Tons-	100	11.67	Tons			MCAS
2	FUEL-Fuel Surcharg	100	%				MCAS
3	EVF-P-Standard Env	100	%				MCAS

*H. Love By [Signature]*

Total Fees  
 Total Ticket



B01114

# SPECIAL WASTE MANIFEST

WASTE ID NUMBER <b>102107SC</b>	<b>Hickory Hill Landfill</b> 2621 Low Country Drive Ridgeland, SC 29936  Special Waste Phone: 843-987-4643 Fax: (843) 987 8594	
EXPIRATION DATE <b>September 22, 2011</b>		
Prepared by: <b>Carol Weldon</b>		
GENERATOR OF WASTE: <b>Commanding General USMC/MCRD</b>	ACCOUNT NUMBER: <b>210-543</b>	
CUSTOMER <b>Beaufort County - USMC</b>		
LOCATION OF WASTE: <b>MCRD</b>		
CITY: <b>Parris Island, SC</b>		
PHONE NUM <b>843-228-3102</b>	CONTACT: <b>James W. (Jim) Clark</b>	
FAX NUMBI <b>843-228-2616</b>		
* GENERATOR'S SIGNATURE <i>John B. Caldwell</i>	DATE: <b>2/23/11</b>	
* TRANSPORTER OF WASTE: <i>William R. Bredel</i>		
DATE: <b>2/23/11</b>	TRUCK NUMBER: <b>MC 292839</b>	
* DRIVER'S SIGNATURE <i>William R. Bredel</i>		
**** TO BE COMPLETED BY HICKORY HILL LANDFILL ****		
DISPOSAL SITE: <b>Hickory Hill Landfill, Ridgeland, SC</b>	Waste Class: <b>Soil</b>	
DESCRIPTION OF WASTE: <b>Soil contaminated w/CERCLA derived Waste</b>		
TICKET NUMBER: <b>644665</b>	Ton: <b>11.67 tons</b>	
HH * RECEIVED BY: <i>Voni Cofield</i>		



Waste Management  
Industrial Technical Service Center  
36964 Alabama Hwy 17  
P.O. Box 55  
Emelle, AL 35459  
(800) 963-4776

**PROFILE APPROVAL**

TO: James W. (Jim) Clark/Commanding General - USMC/MCRD

FROM: Carol Weldon *CW*

FAX/EMAIL: james.w.clark@usmc.mil

DATE: 10/4/2010 *10/5/10*

RE: PROFILE APPROVAL #102107SC - Commanding General - USMC/MCRD PAGES: *43*  
Soils contaminated w/CERCLA derived Waste

Waste Management will approve your Special Waste for disposal at Hickory Hill Landfill located in Ridgeland, SC, subject to the terms of the Disposal Service Agreement. A copy of the WM Waste Profile has been included for you to complete and return via fax or email.

Thank you for the opportunity to be of service to you. If you have any questions, please feel free to call me at (800) 963-4776 or direct at (205)-652-8186.

Cc: Jan Collins  
Wray Mattice

*Manifest sent  
separately.*

We appreciate your business. ☺ Visit us on the web at [www.wmdisposal.com](http://www.wmdisposal.com).

Industrial Waste Service Agreement  
Exhibit A

Date: September 23, 2010

WM Profile # 102107SC





Generator's Non-hazardous Waste Profile Sheet

102107SC

Requested Disposal Facility: Hickory Hill, Ridgeland SC, Profile Number:
Renewal for Profile Number: Waste Approval Expiration Date:
Check here if there are multiple generating locations for this waste. Attach additional locations.

A. Waste Generator Facility Information (must reflect location of waste generation/origin)

1. Generator Name: Commanding General / USMC - MCRD
2. Site Address: MCRD
3. City/ZIP: Parris Island SC
4. State: South Carolina
5. County: Beaufort
6. Contact Name/Title: James W. Clark
7. Email Address: james.w.clark@usmc.mil
8. Phone: 843 228-3102
9. FAX: 843 228-2616
10. NAICS Code:
11. Generator USEPA ID #: SC 6170022762
12. State/ID# (if applicable):

B. Customer Information (same as above)

1. Customer Name: B/H Co USMC Asect 543
2. Billing Address: 120 Shanklin Rd.
3. City, State and ZIP: Parris Island Beaufort, SC 29908
4. Contact Name: James Clark / Jeanne Lebe
8. Contact Email: james.w.clark@usmc.mil
P.O. Number: 916 3A10
Phone: (843) 228-3102 FAX: (843) 228-2616
7. Transporter Name:
8. Transporter ID# (if appl.):
9. Transporter Address:
10. City, State and ZIP:

C. Waste Stream Information

1. DESCRIPTION

a. Common Waste Name: Soils contaminated with CERCLA Derived wastes
State Waste Code(s): N/A

b. Describe Process Generating Waste or Source of Contamination:

Repair broken culvert generating excess removed soil

c. Typical Color(s): Brownish Soil Colors

d. Strong Odor? Yes No Describe:

e. Physical State at 70°F: Solid Liquid Powder Semi-Solid or Sludge Other:

f. Layers? Single layer Multi-layer O/A

g. Water Reactive? Yes No If Yes, Describe:

h. Free Liquid Range (%): to NA(solid)

i. pH Range: to NA(solid)

j. Liquid Flash Point: < 140°F 140°- 199°F ≥ 200°F NA(solid)

k. Flammable Solid: Yes No

l. Physical Constituents: List all constituents of waste stream - (e.g. Soil 0-80%, Wood 0-20%): (See Attached)

Table with 5 columns: Constituents (Total Composition Must be ≥ 100%), Lower Range, Unit of Measure, Upper Range, Unit of Measure. Rows include Soil and Landfill Contaminants.

2. ESTIMATED QUANTITY OF WASTE AND SHIPPING INFORMATION

a. One Time Event Base Repeat Event

b. Estimated Annual Quantity: 20 Tons Cubic Yards Drums Gallons Other (specify):

c. Shipping Frequency: Units per Month Quarter Year One Time Other

d. Is this a U.S. Department of Transportation (USDOT) Hazardous Material? (If yes, answer e.) Yes No

e. USDOT Shipping Description (if applicable):

3. SAFETY REQUIREMENTS (Handling, PPE, etc.): None



**Generator's Non-hazardous Waste Profile Sheet**

**D. Regulatory Status (Please check appropriate responses)**

- 1. Waste Identification:
  - a. Does the waste meet the definition of a USEPA listed or characteristic hazardous waste as defined by 40 CFR Part 261?  Yes  No
    - 1. If yes, please complete a hazardous waste profile.
  - b. Does the waste meet the definition of a state hazardous waste other than identified in D.1.a?  Yes  No
    - 1. If yes, please complete a hazardous waste profile.
- 2. Is this waste included in one or more of categories below (Check all that apply)? If yes, attach supporting documentation.  Yes  No
  - Delisted Hazardous Waste
  - Excluded Wastes Under 40CFR 261.4
  - Treated Hazardous Waste Debris
  - Treated Characteristic Hazardous Waste
- 3. Is the waste from a Federal (40 CFR 300, Appendix B) or state mandated clean-up? If yes, see instructions.  Yes  No
- 4. Does the waste represented by this waste profile sheet contain radioactive material?  Yes  No
  - a. If yes, is disposal regulated by the Nuclear Regulatory Commission?  Yes  No
  - b. If yes, is disposal regulated by a State Agency for radioactive waste/NORM?  Yes  No
- 5. Does the waste represented by this waste profile sheet contain Polychlorinated Biphenyls (PCBs)?  Yes  No  
(If yes, list in Chemical Composition - C.1.1.)
  - a. If yes, are the PCBs regulated by 40 CFR 781?  Yes  No
  - b. If yes, is it remediation waste from a project being performed under the Self-Implementing option provided in 40 CFR 761.61(a)?  Yes  No
  - c. If yes, were the PCBs imported into the US?  Yes  No
- 6. Does the waste contain untreated, regulated medical or infectious waste?  Yes  No
- 7. Does the waste contain asbestos?  Yes  No
  - a. If Yes,  Friable  Non Friable
- 8. Is this profile for remediation waste from a facility that is a major source of Hazardous Air Pollutants (Site Remediation NESHAP, 40 CFR 63 subpart GGGGG)?  Yes  No
  - a. If yes, does the waste contain <500 ppmw VOHAPs at the point of determination?  Yes  No

**E. Generator Certification (Please read and certify by signature below)**

By signing this Generator's Waste Profile Sheet, I hereby certify that all:

- 1. Information submitted in this profile and all attached documents contain true and accurate descriptions of the waste material;
- 2. Relevant information within the possession of the Generator regarding known or suspected hazards pertaining to this waste has been disclosed to WM/the Contractor;
- 3. Analytical data attached pertaining to the profiled waste was derived from testing a representative sample in accordance with 40 CFR 261.20(c) or equivalent rules; and
- 4. Changes that occur in the character of the waste (i.e. changes in the process or new analytical) will be identified by the Generator and disclosed to WM (and the Contractor if applicable) prior to providing the waste to WM (and the contractor if applicable).
- 5. Check all that apply:
  - a. Attached analytical pertains to the waste. Identify laboratory & sample ID #'s and parameters tested: \_\_\_\_\_ # Pages: 6
  - b. Only the analysis identified on the attachment pertain to the waste (Identify by laboratory & sample ID #'s and parameters tested). Attachment #: \_\_\_\_\_
  - c. Additional information necessary to characterize the profiled waste has been attached (other than analytical, such as MSDS). Indicate the number of attached pages: \_\_\_\_\_
  - d. I am an agent signing on behalf of the Generator, and the delegation of authority to me from the Generator for this signature is available upon request.

Certification Signature: James W Clark Title: Envir Comp Sect. Mgr  
 Company Name: USMC - MCRD Parris Island Name (Print): James W Clark  
 Date: 22 Sep 2010



Hickory Hill Landfill  
 2621 LOW COUNTRY DRIVE  
 RIDGELAND, SC, 29956  
 Ph: 843-987-4643

Original  
 Ticket# 644708

Customer Name BEAUFORTCOU BEAUFORT COUNTY W Carrier USMC USMC  
 Ticket Date 02/23/2011 Vehicle# 292539201 Volume  
 Payment Type Credit Account Container  
 Manual Ticket# Driver  
 Hauling Ticket# Check#  
 Route Billing # 0000543  
 State Waste Code Gen EPA ID NR  
 Manifest command  
 Destination  
 PO  
 Profile 102107SC (SOILS CONTAMINATED W/CERCLA DERIVED WASTE)  
 Generator 126-COMMANDINGGENERALMCRDPARRI COMMANDING GENERAL MCRD PARRIS ISLAND

	Time	Scale	Operator	Gross	
In	02/23/2011 14:43:51	scale2	jcafield	35700 lb	Tare
Out	02/23/2011 14:55:22	scale2	jcafield	32100 lb	Net
				23500 lb	Tons
				11.79	

Comments

Product	LDX	Qty	UOM	Rate	Fee	Amount	Origin
1	Special Misc-Tons-	100	11.79	Tons			MCAS
2	FUEL-Fuel Surcharg	100	%				MCAS
3	EVF-P-Standard Env	100	%				MCAS

Total Fees  
 Total Ticket



US  
**SPECIAL WASTE MANIFEST**

WASTE ID NUMBER <b>102107SC</b>	<b>Hickory Hill Landfill</b> 2621 Low Country Drive Ridgeland, SC 29936  Special Waste Phone: 843-987-4643 Fax: (843) 987 8594	
EXPIRATION DATE <b>September 22, 2011</b>		
Prepared by: <b>Carol Weldon</b>		
GENERATOR OF WASTE: <b>Commanding General USMC/MCRD</b>	ACCOUNT NUMBER: <b>210-543</b>	
CUSTOMER <b>Beaufort County - USMC</b>		
LOCATION OF WASTE: <b>MCRD</b>		
CITY: <b>Parris Island, SC</b>		
PHONE NUM <b>843-228-3102</b>	CONTACT: <b>James W. (Jim) Clark</b>	
FAX NUMBI <b>843-228-2616</b>		
GENERATOR'S SIGNATURE <i>John B. Stooch</i>	DATE: <b>2/23/11</b>	
* TRANSPORTER OF WASTE: <i>William G. Pollock</i>		
† DATE: <b>2/23/11</b>	TRUCK NUMBER: <b>MC292839</b>	
* DRIVER'S SIGNATURE <i>William G. Pollock</i>		
**** TO BE COMPLETED BY HICKORY HILL LANDFILL****		
DISPOSAL SITE: <b>Hickory Hill Landfill, Ridgeland, SC</b>	Waste Class: <b>Soil</b>	
DESCRIPTION OF WASTE: <b>Soil contaminated w/CERCLA derived Waste</b>		
TICKET NUMBER: <b>644708</b>	TOW: <b>11.29</b>	
HA * RECEIVED BY: <i>Toni Cofield</i>		



Hickory Hill Landfill  
 2621 LOW COUNTRY DRIVE  
 RIDGELAND, SC, 29936  
 Ph: 843-987-4643

Original  
 Ticket# 644752

Customer Name BEAUFORTCOH BEAUFORT COUNTY U. Carrier USMC USMC  
 Ticket Date 02/24/2011 Vehicle# 252039201 Volume  
 Payment Type Credit Account Container  
 Manual Ticket# Driver  
 Hauling Ticket# Check#  
 Route Billing # 0000543  
 State Waste Code Gen EPA ID NR  
 Manifest commanding gen  
 Destination  
 PD  
 Profile 102107SD (SOILS CONTAMINATED w/CERCLA DERIVED WASTE)  
 Generator 126-COMMANDINGGENERALMCRDPARRI COMMANDING GENERAL MCRD PARRIS ISLAND

	Time	Scale	Operator	Gross	48940 15
In	02/24/2011 09:29:02	scale2	jcofield	Tare	32120 15
Out	02/24/2011 09:29:02		jcofield	Net	16820 15
				Tone	8.41

Comments

Product	LDX	Qty	UDM	Rate	Fee	Amount	Origin
1	Special Misc-Tons-	100	8.41 Tons				MCAS
2	FUEL-Fuel Surcharg	100	%				MCAS
3	EVF-P-Standard Env	100	%				MCAS

*W. G. P. [Signature]*

Total Fees  
 Total Ticket



Extrms

# SPECIAL WASTE MANIFEST

WASTE ID NUMBER <b>102107SC</b>	<b>Hickory Hill Landfill</b> 2621 Low Country Drive Ridgeland, SC 29936  Special Waste Phone: 843-987-4643 Fax: (843) 987 8594	
EXPIRATION DATE <b>September 22, 2011</b>		
Prepared by: <b>Carol Weldon</b>		
GENERATOR OF WASTE: <b>Commanding General USMC/MCRD</b>	ACCOUNT NUMBER:	
CUSTOMER <b>Beaufort County - USMC</b>	<b>210-543</b>	
LOCATION OF WASTE: <b>MCRD</b>		
CITY: <b>Parris Island, SC</b>		
PHONE NUM <b>843-228-3102</b>	CONTACT: <b>James W. (Jim) Clark</b>	
FAX NUMBI <b>843-228-2616</b>		
GENERATOR'S SIGNATURE <i>John B. [Signature]</i>	DATE: <b>2/24/11</b>	
* TRANSPORTER OF WASTE: <i>William [Signature]</i>		
DATE: <b>2/24/11</b>	TRUCK NUMBER: <b>MC 292839</b>	
* DRIVER'S SIGNATURE <i>William [Signature]</i>		
**** TO BE COMPLETED BY HICKORY HILL LANDFILL ****		
DISPOSAL SITE: <b>Hickory Hill Landfill, Ridgeland, SC</b>	Waste Class: <b>Soil</b>	
DESCRIPTION OF WASTE: <b>Soil contaminated w/CERCLA derived Waste</b>		
TICKET NUMBER: <b>644752</b>	<b>TOW: 8.41</b>	
RECEIVED BY: <i>Toni [Signature]</i>		

HH\*



Waste Management  
Industrial Technical Service Center  
36964 Alabama Hwy 17  
P.O. Box 55  
Emelle, AL 35459  
(800) 963-4776

### PROFILE APPROVAL

TO: James W. (Jim) Clark/Commanding General – USMC/MCRD

FROM: Carol Weldon *CW*

FAX/EMAIL: james.w.clark@usmc.mil

DATE: 10/4/2010 *10/5/10*

RE: PROFILE APPROVAL #102107SC – Commanding General – USMC/MCRD PAGES: *43*  
Soils contaminated w/CERCLA derived Waste

Waste Management will approve your Special Waste for disposal at **Hickory Hill Landfill** located in Ridgeland, SC, subject to the terms of the Disposal Service Agreement. A copy of the WM Waste Profile has been included for you to complete and return via fax or email.

Thank you for the opportunity to be of service to you. If you have any questions, please feel free to call me at (800) 963-4776 or direct at (205)-652-8186.

Cc: Jan Collins  
Wray Mattice

*Manifest sent  
separately.*

We appreciate your business. ☺ Visit us on the web at [www.wmdisposal.com](http://www.wmdisposal.com).

Industrial Waste Service Agreement  
Exhibit A

Date: September 23, 2010

WM Profile # 102107SC





**Generator's Non-hazardous Waste Profile Sheet**

Requested Disposal Facility: Hickory Hill, Ridgeland S.C. Profile Number: \_\_\_\_\_

Renewal for Profile Number: \_\_\_\_\_ Waste Approval Expiration Date: \_\_\_\_\_

Check here if there are multiple generating locations for this waste. Attach additional locations.

**A. Waste Generator Facility Information (must reflect location of waste generation/origin)**

1. Generator Name: Commanding General / USMC - MCRD  
 2. Site Address: MCRD 7. Email Address: james.w.clark@usmc.mil  
 3. City/ZIP: Parris Island SC 8. Phone: 843 228-3102 9. FAX: 843 228-2616  
 4. State: South Carolina 10. NAICS Code: \_\_\_\_\_  
 5. County: Beaufort 11. Generator USEPA ID #: SC 6170022762  
 6. Contact Name/Title: James W. Clark 12. State/ID# (if applicable): \_\_\_\_\_

**B. Customer Information (same as above)**

1. Customer Name: Bft Co - USMC Acct 542 P.O. Number: 916 3910  
 2. Billing Address: 120 Shanklin Rd. 8. Phone: (843) 228-3102 FAX: (843) 228-2616  
 3. City, State and ZIP: Parris Island Beaufort SC 29902 7. Transporter Name: \_\_\_\_\_  
 4. Contact Name: James Clark / JoAnne Lake 8. Transporter ID# (if appl.): \_\_\_\_\_  
 5. Contact Email: james.w.clark@usmc.mil 9. Transporter Address: \_\_\_\_\_  
 10. City, State and ZIP: \_\_\_\_\_

**C. Waste Stream Information**

**1. DESCRIPTION**

a. Common Waste Name: Soils contaminated with CERCLA Derived Wastes  
 State Waste Code(s): N/A

b. Describe Process Generating Waste or Source of Contamination:

Repair broken culvert generating excess removed soil

c. Typical Color(s): Brownish Soil Colors

d. Strong Odor?  Yes  No Describe: \_\_\_\_\_

e. Physical State at 70°F:  Solid  Liquid  Powder  Semi-Solid or Sludge  Other: \_\_\_\_\_

f. Layers?  Single layer  Multi-layer  NA

g. Water Reactive?  Yes  No If Yes, Describe: \_\_\_\_\_

h. Free Liquid Range (%): \_\_\_\_\_ to \_\_\_\_\_  NA(solid)

i. pH Range: \_\_\_\_\_ to \_\_\_\_\_  NA(solid)

j. Liquid Flash Point:  < 140°F  140°- 199°F  ≥ 200°F  NA(solid)

k. Flammable Solid:  Yes  No

l. Physical Constituents: List all constituents of waste stream - (e.g. Soil 0-80%, Wood 0-20%):  (See Attached)

Constituents (Total Composition Must be ≥ 100%)	Lower Range	Unit of Measure	Upper Range	Unit of Measure
1. <u>Soil</u>	<u>95</u>	<u>%</u>	<u>99</u>	<u>%</u>
2. <u>Leachate Contaminants</u>	<u>5</u>	<u>%</u>	<u>1</u>	<u>%</u>
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____

**2. ESTIMATED QUANTITY OF WASTE AND SHIPPING INFORMATION**

a.  One Time Event  Base  Repeat Event

b. Estimated Annual Quantity: 20  Tons  Cubic Yards  Drums  Gallons  Other (specify): \_\_\_\_\_

c. Shipping Frequency: \_\_\_\_\_ Units per  Month  Quarter  Year  One Time  Other

d. Is this a U.S. Department of Transportation (USDOT) Hazardous Material? (If yes, answer e.)  Yes  No

e. USDOT Shipping Description (if applicable): \_\_\_\_\_

3. SAFETY REQUIREMENTS (Handling, PPE, etc.): None



Generator's Non-hazardous Waste Profile Sheet

D. Regulatory Status (Please check appropriate responses)

1. Waste Identification:

- a. Does the waste meet the definition of a USEPA listed or characteristic hazardous waste as defined by 40 CFR Part 261?  Yes  No
  - 1. If yes, please complete a hazardous waste profile.
- b. Does the waste meet the definition of a state hazardous waste other than identified in D.1.a?  Yes  No
  - 1. If yes, please complete a hazardous waste profile.

- 2. Is this waste included in one or more of categories below (Check all that apply)? If yes, attach supporting documentation.  Yes  No
  - Delisted Hazardous Waste  Excluded Wastes Under 40CFR 261.4
  - Treated Hazardous Waste Debris  Treated Characteristic Hazardous Waste

- 3. Is the waste from a Federal (40 CFR 300, Appendix B) or state mandated clean-up? If yes, see instructions.  Yes  No

- 4. Does the waste represented by this waste profile sheet contain radioactive material?  Yes  No
  - a. If yes, is disposal regulated by the Nuclear Regulatory Commission?  Yes  No
  - b. If yes, is disposal regulated by a State Agency for radioactive waste/NORM?  Yes  No

- 5. Does the waste represented by this waste profile sheet contain Polychlorinated Biphenyls (PCBs)?  Yes  No  
(If yes, list in Chemical Composition - C.1.1.)
  - a. If yes, are the PCBs regulated by 40 CFR 761?  Yes  No
  - b. If yes, is it remediation waste from a project being performed under the Self-Implementing option provided in 40 CFR 761.61(a)?  Yes  No
  - c. If yes, were the PCBs imported into the US?  Yes  No

- 6. Does the waste contain untreated, regulated medical or infectious waste?  Yes  No

- 7. Does the waste contain asbestos?  Yes  No
  - a. If Yes,  Friable  Non Friable

- 8. Is this profile for remediation waste from a facility that is a major source of Hazardous Air Pollutants (Site Remediation NESHAP, 40 CFR 63 subpart GGGGG)?  Yes  No
  - a. If yes, does the waste contain <800 ppmw VOHAPs at the point of determination?  Yes  No

E. Generator Certification (Please read and certify by signature below)

By signing this Generator's Waste Profile Sheet, I hereby certify that all:

- 1. Information submitted in this profile and all attached documents contain true and accurate descriptions of the waste material;
- 2. Relevant information within the possession of the Generator regarding known or suspected hazards pertaining to this waste has been disclosed to WM/the Contractor;
- 3. Analytical data attached pertaining to the profiled waste was derived from testing a representative sample in accordance with 40 CFR 261.20(c) or equivalent rules; and
- 4. Changes that occur in the character of the waste (i.e. changes in the process or new analytical) will be identified by the Generator and disclosed to WM (and the Contractor if applicable) prior to providing the waste to WM (and the contractor if applicable).
- 5. Check all that apply:

- a. Attached analytical pertains to the waste. Identify laboratory & sample ID #'s and parameters tested: \_\_\_\_\_ # Pages: 6
- b. Only the analysis identified on the attachment pertain to the waste (Identify by laboratory & sample ID #'s and parameters tested). Attachment #: \_\_\_\_\_
- c. Additional information necessary to characterize the profiled waste has been attached (other than analytical, such as MSDS). Indicate the number of attached pages: \_\_\_\_\_
- d. I am an agent signing on behalf of the Generator, and the delegation of authority to me from the Generator for this signature is available upon request.

Certification Signature: James W Clark Title: Envir Comp Sect. Mgr  
 Company Name: USMC - MERD Parris Island Name (Print): James W Clark  
 Date: 22 Sep 2010

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 12 / SWMU 10 – Jericho Island

Site Location (provide nearest road name, GIS coordinates, etc.): Shell Point, Broad River Drive

Date(s) of Inspection/Review: 22 SEPT 2010, 31 DEC 2010, 26 MAR 2011, 01 JUNE 2011

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Land Use Controls</u></b>				
5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]



**ANNUAL LUC INSPECTION REPORT  
SITE 12 / SWMU 10 JERICHO ISLAND  
2010 - 2011**



**31 DEC 2010 Lack of Spartina re-growth on north side of Jericho Island**



**31 DEC 2010 Lack of Spartina re-growth on south side of Jericho Island**



**01 JUNE 2011 Lack of Spartina re-growth on north side of Jericho Island**



**01 JUNE 2011 Lack of Spartina re-growth on south side of Jericho Island**

**2011-2012  
Land Use Control Compliance Certificates**





Electronic copy of signed  
letter is not available.

## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
August 2, 2012

Ms. Lila Llamas  
US Environmental Protection Agency  
Atlanta Federal Center  
61 Forsyth Street  
Atlanta, GA 30303

RE: 2011 - 2012 Annual Land Use Compliance Certificates for  
Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway  
Landfill, and Site 12/SWMU 10 Jericho Island

Dear Ms. Llamas:

Enclosed are the Annual Land Use Compliance Certificates  
for the period of 01 JULY 2011 to 30 JUNE 2012 for Site 1/SWMU 1  
Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site  
12/SWMU 10 Jericho Island.

If you have questions, please contact Ms. Lisa Donohoe at  
(843) 228-2779.

Sincerely,

S. F. KIRKPATRICK  
Colonel, USMC  
Assistant Chief of Staff,  
Installation and Logistics  
By direction of the  
Commanding General

Enclosures

cc: Charles Cook, NAVFAC SE (original signed letter)  
Meredith Amick, SCDHEC (original signed letter)  
Peggy Churchill, Tetra Tech (electronic copy)



**ANNUAL LUC COMPLIANCE CHECKLIST**  
 MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 1 / SWMU 1 – Incinerator Landfill

Site Location (provide nearest road name, GIS coordinates, etc.): Horse Island, Malecon Drive

Date(s) of Inspection/Review: 07 SEPT 2011, 28 DEC 2011, 30 MAR 2012, 27 JUNE 2012

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Land Use Controls</u></b>				
5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]



**ANNUAL LUC INSPECTION REPORT  
SITE 1 / SWMU 1 INCINERATOR LANDFILL  
2011 - 2012**

**South side of site**



**07 SEPT 2011 Spartina on the south side of the site**



**28 DEC 2011 Spartina on the south side of the site**

**Vegetation in rip rap**



**30 MARCH 2012 Vegetation in rip rap**

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 3 / SWMU 3 – Causeway Landfill

Site Location (provide nearest road name, GIS coordinates, etc.): 3<sup>rd</sup> Battalion Causeway

Date(s) of Inspection/Review: 07 SEPT 2011, 28 DEC 2011

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Land Use Controls**

5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

**See comment box.**



**ANNUAL LUC INSPECTION REPORT  
SITE 3 / SWMU 3 CAUSEWAY LANDFILL  
2011**

**Erosion**



**07 SEPT 2011 Erosion on pond side of the  
Causeway, south of the northern fishing dock.**

**ANNUAL LUC COMPLIANCE CHECKLIST**  
 MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 12 / SWMU 10 – Jericho Island

Site Location (provide nearest road name, GIS coordinates, etc.): Shell Point, Broad River Drive

Date(s) of Inspection/Review: 07 SEPT 2011, 28 DEC 2011, 30 MAR 2012, 27 JUNE 2012

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Land Use Controls**

5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]



**ANNUAL LUC INSPECTION REPORT  
SITE 12 / SWMU 10 JERICHO ISLAND  
2011 - 2012**



**07 SEPT 2011 Lack of Spartina re-growth on north side of Jericho Island**



**30 MARCH 2012 Lack of Spartina re-growth on south side of Jericho Island**

**2012-2013  
Land Use Control Compliance Certificates**



## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
January 13, 2014

From: Commanding General, Marine Corps Recruit Depot, Parris Island SC  
To: Commander, Naval Facilities Engineering Command, Southeast  
Subj: 2012-2013 ANNUAL LAND USE CONTROL COMPLIANCE CERTIFICATES  
Encl: 2012-2013 Annual Land Use Control Compliance Certificates for Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho Island

1. In accordance with MCRD Parris Island Land Use Control documents, the 2012-2013 Annual Land Use Control Compliance Certificates for Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho Island are being submitted to Naval Facilities Engineering Command, Southeast; U.S. Environmental Protection Agency; and South Carolina Department of Health and Environmental Control.

2. Should you have any questions or concerns, please contact Ms. Lisa Donohoe, Installation Restoration & Munitions Response Program Manager at (843) 228-2779 or [lisa.donohoe@usmc.mil](mailto:lisa.donohoe@usmc.mil).

A handwritten signature in black ink, appearing to read "W S T A", with a diagonal line striking through it.

W. S. TATE  
By direction

Copy to: Lila Llamas, EPA (original signed letter)  
Meredith Amick, SCDHEC (original signed letter)



## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
January 13, 2014

Ms. Lila Llamas  
US Environmental Protection Agency  
Atlanta Federal Center  
61 Forsyth Street  
Atlanta, GA 30303

RE: 2012 - 2013 Annual Land Use Compliance Certificates for  
Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway  
Landfill, and Site 12/SWMU 10 Jericho Island

Dear Ms. Llamas:

Enclosed are the Annual Land Use Compliance Certificates  
for the period of 01 JULY 2012 to 30 JUNE 2013 for Site 1/SWMU 1  
Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site  
12/SWMU 10 Jericho Island.

If you have questions, please contact Ms. Lisa Donohoe at  
(843) 228-2779.

Sincerely,

A handwritten signature in black ink, appearing to read "W S Tate".

W. S. TATE  
Assistant Chief of Staff,  
Installation and Logistics  
By direction of the  
Commanding General

Enclosures

Copy to: Dan Owens, NAVFAC SE (original signed letter)  
Meredith Amick, SCDHEC (original signed letter)



## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
January 13, 2014

Ms. Meredith Amick  
South Carolina Department of Health  
and Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

RE: 2012 - 2013 Annual Land Use Compliance Certificates for  
Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway  
Landfill, and Site 12/SWMU 10 Jericho Island

Dear Ms. Amick:

Enclosed are the Annual Land Use Compliance Certificates  
for the period of 01 JULY 2012 to 30 JUNE 2013 for Site 1/SWMU 1  
Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site  
12/SWMU 10 Jericho Island.

If you have questions, please contact Ms. Lisa Donohoe at  
(843) 228-2779.

W  
Sincerely,  
W S Tate

W. S. TATE  
Assistant Chief of Staff,  
Installation and Logistics  
By direction of the  
Commanding General

Enclosures

Copy to: Dan Owens, NAVFAC SE (original signed letter)  
Lila Llamas, EPA (original signed letter)

**ANNUAL LUC COMPLIANCE CHECKLIST**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

**Site Name (include SWMU #):** Site 1 / SWMU 1 – Incinerator Landfill

**Site Location (provide nearest road name, GIS coordinates, etc.):** Horse Island, Malecon Drive

**Date(s) of Inspection/Review:** 28 SEPT 2012, 27 DEC 2012, 29 MAR 2013, 19 JUNE 2013

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b><u>Land Use Controls</u></b>				
5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. None

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

---

**ANNUAL LUC COMPLIANCE CHECKLIST**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD, US EPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

Comments from checklist item 1-4:

4) Woody species are growing in the rip rap.

Comments from checklist item 5-8:

7) A shape file for the Site is in the Depot's GIS. When the Site is double clicked in GIS the Identification Tool box opens. Due to the limit of the number of characters that can be entered into the Identification Tool box, the land use restrictions cannot be entered in entirety. The following is in the Depot's GIS: "THIS AREA CONTAINS CONTAMINATED SOIL, SEDIMENT, SURFACE WATER, AND/OR GROUNDWATER. PLEASE CONTACT NREAD SUBJECT MATTER EXPERT AT 843-228-2779 FOR ADDITIONAL DETAILS AND GUIDANCE."

Comments other:

- Spartina has re-established well on the north and east sides of the Site.
- Re-establishment of Spartina on the south side of the Site is increasing.

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps/Navy and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps/Navy completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

T. J. Harrington  
Name/Signature

T. J. Harrington

13 JAN 14  
Date

Mail completed form(s) to:

U.S. Environmental  
Protection Agency  
Region 4  
Superfund Division,  
Federal Facilities Branch,  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department  
of Health and  
Environmental Control  
Division of Waste  
Management  
2600 Bull Street  
Columbia, SC 29201

Commanding Officer  
NAVFAC SE  
ATTN: Director, Environmental  
Restoration Division  
P.O. Box 30  
North Ajax Street, Bldg. 135  
Jacksonville, Florida 32212-0030

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

**Site Name (include SWMU #):** Site 3 / SWMU 3 – Causeway Landfill

**Site Location (provide nearest road name, GIS coordinates, etc.):** 3<sup>rd</sup> Battalion Causeway

**Date(s) of Inspection/Review:** 28 SEPT 2012, 27 DEC 2012, 29 MAR 2013, 19 JUNE 2013

**INSPECTION CHECKLIST**

	In Compliance	Non-Compliance	See Comment
<u>Land Use Restrictions</u>			
1) No extraction, removal, or use (including consumption) of groundwater observed (see Note 1, page 2).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential or residential-like use, (including but not limited to any form of housing, child-care facilities, preschools, elementary schools, secondary schools, playgrounds, or full-time adult convalescent or nursing care facilities (unless previously approved by USEPA and SCDHEC).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No commercial, agricultural, or recreational (no fishing, wading, or swimming) uses of the site.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) No unauthorized excavation, construction, or intrusive activities that would compromise the integrity of the Causeway Landfill cover system unless a construction plan is submitted and approved by Navy, USEPA, and SCDHEC prior to initiating work.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5) No disturbance of the covered sediment areas in the 3 <sup>rd</sup> Battalion Pond.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Landfill cover system has been maintained.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>Land Use Controls</u>			
7) Base Master Plan review identifies this Site and the land use restrictions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

	In Compliance	Non-Compliance	See Comment
8) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9) Base Environmental Management System identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10) Base Depot Order is available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11) Signs posted at Site 3 indicate no fishing, shrimping, crabbing or boating.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

None

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD Parris Island, USEPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

Comments from checklist item 1-6:

Comments from checklist item 7-11:

7) The most recent Base Master Plan is dated February 2007. The Site 3 Land Use Control Remedial Design D2 is dated February 2012. The Base Master Plan is currently being updated. Site 3 and Site 3 Land Use Controls will be added to the updated Base Master Plan. *THIS COMMENT SUPERSEDES PREVIOUS ANNUAL LUC COMPLIANCE CERTIFICATES THAT STATED SITE 3 AND SITE 3 LUCS WERE IN THE BASE MASTER PLAN.*

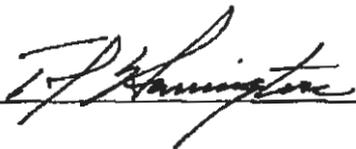
8) A shape file for the Site is in the Depot's GIS. When the Site is double clicked in GIS the Identification Tool box opens. Due to the limit of the number of characters that can be entered into the Identification Tool box, the land use restrictions cannot be entered in entirety. The following is in the Depot's GIS: "THIS AREA CONTAINS CONTAMINATED SOIL, SEDIMENT, SURFACE WATER, AND/OR GROUNDWATER. PLEASE CONTACT NREAO SUBJECT MATTER EXPERT AT 843-228-2779 FOR ADDITIONAL DETAILS AND GUIDANCE."

**ANNUAL LUC COMPLIANCE CERTIFICATE  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

This evaluation covers the period from 1 ~~January~~ <sup>JULY 1<sup>st</sup></sup> (year) 2012 through ~~31 December~~ <sup>30 JUNE 1<sup>st</sup></sup> (year) 2013.

**NOTE 2:** Certificate shall be submitted by 1 March of the year following the reporting period.

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

T. J. HARRINGTON   
Printed Name / Signature

13 JAN 14  
Date

Mall completed form(s) to:

U.S. Environmental Protection Agency  
Region 4  
Superfund Division  
Federal Facilities Branch  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department of Health and Environmental Control  
Division of Waste Management  
2600 Bull Street  
Columbia, SC 29201

Commanding Officer  
Naval Facilities Engineering Command Southeast  
ATTN: Director, Environmental Restoration Division  
P.O. Box 30  
North Ajax Street, Bldg. 135  
Jacksonville, FL 32212

**ANNUAL LUC COMPLIANCE CHECKLIST**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

**Site Name (include SWMU #):** Site 12 / SWMU 10 – Jericho Island

**Site Location (provide nearest road name, GIS coordinates, etc.):** Shell Point, Broad River Drive

**Date(s) of Inspection/Review:** 28 SEPT 2012, 27 DEC 2012, 29 MAR 2013, 19 JUNE 2013

**INSPECTION CHECKLIST**

	YES	NO	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Land Use Controls</u></b>				
5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. No

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

**ANNUAL LUC COMPLIANCE CHECKLIST**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD, US EPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

Comments from checklist item 1-4:

- None

Comments from checklist item 5-9:

7) A shape file for the Site is in the Depot's GIS. When the Site is double clicked in GIS the Identification Tool box opens. Due to the limit of the number of characters that can be entered into the Identification Tool box, the land use restrictions cannot be entered in entirety. The following is in the Depot's GIS: "THIS AREA CONTAINS CONTAMINATED SOIL, SEDIMENT, SURFACE WATER, AND/OR GROUNDWATER. PLEASE CONTACT NREAO SUBJECT MATTER EXPERT AT 843-228-2779 FOR ADDITIONAL DETAILS AND GUIDANCE."

Comments other:

- Spartina is not re-establishing well (see photos).

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps/Navy and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps/Navy completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

  
Name/Signature T.J. HARRINGTON

13 JAN 14  
Date

Mail completed form(s) to:

U.S. Environmental  
Protection Agency  
Region 4  
Superfund Division,  
Federal Facilities Branch,  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department  
of Health and  
Environmental Control  
Division of Waste  
Management  
2600 Bull Street  
Columbia, SC 29201

Commanding Officer  
NAVFAC SE  
ATTN: Director, Environmental  
Restoration Division  
P.O. Box 30  
North Ajax Street, Bldg. 135  
Jacksonville, Florida 32212-0030

**ANNUAL LUC COMPLIANCE CHECKLIST**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**



**29 MARCH 2013 Lack of Spartina re-growth on north side of Jericho Island**



**29 MARCH 2013 Lack of Spartina re-growth on south side of Jericho Island**

**2013-2014**  
**Land Use Control Compliance Certificates**



## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
June 2, 2015

From: Commanding General, Marine Corps Recruit Depot Parris  
Island, SC  
To: Commander, Naval Facilities Engineering Command, Mid-  
Atlantic  
Subj: 2013 - 2014 ANNUAL LAND USE CONTROL COMPLIANCE  
CERTIFICATES

Encl: (1) Site 1/SWMU 1 Incinerator Landfill 2013 - 2014  
Annual LUC Compliance Checklist  
(2) Site 3/SWMU 3 Causeway Landfill 2013 - 2014 Annual  
LUC Compliance Checklist  
(3) Site 12/SWMU 10 Jericho Island Disposal Area 2013 -  
2014 Annual LUC Compliance Checklist

1. In accordance with MCRD Parris Island Land Use Control documents, the 2013 - 2014 Annual Land Use Control Compliance Certificates for Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho Island Disposal Area are being submitted to Naval Facilities Engineering Command, Mid-Atlantic; US Environmental Protection Agency; and South Carolina Department of Health and Environmental Control.

2. Should you have any questions or concerns, please contact Ms. Lisa Donohoe, Environmental Restoration Program Manager at (843) 228-2779 or [lisa.donohoe@usmc.mil](mailto:lisa.donohoe@usmc.mil).

  
J. A. BEAUDOIN  
By direction



## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
June 2, 2015

Ms. Lila Llamas  
US Environmental Protection Agency  
Atlanta Federal Center  
61 Forsyth Street  
Atlanta, GA 30303

Ms. Meredith Amick  
South Carolina Department of Health  
and Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

RE: 2013 - 2014 Annual Land Use Compliance Certificates for  
Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway  
Landfill, and Site 12/SWMU 10 Jericho Island Disposal Area

Dear Ms. Llamas and Ms. Amick:

Enclosed are the Annual Land Use Compliance Certificates for the  
period of 01 JULY 2013 to 30 JUNE 2014 for Site 1/SWMU 1 Incinerator  
Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho  
Island Disposal Area.

If you have questions, please contact Ms. Lisa Donohoe at (843)  
228-2779.

Sincerely,

A handwritten signature in black ink, appearing to read "J. A. Beaudoin".

J. A. BEAUDOIN  
Colonel, USMC  
Assistant Chief of Staff,  
Installation and Logistics  
By direction of the  
Commanding General

- Enclosures:
- (1) Site 1/SWMU 1 Incinerator Landfill 2013 - 2014  
Annual LUC Compliance Checklist
  - (2) Site 3/SWMU 3 Causeway Landfill 2013 - 2014 Annual  
LUC Compliance Checklist
  - (3) Site 12/SWMU 10 Jericho Island Disposal Area 2013 -  
2014 Annual LUC Compliance Checklist

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 1 / SWMU 1 – Incinerator Landfill

Site Location (provide nearest road name, GIS coordinates, etc.): Horse Island, Malecon Drive

Date(s) of Inspection/Review: 25 SEPT 2013, 27 DEC 2013, 01 APRIL 2014 (this inspection is for the 1<sup>st</sup> quarter of 2014), 25 JUNE 2014

**INSPECTION CHECKLIST**

	IN COMPLIANCE	NON- COMPLIANCE	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b><u>Land Use Controls</u></b>				
5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. None

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD, US EPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

**Comments from checklist items 1-4:**

- 4.1) Site was bush hogged 24 September 2013.
- 4.2) Woody vegetation is present in the rip rap.

**Comments from checklist items 5-8:**

6) In the February 2007 Base Master Plan, Site 1 is on Figure 4-3 and listed on Table 4-4. Whether the polygon on Figure 4-3 is the site boundary or the LUC boundary is not known. The land use controls are not identified in the Base Master Plan.

7) A shape file for the site is in Parris Island's GIS. Currently, when the site is double clicked in GIS the Identification Tool box opens. Due to the limit of the number of characters that can be entered into the Identification Tool box, the land use restrictions cannot be entered into the GIS in entirety. The following is in Parris Island's GIS: "THIS AREA CONTAINS CONTAMINATED SOIL, SEDIMENT, SURFACE WATER, AND/OR GROUNDWATER. PLEASE CONTACT NREAO SUBJECT MATTER EXPERT AT 843-228-2779 FOR ADDITIONAL DETAILS AND GUIDANCE."

8) An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. An Environmental Management System is a framework that helps an organization achieve its environmental goals through consistent control of its operations. The assumption is that this increased control will improve the environmental performance of the organization. The EMS itself does not dictate a level of environmental performance that must be achieved; each organization's EMS is tailored to the organization's business and goals.

During MCRD Parris Island's Dig Permit Request process, construction design process, etc. the Environmental Restoration Program Manager submits comments regarding Environmental Restoration Program sites, site boundaries, LUC boundaries, and land use controls.

9) There is not a Depot Order that identifies this site, the LUC boundary, and the land use controls.

**Comments other:**

- *Spartina* has re-established well on the north and east sides of the site.
- Re-establishment of *Spartina* on the south side of the site is increasing.

**ANNUAL LUC COMPLIANCE CHECKLIST**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps/Navy and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps/Navy completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

*LISA C. DONOHUE*  
*Lisa C. Donohue*  
Name/Signature

*02 June 2015*  
Date

Mail completed form(s) to:

U.S. Environmental Protection Agency  
Region 4  
Superfund Division  
Federal Facilities Branch  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department of Health and Environmental Control  
Division of Waste Management  
2600 Bull Street  
Columbia, SC 29201

Commanding Officer  
NAVFAC SE  
ATTN: Director, Environmental Restoration Division  
P.O. Box 30  
North Ajax Street, Bldg. 135  
Jacksonville, Florida 32212-0030

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA



Site 1 / SWMU 1 Photo taken 01 APRIL 2014. Photo of cap and vegetation in rip rap. Facing north-northwest.



Site 1 / SWMU 1 Photo taken 01 APRIL 2014. Photo of cap and vegetation in rip rap. Facing north.

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA



Site 1 / SWMU 1 Photo taken 25 JUNE 2014. Photo of marsh grass and vegetation in rip rap. Facing southeast.



Site 1 / SWMU 1 Photo taken 25 JUNE 2014. Photo of marsh grass and vegetation in rip rap. Facing southeast (taken from a different location than the photo above).

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

**Site Name** (include SWMU #): Site 3 / SWMU 3 – Causeway Landfill

**Site Location** (provide nearest road name, GIS coordinates, etc.): 3<sup>rd</sup> Battalion Causeway

**Date(s) of Inspection/Review:** 25 SEPT 2013, 27 DEC 2013, 01 APRIL 2014 (this inspection is for the 1<sup>st</sup> quarter of 2014), 25 JUNE 2014

**INSPECTION CHECKLIST**

	In Compliance	Non-Compliance	See Comment
<u>Land Use Restrictions</u>			
1) No extraction, removal, or use (including consumption) of groundwater observed (see Note 1, page 2).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential or residential-like use, (including but not limited to any form of housing, child-care facilities, preschools, elementary schools, secondary schools, playgrounds, or full-time adult convalescent or nursing care facilities (unless previously approved by USEPA and SCDHEC).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No commercial, agricultural, or recreational (no fishing, wading, or swimming) uses of the site.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) No unauthorized excavation, construction, or intrusive activities that would compromise the integrity of the Causeway Landfill cover system unless a construction plan is submitted and approved by Navy, USEPA, and SCDHEC prior to initiating work.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5) No disturbance of the covered sediment areas in the 3 <sup>rd</sup> Battalion Pond.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Landfill cover system has been maintained.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

<u>Land Use Controls</u>	In Compliance	Non-Compliance	See Comment
7) Base Master Plan review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
9) Base Environmental Management System identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10) Base Depot Order is available.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
11) Signs posted at Site 3 indicate no fishing, shrimping, crabbing or boating.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period.   No  

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

Letters regarding a sinkhole were emailed to the MCRD Partnering Team by Tim Harrington on 13 JAN 2014 (hard copies were mailed to USEPA and SCDHEC) (Tate to Llamas and Tate to Amick dated 06 JAN 2014).

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD Parris Island, USEPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

Comments from checklist item 1-6:

6.1) Sinkholes continue to enlarge in circumference and deepen.

6.2) 3<sup>rd</sup> Bn Pond Road asphalt is increasingly being undercut by sinkhole at northern culverts.

6.3) Woody vegetation is re-establishing in the rip rap.

6.4) Cracks are in the headwalls at the northern and southern culverts (marsh side).

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Comments from checklist item 7-11:

7) In the February 2007 Base Master Plan, Site 3 is on Figure 4-3 and listed on Table 4-4. The LUC boundary had not been determined by 2007 and, therefore, is not in the Base Master Plan. The land use controls are not identified in the Base Master Plan.

8) A shape file for the site is in Parris Island's GIS. Currently, when the site is double clicked in GIS the Identification Tool box opens. Due to the limit of the number of characters that can be entered into the Identification Tool box, the land use restrictions cannot be entered into the GIS in entirety. The following is in Parris Island's GIS: "THIS AREA CONTAINS CONTAMINATED SOIL, SEDIMENT, SURFACE WATER, AND/OR GROUNDWATER. PLEASE CONTACT NREAO SUBJECT MATTER EXPERT AT 843-228-2779 FOR ADDITIONAL DETAILS AND GUIDANCE."

9) An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. An Environmental Management System is a framework that helps an organization achieve its environmental goals through consistent control of its operations. The assumption is that this increased control will improve the environmental performance of the organization. The EMS itself does not dictate a level of environmental performance that must be achieved; each organization's EMS is tailored to the organization's business and goals.

During MCRD Parris Island's Dig Permit Request process, construction design process, etc. the Environmental Restoration Program Manager submits comments regarding Environmental Restoration Program sites, site boundaries, LUC boundaries, and land use controls.

10) There is not a Depot Order that identifies this site, the LUC boundary, and the land use controls.

11) The "DANGER ALLIGATORS NO SWIMMING OR WADING" sign is still missing from the northern fishing dock. A work request to create new sign and hang then sign was submitted by the Environmental Restoration (ER) Program Manager on 18 October 2013. The ER Program Manager contacted Facilities Maintenance Division (FMD) 04 December 2013 requesting the status of the work request. On 16 December 2013 the ER Program Manager was informed the work request had not been entered into the system by FMD; ER Program Manager was asked to re-submit the work request. A new process was put in place for the Natural Resources & Environmental Affairs Office (NREAO) to submit work requests to FMD. The work request was entered into FMD's work request system by NREAO's Admin Officer on 22 January 2014. On 03 April 2014 the ER Program Manager requested the status of the work order to replace the sign from NREAO's Admin Officer. The Admin Officer stated FMD's database indicated the work request was "resolved" (meaning "completed"). FMD said they would investigate why the database indicated the work request was resolved yet there was no sign posted.

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

This evaluation covers the period from 01 July 2013 through 30 June 2014.

**NOTE 2:** Certificate shall be submitted by 1 March of the year following the reporting period.

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

*LISA C. DONOHUE*

*[Handwritten Signature]*  
Printed Name / Signature

*02 June 2015*  
Date

Mail completed form(s) to:

U.S. Environmental Protection Agency  
Region 4  
Superfund Division  
Federal Facilities Branch  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department of Health and Environmental Control  
Division of Waste Management  
2600 Bull Street  
Columbia, SC 29201

Commanding Officer  
Naval Facilities Engineering Command Southeast  
ATTN: Director, Environmental Restoration Division  
P.O. Box 30  
North Ajax Street, Bldg. 135  
Jacksonville, FL 32212

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA



Site 3 / SWMU 3 Photo taken 25 SEPT 2013. Sinkhole at northern culverts on the marsh side.



Site 3 / SWMU 3 Photo taken 03 JAN 2014. Sinkhole at northern culverts on the pond side (between athletic path and road).

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND**  
**PARRIS ISLAND, SOUTH CAROLINA**

**Site Name** (include SWMU #): Site 12 / SWMU 10 – Jericho Island Disposal Area

**Site Location** (provide nearest road name, GIS coordinates, etc.): Shell Point, Broad River Drive

**Date(s) of Inspection/Review:** 27 SEPT 2013, 27 DEC 2013, 01 APRIL 2014 (this inspection is for the 1<sup>st</sup> quarter of 2014), 25 JUNE 2014

**INSPECTION CHECKLIST**

	IN COMPLIANCE	NON- COMPLIANCE	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Land Use Controls</u></b>				
2) Base Master Plan review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4) Base Environmental Management System Identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5) Base Depot Order is available, identifying this Site and the land use restrictions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. None

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

---

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND**  
**PARRIS ISLAND, SOUTH CAROLINA**

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD Parris Island, USEPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

Comments from checklist items 1-5:

2) In the February 2007 Base Master Plan, Site 12 is on Figure 4-3 and listed on Table 4-4. Whether the polygon on Figure 4-3 is the site boundary or the LUC boundary is not known. The land use controls are not identified in the Base Master Plan.

3) A shape file for the Site is in the Depot's GIS. When the Site is double clicked in GIS the Identification Tool box opens. Due to the limit of the number of characters that can be entered into the Identification Tool box, the land use restrictions cannot be entered in entirety. The following is in the Depot's GIS: "THIS AREA CONTAINS CONTAMINATED SOIL, SEDIMENT, SURFACE WATER, AND/OR GROUNDWATER. PLEASE CONTACT NREAO SUBJECT MATTER EXPERT AT 843-228-2779 FOR ADDITIONAL DETAILS AND GUIDANCE."

4) An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. An Environmental Management System is a framework that helps an organization achieve its environmental goals through consistent control of its operations. The supposition is that this increased control will improve the environmental performance of the organization. The EMS itself does not dictate a level of environmental performance that must be achieved; each organization's EMS is tailored to the organization's business and goals.

During MCRD Parris Island's Dig Permit Request process, construction design process, etc. the Environmental Restoration Program Manager submits comments regarding Environmental Restoration Program sites, site boundaries, and land use controls.

5) There is not a Depot Order that identifies this site, the LUC boundary, and the land use controls.

Comments other:

1) MCRD Parris Island's Conservation Law Enforcement Officer, Van Horton, and Environmental Restoration Program Manager, Lisa Donohoe, moved the sign off of the property of the land owners to the northern end of Jericho Island in August 2013.

2) Marsh grass is not growing north of Jericho Island (old causeway).

3) Marsh grass is not growing south of Jericho Island.

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND**  
**PARRIS ISLAND, SOUTH CAROLINA**

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps/Navy and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps/Navy completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

*LLSA C. SANDOZ*  
  
Name/Signature

*02 June 2015*  
Date

Mail completed form(s) to:

U.S. Environmental  
Protection Agency  
Region 4  
Superfund Division,  
Federal Facilities Branch,  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department  
of Health and  
Environmental Control  
Division of Waste  
Management  
2600 Bull Street  
Columbia, SC 29201

Commanding Officer  
NAVFAC SE  
ATTN: Director, Environmental  
Restoration Division  
P.O. Box 30  
North Ajax Street, Bldg. 135  
Jacksonville, Florida 32212-0030

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND  
PARRIS ISLAND, SOUTH CAROLINA



Site 12 / SWMU 10 Photo taken 27 SEPT 2013. North end of Jericho Island showing lack of marsh grass growth. Facing south.



Site 12 / SWMU 10 Photo taken 27 SEPT 2013. South end of Jericho Island showing lack of marsh grass growth. Facing southeast.

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND  
PARRIS ISLAND, SOUTH CAROLINA



Site 12 / SWMU 10 Photo taken 27 SEPT 2013. South end of Jericho Island showing lack of marsh grass growth. Facing south.



Site 12 / SWMU 10 Photo taken 27 SEPT 2013. South end of Jericho Island showing lack of marsh grass growth. Facing southwest.

**2014-2015  
Land Use Control Compliance Certificates**



## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
August 11, 2015

From: Commanding General, Marine Corps Recruit Depot Parris Island, SC  
To: Commander, Naval Facilities Engineering Command, Mid-Atlantic  
Subj: 2014 - 2015 ANNUAL LAND USE CONTROL COMPLIANCE CERTIFICATES

Encl: (1) Site 1/SWMU 1 Incinerator Landfill 2014 - 2015 Annual LUC Compliance Checklist  
(2) Site 3/SWMU 3 Causeway Landfill 2014 - 2015 Annual LUC Compliance Checklist  
(3) Site 12/SWMU 10 Jericho Island Disposal Area 2014 - 2015 Annual LUC Compliance Checklist

1. In accordance with MCRD Parris Island Land Use Control documents, the 2014 - 2015 Annual Land Use Control Compliance Certificates for Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho Island Disposal Area are being submitted to Naval Facilities Engineering Command, Mid-Atlantic; US Environmental Protection Agency; and South Carolina Department of Health and Environmental Control.

2. Should you have any questions or concerns, please contact Ms. Lisa Donohoe, Environmental Restoration Program Manager at (843) 228-2779 or [lisa.donohoe@usmc.mil](mailto:lisa.donohoe@usmc.mil).

A handwritten signature in black ink, appearing to read "J. A. Beaudoin".

J. A. BEAUDOIN  
By direction



## UNITED STATES MARINE CORPS

MARINE CORPS RECRUIT DEPOT/EASTERN RECRUITING REGION  
P.O. BOX 19001  
PARRIS ISLAND, SOUTH CAROLINA 29905-9001

5090  
NREAO  
August 11, 2015

Ms. Lila Llamas  
US Environmental Protection Agency  
Atlanta Federal Center  
61 Forsyth Street  
Atlanta, GA 30303

Ms. Meredith Amick  
South Carolina Department of Health  
and Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

RE: 2014 - 2015 Annual Land Use Compliance Certificates for  
Site 1/SWMU 1 Incinerator Landfill, Site 3/SWMU 3 Causeway  
Landfill, and Site 12/SWMU 10 Jericho Island Disposal Area

Dear Ms. Llamas and Ms. Amick:

Enclosed are the Annual Land Use Compliance Certificates for the  
period of 01 JULY 2014 to 30 JUNE 2015 for Site 1/SWMU 1 Incinerator  
Landfill, Site 3/SWMU 3 Causeway Landfill, and Site 12/SWMU 10 Jericho  
Island Disposal Area.

If you have questions, please contact Ms. Lisa Donohoe at (843)  
228-2779.

Sincerely,

A handwritten signature in black ink, appearing to read "J. A. Beauoin", with a long horizontal flourish extending to the right.

J. A. BEAUDOIN  
Colonel, USMC  
Assistant Chief of Staff,  
Installation and Logistics  
By direction of the  
Commanding General

- Enclosures:
- (1) Site 1/SWMU 1 Incinerator Landfill 2014 - 2015  
Annual LUC Compliance Checklist
  - (2) Site 3/SWMU 3 Causeway Landfill 2014 - 2015 Annual  
LUC Compliance Checklist
  - (3) Site 12/SWMU 10 Jericho Island Disposal Area 2014 -  
2015 Annual LUC Compliance Checklist

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site Name (include SWMU #): Site 1 / SWMU 1 – Incinerator Landfill

Site Location (provide nearest road name, GIS coordinates, etc.): Horse Island, Malecon Drive

Date(s) of Inspection/Review: 30 SEPT 2014, 31 DEC 2014, 31 MARCH 2015, 30 JUNE 2015

**INSPECTION CHECKLIST**

	IN COMPLIANCE	NON- COMPLIANCE	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No unauthorized construction or intrusive activities (e.g., digging into sediment, soils, or cover material observed).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential development, (including but not limited to, any form of housing, child care facilities, pre-schools, elementary schools, secondary schools, or playgrounds) observed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Groundwater monitoring well and/or remedial system (groundwater treatment system or cap) intact (e.g. wells intact, no woody species present on cap, etc.).	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Land Use Controls**

5) Warning signs are visible and in good repair.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Base Master Plan review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8) Base Environmental Management System review identifies this Site, site boundary, LUC boundary, and the land use controls.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9) Base Depot Order is available, identifying this Site, LUC boundary, and the land use controls.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. None

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD, US EPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

**Comments from checklist items 1-4:**

4.1) Site (area without riprap) was bush hogged either 19 or 20 AUGUST 2014.

4.2) Woody vegetation in the riprap was cut on 31 JANUARY 2015.

**Comments from checklist items 5-8:**

6) The Base Master Plan was finalized in December 2014. Site 1 is on Figure 3.3; however, the site is not labeled. Whether the polygon on Figure 3.3 is the site boundary or the LUC boundary is not known. The land use controls are not identified in the Base Master Plan. In October 2014, the Environmental Restoration Program Manager submitted many comments on the draft revised Base Master Plan including:

- Land Use Controls for Sites 1, 3, and 12 need to be included in the Base Master Plan
- Land Use Control boundaries need to be included on a figure in the Base Master Plan
- Site boundaries need to be updated in the Base Master Plan
- Munitions Response Program boundaries need to be included in the Base Master Plan
- Installation Restoration Program sites and Munitions Response Program sites need to be labeled on a figure in the Base Master Plan.

The Planner for MCRD Parris Island did not thoroughly read the Unified Facilities Criteria for Base Master Plans and, therefore, the Land Use Control information was not included in the final Base Master Plan.

7) A shape file for the site is in Parris Island's GIS. Parris Island's Environmental Restoration Program Manager worked with the Installation's GIS Specialist contractor to produce a map of all Environmental Restoration Program sites in August and September 2014 (the Environmental Restoration Program Manager provided copies of the map to other units on Parris Island). The GIS Specialist contractor was not able to find the information that had been previously entered into the Identification Tool box for Environmental Restoration Program sites. The GIS Specialist contractor left the position prior to re-entering the information into the Identification Tool box for Environmental Restoration Program sites.

As of the second quarter of 2015 a GIS Specialist was hired for MCRD Parris Island; however, because so few personnel have access to GIS it is questionable whether having land use restrictions in an obscure file in GIS is valuable.

8) An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. An Environmental Management System is a framework that helps an organization achieve its environmental goals through consistent control of its operations. The assumption is that this increased control will improve the environmental performance of the organization. The EMS itself does not dictate a level of environmental performance that must be achieved; each organization's EMS is tailored to the organization's business and goals.

During MCRD Parris Island's Dig Permit Request process, construction design process, etc. the Environmental Restoration Program Manager submits comments regarding Environmental Restoration Program sites, site boundaries, LUC boundaries, and land use controls.

9) There is not a Depot Order that identifies this site, the LUC boundary, and the land use controls. The Environmental Restoration Program Manager met with contractors in September 2014, October 2014, and June 2015 to develop a Depot Order that identifies this site, the LUC boundary, and the land use controls.

**ANNUAL LUC COMPLIANCE CHECKLIST**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

**Comments other:**

- *Spartina* has re-established well on the north and west sides of the site.
- Re-establishment of *Spartina* on the east side of the site is increasing.
- During the second quarter of 2015, *Sesbania vesicaria* was noted as growing over entire site, including some areas in the riprap.

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps/Navy and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps/Navy completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

LISA C. DONOHUE  
  
Name/Signature

11 AUG 2015  
Date

Mail completed form(s) to:

NAVFAC Mid-Atlantic  
IPT Marine Corps  
9324 Virginia Avenue  
Norfolk, VA 23511-3095

U.S. Environmental Protection Agency  
Region 4  
Superfund Division  
Federal Facilities Branch  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department of Health and Environmental Control  
DOD Corrective Action Section  
Division of Waste Management  
2600 Bull Street  
Columbia, SC 29201

**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 DECEMBER 2014. Photo of vegetation in riprap. Facing north-northeast.



Site 1 / SWMU 1 Photo taken 02 FEBRUARY 2015. Photo of riprap on east side of Site 1/SWMU 1 after vegetation clearance on 31 JANUARY 2015. Facing north.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 02 FEBRUARY 2015. Photo of riprap on west side of Site 1/SWMU 1 after vegetation clearance on 31 JANUARY 2015. Facing north.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of cap. Facing east.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of cap. Facing north.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of cap. Facing west.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of riprap on east side of Site 1/SWMU 1. Facing north.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of riprap on west side of Site 1/SWMU 1. Facing south.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of marsh grass on east side of Site 1/SWMU 1. Facing north-northeast.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of eroding bank east of Site 1/SWMU 1. White items in photo are plates and mugs. Facing south.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of eroding bank east of Site 1/SWMU 1. White items in photo are plates and mugs. Facing south.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of eroding bank east of Site 1/SWMU 1. White items in photo are plates and mugs. Facing south.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of eroding bank east of Site 1/SWMU 1. White items in photo are plates and mugs. Facing south.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of eroding bank east of Site 1/SWMU 1. White items in photo are plates and mugs. Facing south.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of eroding bank east of Site 1/SWMU 1. White items in photo are plates and mugs. Facing south.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of mug eroded from bank east of Site 1/SWMU 1.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Photo of mug eroded from bank east of Site 1/SWMU 1.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Various items in bank east of Site 1/SWMU 1.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Close up of various items in bank east of Site 1/SWMU 1.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Close up of various items in bank east of Site 1/SWMU 1.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Close up of various items in bank east of Site 1/SWMU 1.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Close up of layers of unidentifiable burned materials in bank east of Site 1/SWMU 1.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Fork removed from bank east of Site 1/SWMU 1.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Key removed from bank east of Site 1/SWMU 1. In the photo the key is surrounded by burned glass and burned/rusted metal.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Part of light bulb removed from bank east of Site 1/SWMU 1.



**ANNUAL LUC COMPLIANCE CHECKLIST**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Tool removed from bank east of Site 1/SWMU 1.



Site 1 / SWMU 1 Photo taken 31 MARCH 2015. Layers of burned/rusted metal in bank east of Site 1/SWMU 1.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

**Site Name** (include SWMU #): Site 3 / SWMU 3 – Causeway Landfill

**Site Location** (provide nearest road name, GIS coordinates, etc.): 3<sup>rd</sup> Battalion Causeway

**Date(s) of Inspection/Review:** 30 SEPT 2014, 31 DEC 2014, 31 MARCH 2015, 30 JUNE 2015

**INSPECTION CHECKLIST**

	In Compliance	Non-Compliance	See Comment
<u>Land Use Restrictions</u>			
1) No extraction, removal, or use (including consumption) of groundwater observed (see Note 1, page 2).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) No residential or residential-like use, (including but not limited to any form of housing, child-care facilities, preschools, elementary schools, secondary schools, playgrounds, or full-time adult convalescent or nursing care facilities (unless previously approved by USEPA and SCDHEC).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) No commercial, agricultural, or recreational (no fishing, wading, or swimming) uses of the site.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) No unauthorized excavation, construction, or intrusive activities that would compromise the integrity of the Causeway Landfill cover system unless a construction plan is submitted and approved by Navy, USEPA, and SCDHEC prior to initiating work.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5) No disturbance of the covered sediment areas in the 3 <sup>rd</sup> Battalion Pond.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Landfill cover system has been maintained.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

<u>Land Use Controls</u>	<b>In Compliance</b>	<b>Non-Compliance</b>	<b>See Comment</b>
7) Base Master Plan review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
9) Base Environmental Management System identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10) Base Depot Order is available.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
11) Signs posted at Site 3 indicate no fishing, shrimping, crabbing or boating.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. **A new sinkhole was discovered on 30 JUNE 2015.**

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]  
**An email regarding the new sinkhole was sent to the MCRD Partnering Team by Lisa Donohoe on 01 JULY 2015. A follow up letter was sent via email to the MCRD Parris Island Partnering Team by Lisa Donohoe on 06 AUGUST 2015 (Col Beaudoin to L. Llamas and M. Amick).**

**NOTE 1:** Exclude any activities previously approved by Navy, MCRD Parris Island, USEPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

Comments from checklist item 1-6:

- 6.1) A new sinkhole was discovered at the northern culverts on the marsh side of the road (June 30, 2015).
- 6.2) There is a "depression" at the northern culverts on the marsh side of the road that may be a significant sinkhole. The area is covered with fabric and rip rap making the area difficult to investigate.
- 6.3) The dips in the road along the Causeway continue to increase in number and severity.
- 6.4) Existing sinkholes continue to enlarge in circumference and deepen.
- 6.5) The sinkhole at the northern culverts between the road and the exercise path is undercutting the exercise path.

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Comments from checklist item 1-6 (continued):

- 6.6) 3<sup>rd</sup> Bn Pond Road asphalt is increasingly being undercut by sinkhole at the northern culverts on the marsh side of the road.
- 6.7) Cracks are in the headwalls at the northern and southern culverts (marsh side).
- 6.8) Erosion continues to occur on the Causeway just south of the northern fishing dock.
- 6.9) Removal of vegetation from riprap began on 3 October 2014 and continued through 10 or 17 October 2014.

Comments from checklist item 7-11:

7) The Base Master Plan was finalized in December 2014. Site 3 is on Figure 3.3; however, the site is not labeled. The land use controls are not identified in the Base Master Plan. In October 2014, the Environmental Restoration Program Manager submitted many comments on the draft revised Base Master Plan including:

- Land Use Controls for Sites 1, 3, and 12 need to be included in the Base Master Plan
- Land Use Control boundaries need to be included on a figure in the Base Master Plan
- Site boundaries need to be updated in the Base Master Plan
- Munitions Response Program boundaries need to be included in the Base Master Plan
- Installation Restoration Program sites and Munitions Response Program sites need to be labeled on a figure in the Base Master Plan.

The Planner for MCRD Parris Island did not thoroughly read the Unified Facilities Criteria for Base Master Plans and, therefore, the Land Use Control information was not included in the final Base Master Plan.

8) A shape file for the site is in Parris Island's GIS. Parris Island's Environmental Restoration Program Manager worked with the Installation's GIS Specialist contractor to produce a map of all Environmental Restoration Program sites in August and September 2014 (the Environmental Restoration Program Manager provided copies of the map to other units on Parris Island). The GIS Specialist contractor was not able to find the information that had been previously entered into the Identification Tool box for Environmental Restoration Program sites. The GIS Specialist contractor left the position prior to re-entering the information into the Identification Tool box for Environmental Restoration Program sites.

As of the second quarter of 2015 a GIS Specialist was hired for MCRD Parris Island; however, because so few personnel have access to GIS it is questionable whether having land use restrictions in an obscure file in GIS is valuable.

9) An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. An Environmental Management System is a framework that helps an organization achieve its environmental goals through consistent control of its operations. The assumption is that this increased control will improve the environmental performance of the organization. The EMS itself does not dictate a level of environmental performance that must be achieved; each organization's EMS is tailored to the organization's business and goals.

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
**MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA**

Comments from checklist item 7-11 (*continued*):

9) (*continued*) During MCRD Parris Island's Dig Permit Request process, construction design process, etc. the Environmental Restoration Program Manager submits comments regarding Environmental Restoration Program sites, site boundaries, LUC boundaries, and land use controls.

10) There is not a Depot Order that identifies this site, the LUC boundary, and the land use controls. The Environmental Restoration Program Manager met with contractors in September 2014, October 2014, and June 2015 to develop a Depot Order that identifies this site, the LUC boundary, and the land use controls.

11) The "DANGER ALLIGATORS NO SWIMMING OR WADING" sign was replaced in the 3<sup>rd</sup> quarter of 2014.

This evaluation covers the period from 01 July 2014 through 30 June 2015.

**NOTE 2:** Certificate shall be submitted by 1 March of the year following the reporting period.

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

*LISA C. DONOHUE*

*[Handwritten Signature]*

Printed Name / Signature

*11 AUG 2015*

Date

Mail completed form(s) to:

NAVFAC Mid-Atlantic  
IPT Marine Corps  
9324 Virginia Avenue  
Norfolk, VA 23511-3095

U.S. Environmental Protection Agency  
Region 4  
Superfund Division  
Federal Facilities Branch  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department of Health and Environmental Control  
DOD Corrective Action Section  
Division of Waste Management  
2600 Bull Street  
Columbia, SC 29201

**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Pond side of 3<sup>rd</sup> Battalion Pond Road at northern culverts looking northwest. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Pond side of 3<sup>rd</sup> Battalion Pond Road at northern culverts looking southeast. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Pond side of 3<sup>rd</sup> Battalion Pond Road at southern culverts looking northwest. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Pond side of 3<sup>rd</sup> Battalion Pond Road at southern culverts looking southeast. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Marsh side of 3<sup>rd</sup> Battalion Pond Road at northern culverts looking northwest. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Marsh side of 3<sup>rd</sup> Battalion Pond Road at northern culverts looking southeast. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Marsh side of 3<sup>rd</sup> Battalion Pond Road at southern culverts looking northwest. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



Site 3 / SWMU 3 Photo taken 31 DECEMBER 2014. Marsh side of 3<sup>rd</sup> Battalion Pond Road at southern culverts looking southeast. Vegetation removed from riprap 3<sup>rd</sup> quarter 2014.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 MARCH 2015. Erosion just south of northern culverts on pond side of 3<sup>rd</sup> Battalion Causeway.



Site 3 / SWMU 3 Photo taken 31 MARCH 2015. Erosion just south of northern culverts on pond side of 3<sup>rd</sup> Battalion Causeway.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 MARCH 2015. Sinkhole at the northern culverts filled with flowable fill. Erosion is occurring around the flowable fill.



Site 3 / SWMU 3 Photo taken 31 MARCH 2015. Sinkhole at the northern culverts on marsh side of 3<sup>rd</sup> Battalion Pond Road. The sinkhole is enlarging and increasingly undercutting the road.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 MARCH 2015. Depressions around the southern culverts on the marsh side of 3<sup>rd</sup> Battalion Pond Road.



Site 3 / SWMU 3 Photo taken 31 MARCH 2015. Depressions around the southern culverts on the marsh side of 3<sup>rd</sup> Battalion Pond Road.



**ANNUAL LUC COMPLIANCE CERTIFICATE**  
MARINE CORPS RECRUIT DEPOT PARRIS ISLAND, SOUTH CAROLINA

Site 3 / SWMU 3 Photo taken 31 MARCH 2015. Geotextile fabric showing through the soil and riprap cover at the southern culverts on the marsh side of 3<sup>rd</sup> Battalion Pond Road.



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**Site Name** (include SWMU #): Site 12 / SWMU 10 – Jericho Island Disposal Area

**Site Location** (provide nearest road name, GIS coordinates, etc.): Shell Point, Broad River Drive

**Date(s) of Inspection/Review:** 24 SEPT 2014 (3 days before Site 1 and Site 3 inspections), 31 DEC 2014, 31 MARCH 2015, 30 JUNE 2015

**INSPECTION CHECKLIST**

	IN COMPLIANCE	NON- COMPLIANCE	SEE COMMENT	NA
<b><u>Land Use Restrictions</u></b>				
1) No extraction, removal, or use (including consumption) of groundwater observed (See Note 1).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Land Use Controls</u></b>				
2) Base Master Plan review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3) Base Geographical Information System review identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4) Base Environmental Management System Identifies this Site and the land use restrictions.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5) Base Depot Order is available, identifying this Site and the land use restrictions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Indicate whether any breaches or violations of the Land Use Controls and/or Land Use Restrictions have occurred during the reporting period. None

[If a breach(s)/violation(s) occurred, then provide the date(s) that notification was sent to USEPA and SCDHEC.]

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**NOTE 1:** Exclude any activities previously approved by Navy, MCRD Parris Island, USEPA, and SCDHEC such as monitoring wells that are part of the remedial action or maintenance activities that are conducted in accordance with base procedures.

Comments from checklist items 1-5:

2) The Base Master Plan was finalized in December 2014. Site 12 is on Figure 3.3; however, the site is not labeled. Whether the polygon on Figure 3.3 is the site boundary or the LUC boundary is not known. The land use controls are not identified in the Base Master Plan. In October 2014, the Environmental Restoration Program Manager submitted many comments on the draft revised Base Master Plan including:

- Land Use Controls for Sites 1, 3, and 12 need to be included in the Base Master Plan
- Land Use Control boundaries need to be included on a figure in the Base Master Plan
- Site boundaries need to be updated in the Base Master Plan
- Munitions Response Program boundaries need to be included in the Base Master Plan
- Installation Restoration Program sites and Munitions Response Program sites need to be labeled on a figure in the Base Master Plan.

The Planner for MCRD Parris Island did not thoroughly read the Unified Facilities Criteria for Base Master Plans and, therefore, the Land Use Control information was not included in the final Base Master Plan.

3) A shape file for the site is in Parris Island's GIS. Parris Island's Environmental Restoration Program Manager worked with the Installation's GIS Specialist contractor to produce a map of all Environmental Restoration Program sites in August and September 2014 (the Environmental Restoration Program Manager provided copies of the map to other units on Parris Island). The GIS Specialist contractor was not able to find the information that had been previously entered into the Identification Tool box for Environmental Restoration Program sites. The GIS Specialist contractor left the position prior to re-entering the information into the Identification Tool box for Environmental Restoration Program sites.

As of the second quarter of 2015 a GIS Specialist was hired for MCRD Parris Island; however, because so few personnel have access to GIS it is questionable whether having land use restrictions in an obscure file in GIS is valuable.

4) An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. An Environmental Management System is a framework that helps an organization achieve its environmental goals through consistent control of its operations. The supposition is that this increased control will improve the environmental performance of the organization. The EMS itself does not dictate a level of environmental performance that must be achieved; each organization's EMS is tailored to the organization's business and goals.

During MCRD Parris Island's Dig Permit Request process, construction design process, etc. the Environmental Restoration Program Manager submits comments regarding Environmental Restoration Program sites, site boundaries, and land use controls.

5) There is not a Depot Order that identifies this site, the LUC boundary, and the land use controls. The Environmental Restoration Program Manager met with contractors in September 2014, October 2014, and June 2015 to develop a Depot Order that identifies this site, the LUC boundary, and the land use controls.

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Comments other:

- 1) Marsh grass is not re-establishing north of Jericho Island (old causeway).
- 2) Marsh grass is not re-establishing south of Jericho Island.

I, the undersigned, hereby certify that I am an authorized representative of the Marine Corps/Navy and that the above described Land Use Controls have been implemented properly and the Land Use Restrictions complied with for the period noted. Any known deficiencies have been described and Marine Corps/Navy completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

*LISA C. DONOHUE*  
*[Signature]*  
\_\_\_\_\_  
Name/Signature

*11 AUG 2015*  
\_\_\_\_\_  
Date

Mail completed form(s) to:

NAVFAC Mid-Atlantic  
IPT Marine Corps  
9324 Virginia Avenue  
Norfolk, VA 23511-3095

U.S. Environmental Protection Agency  
Region 4  
Superfund Division  
Federal Facilities Branch  
61 Forsyth Street SW  
Atlanta, GA 30303

South Carolina Department of Health and Environmental Control  
DOD Corrective Action Section  
Division of Waste Management  
2600 Bull Street  
Columbia, SC 29201

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Site 12 / SWMU 10 Photo taken 30 JUNE 2015. Former causeway to Jericho Island. Lack of re-establishment of marsh grass. Facing south.



Site 12 / SWMU 10 Photo taken 30 JUNE 2015. Marsh grass restoration area at south end of Jericho Island. Lack of re-establishment of marsh grass. Facing southeast.



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Site 12 / SWMU 10 Photo taken 30 JUNE 2015. Marsh grass restoration area at south end of Jericho Island. Lack of re-establishment of marsh grass. Facing south-southeast.



Site 12 / SWMU 10 Photo taken 30 JUNE 2015. Marsh grass restoration area at south end of Jericho Island. Lack of re-establishment of marsh grass. Facing south-southwest.



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PARRIS ISLAND, SOUTH CAROLINA

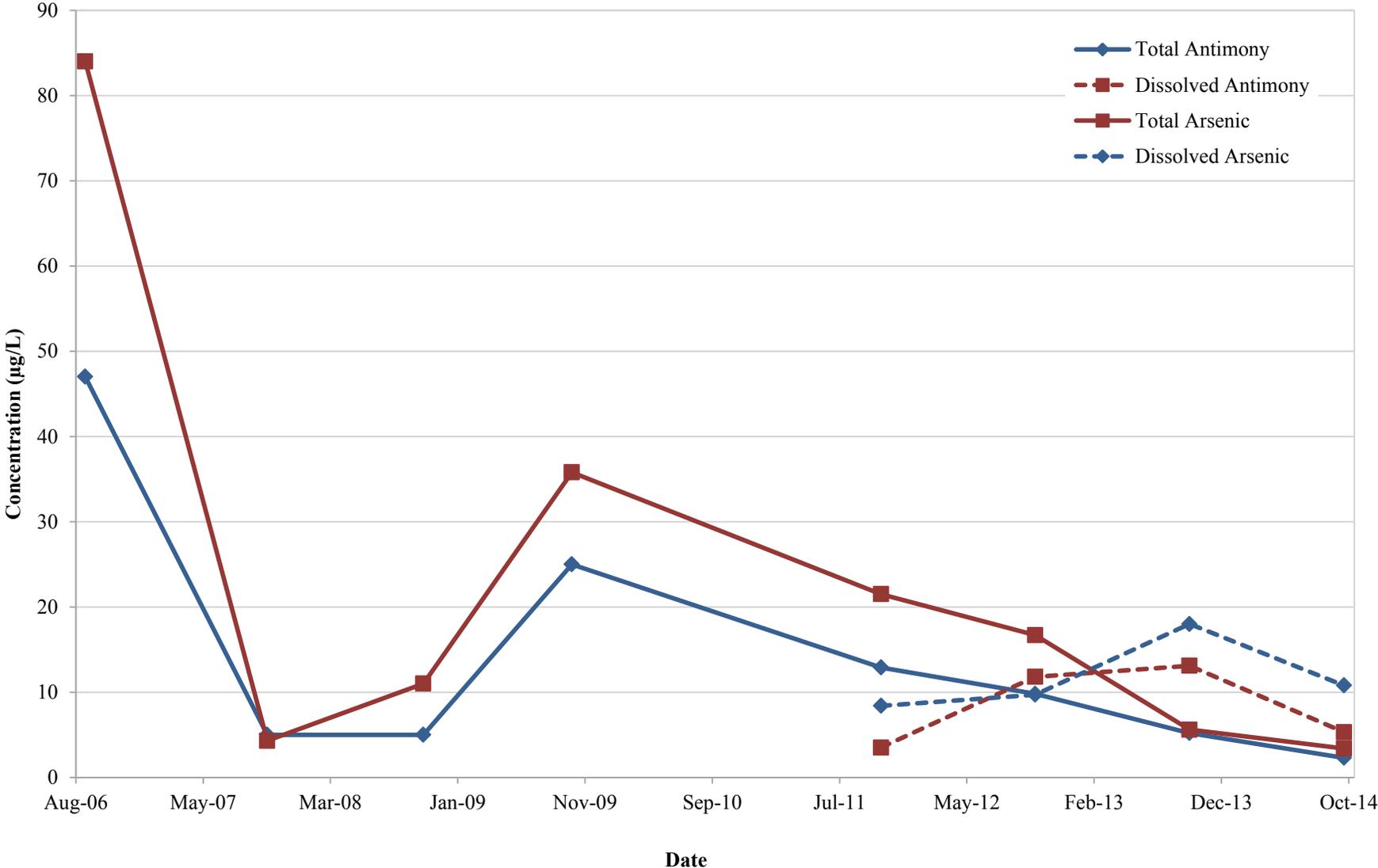
Site 12 / SWMU 10 Photo taken 30 JUNE 2015. Marsh grass restoration area at south end of Jericho Island.  
Lack of re-establishment of marsh grass. Facing southwest.



**Appendix D**  
**Site 1 Trend Graphs**

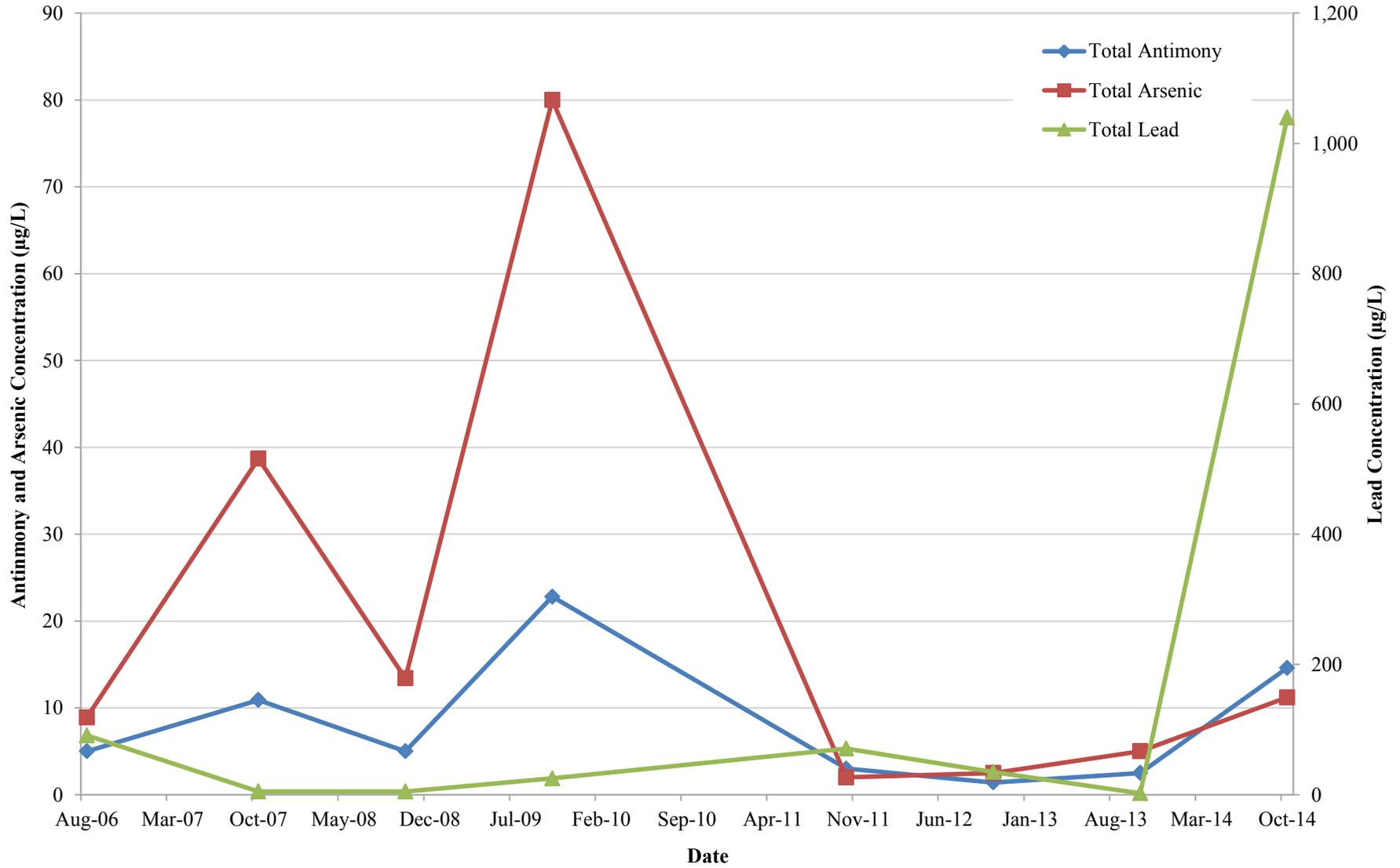
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**FIGURE 4 - SELECT TOTAL AND DISSOLVED METALS - PAI-01-MW-22**



Note: Non-detect analyte results are plotted as the laboratory method detection.

**FIGURE 5 - SELECT TOTAL AND DISSOLVED METALS - PAI-01-MW-23**



**Appendix E**  
**Reference Limits Summary Table**

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Reference Limits Summary Table

Matrix	Site 1 and Site 41 Groundwater		
Analytical Group	Volatile Organic Compounds		
Analyte	CAS Number	U.S. EPA MCL SEPT 2006 (µg/L)	U.S. EPA MCL NOV 2015 (µg/L)
Acetone	67-64-1	-	-
Acrolein	107-02-8	-	-
Acrylonitrile	107-13-1	-	-
Benzene	71-43-2	5	5
Bromobenzene	108-86-1	-	-
Bromochloromethane	74-97-5	-	-
Bromodichloromethane	75-27-4	80	80
Bromoform	75-25-2	80	80
n-Butylbenzene	104-51-8	-	-
sec-Butylbenzene	135-98-8	-	-
tert-Butylbenzene	98-06-6	-	-
Chlorobenzene	108-90-7	100	100
Chloroethane	75-00-3	-	-
Chloroform	67-66-3	80	80
o-Chlorotoluene	95-49-8	-	-
p-Chlorotoluene	106-43-4	-	-
2-Chloroethyl vinyl ether	110-75-8	-	-
Carbon disulfide	75-15-0	-	-
Carbon tetrachloride	56-23-5	5	5
1,1-Dichloroethane	75-34-3	-	-
1,1-Dichloroethylene	75-35-4	7	7
1,1-Dichloropropene	563-58-6	-	-
1,2-Dibromo-3-chloropropane	96-12-8	0.2	0.2
1,2-Dibromoethane	106-93-4	0.05	0.05
1,2-Dichloroethane	107-06-2	5	5
1,2-Dichloropropane	78-87-5	5	5
1,3-Dichloropropane	142-28-9	-	-
Dibromochloromethane	124-48-1	80	80
Dichlorodifluoromethane	75-71-8	-	-
cis-1,2-Dichloroethylene	156-59-2	70	70
cis-1,3-Dichloropropene	10061-01-5	-	-
o-Dichlorobenzene	95-50-1	600	600
p-Dichlorobenzene	106-46-7	75	75
trans-1,2-Dichloroethylene	156-60-5	100	100
trans-1,3-Dichloropropene	10061-02-6	-	-
Ethylbenzene	100-41-4	700	700
2-Hexanone	591-78-6	-	-
Hexachlorobutadiene	87-68-3	-	-
Isopropylbenzene	98-82-8	-	-
p-Isopropyltoluene	99-87-6	-	-
4-Methyl-2-pentanone	108-10-1	-	-
Methyl bromide	74-83-9	-	-
Methyl chloride	74-87-3	-	-
Methylene bromide	74-95-3	-	-
Methylene chloride	75-09-2	5	5
Methyl ethyl ketone	78-93-3	-	-
Methyl Tert Butyl Ether	-	-	-
Naphthalene	91-20-3	-	-
n-Propylbenzene	103-65-1	-	-
Styrene	100-42-5	100	100
1,1,1,2-Tetrachloroethane	630-20-6	-	-
1,1,1-Trichloroethane	71-55-6	200	200
1,1,2,2-Tetrachloroethane	79-34-5	-	-
1,1,2-Trichloroethane	79-00-5	5	5
1,2,3-Trichlorobenzene	87-61-6	-	-
1,2,3-Trichloropropane	96-18-4	-	-
1,2,4-Trichlorobenzene	120-82-1	70	70
1,2,4-Trimethylbenzene	95-63-6	-	-
1,3,5-Trimethylbenzene	108-67-8	-	-
Tetrachloroethylene	127-18-4	5	5
Toluene	108-88-3	1,000	1,000
Trichloroethylene	79-01-6	5	5
Trichlorofluoromethane	75-69-4	-	-
Vinyl chloride	75-01-4	2	2
Vinyl Acetate	108-05-4	-	-
Xylenes (total)	1330-20-7	10,000	10,000

Reference Limits Summary Table

Matrix Analytical Group	Site 1 and Site 41 Groundwater Semi Volatile Organic Compounds		
	Analyte	CAS Number	U.S. EPA MCL SEPT 2006 (µg/L)
Benzoic Acid	65-85-0	-	-
2-Chlorophenol	95-57-8	-	-
4-Chloro-3-methyl phenol	59-50-7	-	-
2,4-Dichlorophenol	120-83-2	-	-
2,4-Dimethylphenol	105-67-9	-	-
2,4-Dinitrophenol	51-28-5	-	-
4,6-Dinitro-o-cresol	534-52-1	-	-
2-Methylphenol	95-48-7	-	-
3&4-Methylphenol	-	-	-
2-Nitrophenol	88-75-5	-	-
4-Nitrophenol	100-02-7	-	-
Pentachlorophenol	87-86-5	<b>1</b>	<b>1</b>
Phenol	108-95-2	-	-
2,4,5-Trichlorophenol	95-95-4	-	-
2,4,6-Trichlorophenol	88-06-2	-	-
Acenaphthene	83-32-9	-	-
Acenaphthylene	208-96-8	-	-
Aniline	62-53-3	-	-
Anthracene	120-12-7	-	-
Benzidine	92-87-5	-	-
Benzo(a)anthracene	56-55-3	-	-
Benzo(a)pyrene	50-32-8	<b>0.2</b>	<b>0.2</b>
Benzo(b)fluoranthene	205-99-2	-	-
Benzo(g,h,i)perylene	191-24-2	-	-
Benzo(k)fluoranthene	207-08-9	-	-
4-Bromophenyl phenyl ether	101-55-3	-	-
Butyl benzyl phthalate	85-68-7	-	-
Benzyl Alcohol	100-51-6	-	-
2-Chloronaphthalene	91-58-7	-	-
4-Chloroaniline	106-47-8	-	-
Carbazole	86-74-8	-	-
Chrysene	218-01-9	-	-
bis(2-Chloroethoxy)methane	111-91-1	-	-
bis(2-Chloroethyl)ether	111-44-4	-	-
bis(2-Chloroisopropyl)ether	108-60-1	-	-
4-Chlorophenyl phenyl ether	7005-72-3	-	-
1,2-Dichlorobenzene	95-50-1	<b>600</b>	<b>600</b>
1,2-Diphenylhydrazine	122-66-7	-	-
1,4-Dichlorobenzene	106-46-7	<b>75</b>	<b>75</b>
2,4-Dinitrotoluene	121-14-2	-	-
2,6-Dinitrotoluene	606-20-2	-	-
3,3'-Dichlorobenzidine	91-94-1	-	-
Dibenzo(a,h)anthracene	53-70-3	-	-
Dibenzofw'an	132-64-9	-	-
Di-n-butyl phthalate	84-74-2	-	-
Di-n-octyl phthalate	117-84-0	-	-
Diethyl phthalate	84-66-2	-	-
Dimethyl phthalate	131-11-3	-	-
bis(2-Ethylhexyl)phthalate	117-81-7	<b>6</b>	<b>6</b>
Fluoranthene	206-44-0	-	-
Fluorene	86-73-7	-	-
Hexachlorobenzene	118-74-1	<b>1</b>	<b>1</b>
Hexachlorobutadiene	87-68-3	-	-
Hexachlorocyclopentadiene	77-47-4	<b>50</b>	<b>50</b>
Hexachloroethane	67-72-1	-	-
Indeno(1,2,3-cd)pyrene	193-39-5	-	-
Isophorone	78-59-1	-	-
1-Methylnaphthalene	90-12-0	-	-
2-Methylnaphthalene	91-57-6	-	-
2-Nitroaniline	88-74-4	-	-
3-Nitroaniline	99-09-2	-	-
4-Nitroaniline	100-01-6	-	-
Naphthalene	91-20-3	-	-
Nitrobenzene	98-95-3	-	-
N-Nitrosodimethylamine	62-75-9	-	-
N-Nitroso-di-n-propylamine	621-64-7	-	-
N-Nitrosodiphenylamine	86-30-6	-	-
Phenanthrene	85-01-8	-	-
Pyrene	129-00-0	-	-
Pyridine	110-86-1	-	-
1,2,4-Trichlorobenzene	120-82-1	<b>70</b>	<b>70</b>

Reference Limits Summary Table

<b>Matrix</b>		<b>Site 1 and Site 41 Groundwater</b>	
<b>Analytical Group</b>		<b>Pesticides</b>	
<b>Analyte</b>	<b>CAS Number</b>	<b>U.S. EPA MCL SEPT 2006 (µg/L)</b>	<b>U.S. EPA MCL NOV 2015 (µg/L)</b>
Aldrin	309-00-2	-	-
alpha-BHC	319-84-6	-	-
beta-BHC	319-85-7	-	-
delta-BHC	319-86-8	-	-
gamma-BHC (Lindane)	58-89-9	<b>0.2</b>	<b>0.2</b>
alpha-Chlordane	5103-71-9	<b>2</b>	<b>2</b>
gamma-Chlordane	5103-74-2	<b>2</b>	<b>2</b>
Dieldrin	60-57-1	-	-
4,4'-DDD	72-54-8	-	-
4,4'-DDE	72-55-9	-	-
4,4'-DDT	50-29-3	-	-
Endrin	72-20-8	<b>2</b>	<b>2</b>
Endosulfan sulfate	1031-07-8	-	-
Endrin aldehyde	7421-93-4	<b>2</b>	<b>2</b>
Endrin ketone	53494-70-5	<b>2</b>	<b>2</b>
Endosulfan-I	959-98-8	-	-
Endosulfan-II	33213-65-9	-	-
Heptachlor	76-44-8	<b>0.4</b>	<b>0.4</b>
Heptachlor epoxide	1024-57-3	<b>0.2</b>	<b>0.2</b>
Methoxychlor	72-43-5	<b>40</b>	<b>40</b>
Toxaphene	8001-35-2	<b>3</b>	<b>3</b>
<b>Matrix</b>		<b>Site 1 and Site 41 Groundwater</b>	
<b>Analytical Group</b>		<b>Metals</b>	
<b>Analyte</b>	<b>CAS Number</b>	<b>U.S. EPA MCL SEPT 2006 (µg/L)</b>	<b>U.S. EPA MCL NOV 2015 (µg/L)</b>
Aluminum	7429-90-5	-	-
Antimony	7440-36-0	<b>6</b>	<b>6</b>
Arsenic	7440-38-2	<b>10</b>	<b>10</b>
Barium	7440-39-3	<b>2000</b>	<b>2000</b>
Beryllium	7440-41-7	<b>4</b>	<b>4</b>
Cadmium	7440-43-9	<b>5</b>	<b>5</b>
Calcium	7440-70-2	-	-
Chromium	7440-47-3	<b>100</b>	<b>100</b>
Cobalt	7440-48-4	-	-
Copper	7440-50-8	<b>1300</b>	<b>1300</b>
Iron	7439-89-6	-	-
Lead	7439-92-1	<b>15</b>	<b>15</b>
Magnesium	7439-95-4	-	-
Manganese	7439-96-5	-	-
Mercury	7439-97-6	<b>2</b>	<b>2</b>
Nickel	7440-02-0	-	-
Potassium	7440-09-7	-	-
Selenium	7782-49-2	<b>50</b>	<b>50</b>
Silver	7440-22-4	-	-
Sodium	7440-23-5	-	-
Thallium	7440-28-0	<b>2</b>	<b>2</b>
Vanadium	7440-62-2	-	-
Zinc	7440-66-6	-	-

**Notes:**

CAS = Chemical Abstract Service

µg/L = Micrograms per liter

- = No MCL

U.S. EPA MCL = United States Environmental Protection Agency Maximum Contaminant Level

Analyte list from Solutions-IES, *Annual Groundwater Monitoring, Sediment Sampling, Marsh Grass Monitoring and O&M Report October 2011*, dated 21 December 2011

Reference Limits Summary Table

Matrix Analytical Group	Site 3 Groundwater Volatile Organic Compounds		
Analyte	CAS Number	U.S. EPA MCL AUG 2011 (µg/L)	U.S. EPA MCL NOV 2015 (µg/L)
Acetone	67-64-1	-	-
Benzene	71-43-2	5	5
Bromodichloromethane	75-27-4	80	80
Bromoform	75-25-2	80	80
Chlorobenzene	108-90-7	100	100
Chloroethane	75-00-3	-	-
Chloroform	67-66-3	80	80
Carbon disulfide	75-15-0	-	-
Carbon tetrachloride	56-23-5	5	5
1,1-Dichloroethane	75-34-3	-	-
1,1-Dichloroethylene	75-35-4	7	7
1,2-Dichloroethane	107-06-2	5	5
1,2-Dichloropropane	78-87-5	5	5
Dibromochloromethane	124-48-1	80	80
cis-1,2-Dichloroethylene	156-59-2	70	70
cis-1,3-Dichloropropene	10061-01-5	-	-
trans-1,2-Dichloroethylene	156-60-5	100	100
trans-1,3-Dichloropropene	10061-02-6	-	-
Ethylbenzene	100-41-4	700	700
2-Hexanone	591-78-6	-	-
4-Methyl-2-pentanone	108-10-1	-	-
Methyl bromide	74-83-9	-	-
Methyl chloride	74-87-3	-	-
Methylene chloride	75-09-2	5	5
Methyl ethyl ketone	78-93-3	-	-
Styrene	100-42-5	100	100
1,1,1-Trichloroethane	71-55-6	200	200
1,1,1,2-Tetrachloroethane	79-34-5	-	-
1,1,2-Trichloroethane	79-00-5	5	5
Tetrachloroethylene	127-18-4	5	5
Toluene	108-88-3	1,000	1,000
Trichloroethylene	79-01-6	5	5
Vinyl chloride	75-01-4	2	2
Xylene (total)	1330-20-7	10,000	10,000

Reference Limits Summary Table

Matrix Analytical Group		Site 3 Groundwater Semi Volatile Organic Compounds	
Analyte	CAS Number	U.S. EPA MCL AUG 2011 (µg/L)	U.S. EPA MCL NOV 2015 (µg/L)
Benzoic Acid	65-85-0	-	-
2-Chlorophenol	95-57-8	-	-
4-Chloro-3-methyl phenol	59-50-7	-	-
2,4-D ichlorophenol	120-83-2	-	-
2,4-D imethy lphenol	105-67-9	-	-
2,4-D initrophenol	51-28-5	-	-
4,6-Dinitro-o-cresol	534-52-1	-	-
2-Methylphenol	95-48-7	-	-
3&4-Methylphenol		-	-
2-Nitrophenol	88-75-5	-	-
4-Nitrophenol	100-02-7	-	-
Pentachlorophenol	87-86-5	<b>1</b>	<b>1</b>
Phenol	108-95-2	-	-
2,4,5-Trichlorophenol	95-95-4	-	-
2,4,6-Trichlorophenol	88-06-2	-	-
Acenaphthene	83-32-9	-	-
Acenaphthy lene	208-96-8	-	-
Anthracene	120-12-7	-	-
Benzo(a)anthracene	56-55-3	-	-
Benzo(a)pyrene	50-32-8	<b>0.2</b>	<b>0.2</b>
Benzo(b)fluoranthene	205-99-2	-	-
Benzo(g,h, i)perylene	191-24-2	-	-
Benzo(k)fluoranthene	207-08-9	-	-
4-Bromophenyl phenyl ether	101-55-3	-	-
Butyl benzyl phthalate	85-68-7	-	-
Benzyl Alcohol	100-51-6	-	-
2-Chloronaphthalene	91-58-7	-	-
4-Chloroaniline	106-47-8	-	-
Carbazole	86-74-8	-	-
Chrysene	218-01-9	-	-
bis(2-Chloroethoxy)methane	111-91-1	-	-
bis(2-Chloroethyl)ether	111-44-4	-	-
bis(2-Chloroisopropyl)ether	108-60-1	-	-
4-Chlorophenyl phenyl ether	7005-72-3	-	-
1,2-Dichlorobenzene	95-50-1	<b>600</b>	<b>600</b>
1,4-Dichlorobenzene	106-46-7	<b>75</b>	<b>75</b>
2,4-Dinitrotoluene	121-14-2	-	-
2,6-Dinitrotoluene	606-20-2	-	-
3,3'-Dichlorobenzidine	91-94-1	-	-
Dibenzo(a, h)anthracene	53-70-3	-	-
Dibenzofuran	132-64-9	-	-
Di-n-butyl phthalate	84-74-2	-	-
Di-n-octyl phthalate	117-84-0	-	-
Diethyl phthalate	84-66-2	-	-
Dimethyl phthalate	131-11-3	-	-
bis(2-Ethylhexyl)phthalate	117-81-7	<b>6</b>	<b>6</b>
Ethylbenzene	100-41-4	<b>700</b>	<b>700</b>
Fluoranthene	206-44-0	-	-
Fluorene	86-73-7	-	-
Hexachlorobenzene	118-74-1	<b>1</b>	<b>1</b>
Hexachlorobutadiene	87-68-3	-	-
Hexachlorocyclopentadiene	77-47-4	<b>50</b>	<b>50</b>
Hexachloroethane	67-72-1	-	-
Indeno(1,2,3-cd)pyrene	193-39-5	-	-
Isophorone	78-59-1	-	-
2-Methylnaphthalene	91-57-6	-	-
2-Nitroaniline	88-74-4	-	-
3-Nitroaniline	99-09-2	-	-
4-Nitroaniline	100-01-6	-	-
Naphthalene	91-20-3	-	-
Nitrobenzene	98-95-3	-	-
N-Nitroso-di-n-propylamine	621-64-7	-	-
N-Nitrosodiphenylamine	86-30-6	-	-
Phenanthrene	85-01-8	-	-
Pyrene	129-00-0	-	-
1,2,4-Trichlorobenzene	120-82-1	<b>70</b>	<b>70</b>

Reference Limits Summary Table

<b>Matrix Analytical Group</b>		<b>Site 3 Groundwater Pesticides</b>	
<b>Analyte</b>	<b>CAS Number</b>	<b>U.S. EPA MCL AUG 2011 (µg/L)</b>	<b>U.S. EPA MCL NOV 2015 (µg/L)</b>
Aldrin	309-00-2	-	-
alpha-BHC	319-84-6	-	-
beta-BHC	319-85-7	-	-
delta-BHC	319-86-8	-	-
gamma-BHC (Lindane)	58-89-9	<b>0.2</b>	<b>0.2</b>
alpha-Chlordane	5103-71-9	<b>2</b>	<b>2</b>
gamma-Chlordane	5103-74-2	<b>2</b>	<b>2</b>
Dieldrin	60-57-1	-	-
4,4'-DDD	72-54-8	-	-
4,4'-DDE	72-55-9	-	-
4,4'-DDT	50-29-3	-	-
Endrin	72-20-8	<b>2</b>	<b>2</b>
Endosulfan sulfate	1031-07-8	-	-
Endrin aldehyde	7421-93-4	<b>2</b>	<b>2</b>
Endrin ketone	53494-70-5	<b>2</b>	<b>2</b>
Endosulfan-I	959-98-8	-	-
Endosulfan-II	33213-65-9	-	-
Heptachlor	76-44-8	<b>0.4</b>	<b>0.4</b>
Heptachlor epoxide	1024-57-3	<b>0.2</b>	<b>0.2</b>
Methoxychlor	72-43-5	<b>40</b>	<b>40</b>
Toxaphene	8001-35-2	<b>3</b>	<b>3</b>

<b>Matrix Analytical Group</b>		<b>Site 3 Groundwater PCBs</b>	
<b>Analyte</b>	<b>CAS Number</b>	<b>U.S. EPA MCL AUG 2011 (µg/L)</b>	<b>U.S. EPA MCL NOV 2015 (µg/L)</b>
Aroclor 1016	12674-11-2	<b>0.5</b>	<b>0.5</b>
Aroclor 1221	11104-28-2	<b>0.5</b>	<b>0.5</b>
Aroclor 1232	11141-16-5	<b>0.5</b>	<b>0.5</b>
Aroclor 1242	53469-21-9	<b>0.5</b>	<b>0.5</b>
Aroclor 1248	12672-29-6	<b>0.5</b>	<b>0.5</b>
Aroclor 1254	11097-69-1	<b>0.5</b>	<b>0.5</b>
Aroclor 1260	11096-82-5	<b>0.5</b>	<b>0.5</b>

<b>Matrix Analytical Group</b>		<b>Site 3 Groundwater TAL Metals</b>	
<b>Analyte</b>	<b>CAS Number</b>	<b>U.S. EPA MCL AUG 2011 (µg/L)</b>	<b>U.S. EPA MCL NOV 2015 (µg/L)</b>
Aluminum	7429-90-5	-	-
Antimony	7440-36-0	<b>6</b>	<b>6</b>
Arsenic	7440-38-2	<b>10</b>	<b>10</b>
Barium	7440-39-3	<b>2000</b>	<b>2000</b>
Beryllium	7440-41-7	<b>4</b>	<b>4</b>
Cadmium	7440-43-9	<b>5</b>	<b>5</b>
Calcium	7440-70-2	-	-
Chromium	7440-47-3	<b>100</b>	<b>100</b>
Cobalt	7440-48-4	-	-
Copper	7440-50-8	<b>1300</b>	<b>1300</b>
Iron	7439-89-6	-	-
Lead	7439-92-1	<b>15</b>	<b>15</b>
Magnesium	7439-95-4	-	-
Manganese	7439-96-5	-	-
Mercury	7439-97-6	<b>2</b>	<b>2</b>
Nickel	7440-02-0	-	-
Potassium	7440-09-7	-	-
Selenium	7782-49-2	<b>50</b>	<b>50</b>
Silver	7440-22-4	-	-
Sodium	7440-23-5	-	-
Thallium	7440-28-0	<b>2</b>	<b>2</b>
Vanadium	7440-62-2	-	-
Zinc	7440-66-6	-	-

**Notes:**

CAS = Chemical Abstract Service

µg/L = Micrograms per liter

- = No MCL

U.S. EPA MCL = United States Environmental Protection Agency Maximum Contaminant Level

Analyte list from Solutions-IES, *Draft Annual Groundwater Sampling April 2014, SWMU 3 Causeway Landfill Marine Corps Recruit Depot*, dated 15 July 2014

**Appendix F**  
**ARAR Review**

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**Changes in Action Specific ARARs  
Site 1 and Site 41, MCRD Parris Island**

<b>ARAR</b>	<b>Citation/ Reference</b>	<b>ARAR Type</b>	<b>Rationale for use at MCRD Parris Island</b>	<b>Update Since ROD (August 2006)</b>	<b>Last Updated</b>	<b>Summary of change</b>	<b>Affect protectiveness of remedy in place?</b>
<b>FEDERAL ARARs</b>							
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.	Yes	Multiple Updates	Several subchapters and Appendix IX have been updated since the ROD was signed. Since no waste is planned for removal, the identification of Hazardous Waste does not affect the protectiveness of the remedy.	No
Standards for Hazardous Waste Generators	40 CFR 262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.	Yes	Multiple Updates	Several subchapters and Appendices have been updated since the ROD was signed. Since no hazardous waste is generated, the updates are not affecting the protectiveness of the remedy.	No
Standards for Hazardous Waste	40 CFR 263	Potentially applicable	Applicable for site wastes determined hazardous that are transported offsite.	Yes	Multiple Updates	Several subchapters have been updated. No hazardous waste is transported from the site; therefore, the protectiveness of the remedy is not affected.	No
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR 264	Potentially applicable	These regulations would be applicable to hazardous waste removed from the site including both onsite and offsite management.	Yes	Multiple Updates	Several subchapters have been updated. The landfill at Site 1 was capped in 2003, in accordance with Subpart G and Subpart N requirements. The updates do not affect the protectiveness of the remedy.	No
RCRA Land Disposal Restrictions Requirements	40 CFR 268	Potentially applicable	If offsite 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 LDRs.	Yes	Multiple Updates	Several subchapters have been updated. No offsite management of contaminated media/treatment residuals is required. The updates do not affect the protectiveness of the remedy.	No
United States Department of Transportation Hazardous Materials Transportation Regulations	49 CFR 171-180	Applicable	These rules are applicable when hazardous materials are transported offsite for laboratory analysis, treatment, or disposal.	Yes	Multiple Updates	Several subchapters have been updated. No waste from Site 1 is transported offsite. The updates do not affect the protectiveness of the remedy.	No
Soil Conservation Act	16 U.S.C. 590 et seq.	Applicable	During remedial activities, implementation of soil conservation practices would be required.	No	February 1936	N/A	No
<b>STATE OF SOUTH CAROLINA ARARs</b>							
Well Standards	R.61-71	Applicable	Remedial action/corrective measures involve the abandonment of monitoring wells.	No	April 2002	N/A	No
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.	Yes	June 2015	Emissions from Fuel Burning Operations, Ambient Air quality Standards, Prevention of Significant Deterioration, Nonattainment new source review, toxic air pollutants, new source performance standards, and Title V operating permit program sections updated. The updates do not affect the protectiveness of the remedy.	No
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.	No	May 1993	N/A	No
Solid Waste Management: Construction, Demolition, and Land Clearing Debris Landfills	R.61-107.11	Relevant and appropriate	Construction, demolition, and land-clearing debris is commingled with other wastes.	Yes	May 2008	R.61-107.19 Solid Waste Management: Solid Waste Landfills and Structural Fill repealed four existing regulations including R.61-107.11. The updates do not affect the protectiveness of the remedy; the cap at Site 1 was completed in 2003.	No

**Changes in Action Specific ARARs  
Site 1 and Site 41, MCRD Parris Island**

<b>ARAR</b>	<b>Citation/ Reference</b>	<b>ARAR Type</b>	<b>Rationale for use at MCRD Parris Island</b>	<b>Update Since ROD (August 2006)</b>	<b>Last Updated</b>	<b>Summary of change</b>	<b>Affect protectiveness of remedy in place?</b>
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.	Yes	March 2013	R.61-107.258 combined with R.61-107.16 to make R.61-107.19 Solid Waste Management: Solid Waste Landfills and Structural Fill. The updates do not affect the protectiveness of the remedy; the cap at Site 1 was completed in 2003.	No
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.	No	June 2002	Remedial design documents cite R. 61-79 as the standards used for closing/capping the site.	No
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.	No	June 2002	N/A	No
General Objectives and Components of Contamination Assessments and Remedial Actions	SCDHEC, 1994	TBC	Provides guidance for conducting remedial action activities.	Yes	Various	This TBC is no longer current. Current SCDHEC guidance is located at <a href="http://www.scdhec.gov/Environment/Guidance/index.htm">www.scdhec.gov/Environment/Guidance/index.htm</a> Ongoing LTM activities are performed in accordance with current SCDHEC guidance. The change does not affect remedy protectiveness.	No
Soil/Groundwater Remediation Guidance Document	SCDHEC, 1992	TBC	Provides guidance for conducting groundwater and soil remediation.	Yes	Various	This TBC is no longer current. Current SCDHEC guidance is located at <a href="http://www.scdhec.gov/Environment/Guidance/index.htm">www.scdhec.gov/Environment/Guidance/index.htm</a> Ongoing LTM activities are performed in accordance with current SCDHEC guidance. The change does not affect remedy protectiveness.	No
Stormwater and Management and Sediment Control Handbook for Land Disturbance Activities	SCDHEC, 1997	TBC	Guidance document to be followed if remedial action/corrective measures involve land-disturbance activities.	Yes	Multiple Updates	This guidance is no longer current. The current document is the SCDHEC Storm Water Management BMP Field Manual, maintained online at <a href="http://www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/">www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/</a> . These updates do not affect the protectiveness of the remedy.	No
<b>Hazardous Waste Management Act (§44-56-30)</b>							
Standards for Hazardous Waste Generators	R.61-79.262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.	Yes	June 2015	No hazardous waste is transported from Site 1. Updates do not affect the protectiveness of the remedy.	No
Standards for Hazardous Waste Transporters	R.61-79.263	Potentially applicable	Applicable for removed site wastes determined to be hazardous that are transported offsite.	Yes	June 2015	No hazardous waste is transported from Site 1. Updates do not affect the protectiveness of the remedy.	No
Standards for Owners and Operators of Hazardous Waste TSD Facilities	R.61-79.264	Potentially applicable	These regulations would be applicable to waste removed from the site including both onsite and offsite management.	Yes	June 2015	The landfill at Site 1 was capped in 2003, in accordance with Subpart G and Subpart N requirements. Updates do not affect the protectiveness of the remedy.	No

**Changes in Action Specific ARARs  
Site 1 and Site 41, MCRD Parris Island**

ARAR	Citation/ Reference	ARAR Type	Rationale for use at MCRD Parris Island	Update Since ROD (August 2006)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
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.	Yes	September 2012	The landfill at Site 1 was capped in 2003, in accordance with Subpart G and Subpart N requirements. Updates do not affect the protectiveness of the remedy.	No
Land Disposal Restrictions Requirements	R.61-79.268	Potentially applicable	If offsite 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 LDRs.	Yes	June 2015	Waste from Site 1 is not managed offsite. Updates do not affect the protectiveness of the remedy.	No

**References:**

**Citation**

40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 268, 49  
16 U.S.C. 590 et seq.  
R.61-71, R.61-62, R.61-107.5, R.61-107.11, R.61-107.258, R.72-  
300, R.72-405, R.61-79.262, R.61-79.263, R.61-79.264, R.61-  
79.265, R.61-79.268  
SCDHEC, 1994 and SCDHEC, 1996  
SCDHEC, 1997

**Website**

<http://www.ecfr.gov/cgi-bin/ECFR?page=browse>  
<http://uscode.house.gov/>  
<http://www.scstatehouse.gov/coderegs/statmast.php>  
  
[www.scdhec.gov/Environment/Guidance/index.htm](http://www.scdhec.gov/Environment/Guidance/index.htm)  
[www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/](http://www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/)

**Note:**

1) South Carolina Department of Health and Environmental Control (SCDHEC) updated several sections of R. 61-79. Please refer to document 4541 (<http://www.scstatehouse.gov/regs/4541.docx>) for detailed changes.

- TBC = To be considered
- ARAR = Applicable or relevant and appropriate requirement
- ROD = Record of Decision
- N/A = Not applicable
- MCRD = Marine Corps Recruit Depot
- CFR = Code of Federal Regulations
- RCRA = Resource Conservation and Recovery Act
- LTM = Long Term Monitoring

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**Changes in Location Specific ARARs  
Site 1 and Site 41, MCRD Parris Island**

ARAR	Citation/ Reference	ARAR Type	Rationale for use at MCRD Parris Island	Update Since ROD (August 2006)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
<b>FEDERAL ARARs</b>							
U.S. EPA's Groundwater Protection Strategy and Guidelines for Ground Water Classification	U.S. EPA, 1984 U.S. EPA, 1986	TBC	Surficial groundwater at Site 1 is considered Class III [Ground Water Not a Potential Source of Drinking Water] because of high salinity and TDS in excess of 13,000 mg/l.	No	November 1986	N/A	No
CWA Section 404 Rivers and Harbors Act, Section 10	40 CFR 230, 33 CFR 320-330	Applicable	Prohibits the unauthorized obstruction or alteration of any U.S. Navigable water. The waters within the vicinity of Site 1, most notably Archers Creek, are classified as navigable waters and therefore the act is applicable.	No	July 1997	N/A	No
Floodplain Management	Executive Order 11988	Applicable	Site 1 is located within a 100-year floodplain.	No	May 1977	N/A	No
Protection of Wetlands	Executive Order 11990	Applicable	Site 1 is located within a saltwater marshland.	No	May 1977	N/A	No
Endangered Species Act Section 7	16 United States Code (U.S.C) 1531 et seq., 50 CFR 402 et seq.	Applicable	Wood storks and alligators are known to live in the	Yes	July 2013	Updates to section further define the mechanism by which federal agencies ensure that the actions they take do not jeopardize the existence of any listed species, or destroy or adversely modify designated critical habitat. MCRD Parris Island procedures are in place to monitor sensitive ecological habitats. Updates do not affect remedy protectiveness.	No
Fish and Wildlife Coordination Act	16 U.S.C 661 et seq., 33 CFR 320-330	Applicable	Ensures that remedial action/corrective measures protect nearby wetlands and protected habitats.	No	July 1965	N/A	No
Coastal Zone Management Act Section 301	16 U.S.C. 1451 et seq.	Applicable	Ensures that remedial action/corrective measures protect coastal resources.	No	November 1992	N/A	No
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.	No	August 1935	N/A	
Archaeological and Historic Preservation Act of 1974, as amended 54 U.S.C. 312501-312508: Preservation of Historical and Archeological Data	former citation: 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.	Yes	September 2015	As noted in the ROD, no artifacts were identified in the boundaries of Site 1. Landfill contents include ash and fill. Updates do not affect remedy protectiveness.	No
Archaeological Resources Protection Act of 1979, as amended 16 U.S.C. 470aa-mm	former citation: 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.	No	1988	N/A	No
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.	No	November 1990	N/A	No

**Changes in Location Specific ARARs  
Site 1 and Site 41, MCRD Parris Island**

ARAR	Citation/ Reference	ARAR Type	Rationale for use at MCRD Parris Island	Update Since ROD (August 2006)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
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.	No	April 1994	N/A	No
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.	Yes	December 2011	Administrative changes to expand coverage of the program to state-owned National Guard installations, as well as updates to enforcement provisions. Updates do not affect remedy protectiveness	No
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.	Yes	2007	N/A	No
<b>STATE OF SOUTH CAROLINA ARARs</b>							
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 high salinity and TDS levels. The surface water at Site 1 is classified as SA (tidal saltwaters).	Yes	February 2012 June 2015	Updates to use best demonstrated available technologies for treatment of a specific type of waste while reducing compliance costs for industry, revise the definition of solid waste, and make technical corrections and correct typographical errors. Updates do not affect remedy protectiveness.	No. No action levels were identified in the ROD.
Coastal Zone Management Act	§48-39-10	Applicable	Ensures that remedial action/corrective measures protect coastal resources.	Yes	June 2011	Several definitions updated in §48-39-10	No
Groundwater Mixing Zone Application Guidance	SCDHEC, 1997	TBC	Guidance for completing application to obtain groundwater waiver for non-attainment of MCLs.	No	1997	N/A	No

**References:**

**Citation**

U.S. EPA, 1984, U.S. EPA, 1986  
Executive Order 11988  
Executive Order 11990  
16 United States Code (U.S.C) 1531 et seq, 16 U.S.C 661 et seq, 16 U.S.C. 1451 et seq, 16 U.S.C. 461 et seq, 25 U.S.C. 3001 et seq, 16 U.S.C 688 et seq, 16 U.S.C 670(a) et seq, 16 U.S.C 40 CFR 230, 33 CFR 320-330, 50 CFR 402 et seq  
R.61-68, R.61-69, §48-39-10  
SCDHEC, 1997

**Website**

<http://www.epa.gov/wastes/hazard/correctiveaction/resources/guidance/gw/gwclass.htm>  
<http://www.fema.gov/executive-order-11988-floodplain-management>  
<http://water.epa.gov/lawsregs/guidance/wetlands/eo11990.cfm>  
<http://uscode.house.gov/>  
<http://www.ecfr.gov/cgi-bin/ECFR?page=browse>  
<http://www.scstatehouse.gov/codereqs/statmast.php>  
[www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/](http://www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/)

**Note:**

1) South Carolina Department of Health and Environmental Control (SCDHEC) updated several sections of R. 61-79. Please refer to document 4541 (<http://www.scstatehouse.gov/regs/4541.docx>) for detailed changes.

TBC = To be considered  
ARAR = Applicable or relevant and appropriate requirement  
ROD = Record of Decision  
N/A = Not applicable  
MCRD = Marine Corps Recruit Depot  
CWA = Clean Water Act  
CFR = Code of Federal Regulations  
U.S. EPA = United States Environmental Protection Agency  
SCDHEC = South Carolina Department of Health and Environmental Control  
TDS = Total dissolved solids  
mg/L = milligrams per liter  
MCL = Maximum Contaminant Level

**Changes in Action Specific ARARs  
Site 3, MCRD Parris Island**

<b>Action</b>	<b>Requirements</b>	<b>Prerequisite</b>	<b>Citation</b>	<b>Update Since ROD (August 2011)</b>	<b>Last Updated</b>	<b>Summary of change</b>	<b>Affect protectiveness of remedy in place?</b>
Managing stormwater runoff from land disturbing activities	Must comply with the substantive requirements for stormwater management and sediment control of NPDES General Permit No. SCR100000.	Large and small construction activities (as defined in R. 61-9) of more than 1 acre of land – applicable	SCDHEC R.61-9.122.41 SCDHEC R.61-9.122.28 NPDES General Permit No. SCR100000	No	February 2011	N/A	No
	The stormwater management and sediment control plan shall contain at a minimum the information provided in the following subsections:	Activities involving more than two (2) acres and less than five (5) acres of actual land disturbance which are not part of a larger common plan of development or sale – applicable	SCDHEC R.72-307 I. <i>South Carolina Stormwater Management and Sediment Reduction Regulations</i>	No	June 1992	N/A	No
	A plan for temporary and permanent vegetative and structural erosion and sediment control measures which specify the erosion and sediment control measures to be used during all phases of the land disturbing activity and a description of their proposed operation;		SCDHEC R.72-307 I. (3)(d)	No	June 1992	N/A	No
	Provisions for stormwater runoff control during the land disturbing activity and during the life of the facility meeting the following requirements of subsections (e)1 and 2.		SCDHEC R.72-307 I. (3)(e)	No	June 1992	N/A	No
Managing fugitive dust emissions from land disturbing activities	Emissions of fugitive particulate matter shall be controlled in such a manner and to the degree that it does not create an undesirable level of air pollution. Volatile organic compounds shall not be used for dust control purposes. Oil treatment is also prohibited.	Activities that will generate fugitive particulate matter (Statewide) – applicable	SCDHEC R.61-62.6 Section III(a)- Control of Fugitive Particulate Matter Statewide SCDHEC R.61-62.6 Section III(d)	Yes	December 2013	Emissions from Fuel Burning Operations, Ambient Air quality Standards, Prevention of Significant Deterioration, Nonattainment new source review, toxic air pollutants, new source performance standards, and Title V operating permit program sections updated. Regulatory changes do not affect remedy protectiveness.	No
Installation or Abandonment of Permanent and Temporary Monitoring Wells.	All monitoring wells shall be drilled, constructed, maintained, operated, and/or abandoned to ensure that underground sources of drinking water are not contaminated.	Construction of permanent and temporary monitoring wells (including non-standard installation, as defined in R. 61-71B(2)) –applicable	SCDHEC R. 61-71H.1(b)	No	April 2002	N/A	No
	Abandonment of permanent conventionally installed monitoring wells shall be by forced injection of grout or pouring through a tremie pipe starting at the bottom of the well and proceeding to the surface in one continuous operation. The well shall be filled with either with neat cement, bentonite-cement, or 20% high solids sodium bentonite grout, from the bottom of the well to the land surface.		SCDHEC R.61-71H.2(e)	No	April 2002	N/A	No
	Must determine if solid waste is a hazardous waste using the following method: Should first determine if waste is excluded from regulation under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2 – applicable	40 CFR 262.11(a) SCDHEC R.61-79 262.11(a)	No No	March 2010 May 1996	N/A	No

**Changes in Action Specific ARARs  
Site 3, MCRD Parris Island**

<b>Action</b>	<b>Requirements</b>	<b>Prerequisite</b>	<b>Citation</b>	<b>Update Since ROD (August 2011)</b>	<b>Last Updated</b>	<b>Summary of change</b>	<b>Affect protectiveness of remedy in place?</b>
Characterization of solid waste	Must determine if waste is listed as hazardous waste under 40 CFR Part 261.	Generation of solid waste which is not excluded under 40 CFR 261.4(a) – applicable	40 CFR 262.11(b) SCDHEC R.61-79 262.11(b)	No No	March 2010 May 1996	N/A	No
	Must determine whether the waste is (characteristic waste) identified in subpart C of 40 CFR Part 261 by either: (1) Testing the waste according to the methods set forth in subpart C of 40 CFR part 261, or according to an equivalent method approved by the Administrator under 40 CFR 260.21; or (2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.	Generation of solid waste which is not excluded under 40 CFR 261.4(a) – applicable	40 CFR 262.11(c). SCDHEC R.61-79 262.11(c)	No No	March 2010 May 1996	N/A	No
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be hazardous waste – applicable	40 CFR 262.11(d) SCDHEC R.61-79 262.11(d)	No No	March 2010 May 1996	N/A	No
Determinations for management of hazardous waste	Must determine each U.S. EPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 et seq.. Note: This determination may be made concurrently with the hazardous waste determination required in Sec. 262.11 of this chapter.	Generation of hazardous waste for storage, treatment or disposal – applicable	40 CFR 268.9(a) SCDHEC R.61-79 268.9(a)	No No	April 2006 June 2008	N/A	No
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the characteristic waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non- wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal – applicable	40 CFR 268.9(a) SCDHEC R.61-79 268.9(a)	No No	April 2006 June 2008	N/A	No
	Must determine if the hazardous waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. Note: This determination can be made concurrently with the hazardous waste determination required in 40 CFR 262.11.	Generation of hazardous waste for storage, treatment or disposal – applicable	40 CFR 268.7(a) SCDHEC R.61-79 268.7(a) (1)	No Yes	April 2006 September 2012	N/A	No
Temporary storage of hazardous waste in containers	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171-173; and • the date upon which accumulation begins is clearly marked and visible for inspection on each container • container is marked with the words "hazardous waste"; or	Accumulation of RCRA hazardous waste onsite as defined in 40 CFR 260.10 –applicable	40 CFR 262.34(a)(1) and (2) SCDHEC R.61-79 262.34 (a)	No Yes	January 1982 September 2012	N/A	No

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Action	Requirements	Prerequisite	Citation	Update Since ROD (August 2011)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
	Container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste or 1 quart of acutely hazardous waste listed in 261.33(e) at or near any point of generation – applicable	40 CFR 262.34(c)(1) SCDHEC R.61-79 262.34 (c)	No Yes	January 1982 June 2015	N/A Hazardous waste not stored in containers at Site 3. Updates do not affect protectiveness of the remedy	No
Use and management of hazardous waste in containers	If container holding waste is not in good condition (e.g. severe rusting, structural defects), or if it begins to leak, must transfer waste into container in good condition.	Storage of RCRA hazardous waste in containers – applicable	40 CFR 265.171 SCDHEC R.61-79 265.171	No Yes	- March 2012	N/A Hazardous waste not stored in containers at Site 3. Updates do not affect protectiveness of the remedy	No
	Must use a container made or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired.		40 CFR 265.172 SCDHEC R.61-79 265.172	No Yes	- March 2012	N/A Hazardous waste not stored in containers at Site 3. Updates do not affect protectiveness of the remedy	No
	A container holding hazardous waste must always be closed during storage, except when necessary to add or remove waste. A container holding hazardous waste must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.		40 CFR 265.173(a) and (b)  SCDHEC R.61-79 265.173(a) and (b)	No No	November 1980 June 1997	N/A	No
Storage of hazardous waste in container area	Area must have a containment system designed and operated in accordance with 40 CFR 265.175(b).	Storage of RCRA hazardous waste in containers with free liquids – applicable	40 CFR 264.175(a) SCDHEC R.61-79 264.175(a)	No No	July 2006 December 1993	N/A	No
	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA-hazardous waste in containers that do not contain free liquids (other than F020, F021, F022, F023, F026 and F027) – applicable	40 CFR 265.175(c)(1) and (2) SCDHEC R. 61-79 265.175(c) (1) and (2)	No No	July 2006 June 1995	N/A	No
Temporary storage of solid waste	Shall be conducted in a manner to: a. Inhibit the harborage of flies, rodents, and other vectors; b. Prevent conditions for transmission of diseases to man or animals; c. Prevent blowing debris and particulates so as not to be injurious to human health and the environment; d. Prevent water pollution and prevent the escape of solid waste or leachate to waters of the State; and e. Minimize objectionable odors, dust, unsightliness, and aesthetically objectionable conditions, and prevent the accumulation of materials in an untidy and unsafe manner so as to become a fire and safety hazard.	Generation of solid waste for temporary storage prior to processing, disposal of that waste – relevant and appropriate	SCDHEC R.61-107.5(C)(1) Note: Jurisdictional Authority under South Carolina Solid Waste Policy and Management Act of 1991 (§§ 44-96-10 et seq)	No	May 1993	N/A	No

**Changes in Action Specific ARARs  
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<b>Action</b>	<b>Requirements</b>	<b>Prerequisite</b>	<b>Citation</b>	<b>Update Since ROD (August 2011)</b>	<b>Last Updated</b>	<b>Summary of change</b>	<b>Affect protectiveness of remedy in place?</b>
Disposal of solid waste	Shall ultimately dispose of solid waste at facilities and/or sites permitted or registered by the Department for processing or disposal of that waste stream.	Generation of solid waste intended for offsite disposal – relevant and appropriate	SCDHEC R.61-107.5(D)(3)	No	May 1993	N/A	No
Disposal of RCRA- hazardous waste in an off- site land-based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste – applicable	40 CFR 268.40(a) SCDHEC R.61-79 268.40(a)	No Yes	September 1994  June 2015	N/A  No Site 3 wastes are generated for offsite characterization/disposal. Updates do not affect protectiveness of the remedy	No
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the Universal Treatment Standards, found in 40 CFR 268.48 Table UTS prior to land disposal.	Land disposal of restricted RCRA characteristic wastes (D001-D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well – applicable	40 CFR 268.40(e) SCDHEC R.61-79 268.40(e)	No Yes	September 1994  June 2015	N/A  No Site 3 wastes are generated for offsite characterization/disposal. Updates do not affect protectiveness of the remedy	No
	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or must be treated according to the UTSs [specified in 40 CFR 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils – applicable	40 CFR 268.49(b) SCDHEC R.61-79 268.49(b)	No No	September 1994 June 2002	N/A	No
	To determine whether a hazardous waste identified in this section exceeds the applicable treatment standards of 40 CFR 268.40, the initial generator must test a sample of the waste extract or the entire waste, depending on whether the treatment standards are expressed as concentration in the waste extract or waste, or the generator may use knowledge of the waste. If the waste contains constituents (including UHCs in the characteristic wastes) in excess of the applicable UTS levels in 40 CFR 268.48, the waste is prohibited from land disposal, and all requirements of part 268 are applicable, except as otherwise specified.	Land disposal of RCRA toxicity characteristic wastes (D004-D011) that are newly identified (i.e., wastes, soil, or debris identified by the TCLP but not the Extraction Procedure) – applicable	40 CFR 268.34(f) SCDHEC R.61-79 268.34(f)	No No	September 1994 August 2000	N/A	No
Disposal of RCRA- hazardous waste debris in a land-based unit (i.e., landfill)	Must be treated prior to land disposal as provided in 40 CFR 268.45(a)(1)-(5) unless U.S. EPA determines under 40 CFR 261.3(f)(2) that the debris no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standard provided in 40 CFR 268.40 for the waste contaminating the debris.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA-hazardous debris – applicable	40 CFR 268.45(a) SCDHEC R.61-79 268.45(a)	No No	September 1994 May 1996	N/A	No

**Changes in Action Specific ARARs  
Site 3, MCRD Parris Island**

Action	Requirements	Prerequisite	Citation	Update Since ROD (August 2011)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
Maintenance of landfill cover (including riprap along base)	Maintain the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and prevent run-on and run-off from eroding or otherwise damaging the final cover.	Post-closure care of Class III landfill – relevant and appropriate	SCDHEC R.61-107.19 Part V Subpart F 258.61(a)(1)	No	May 2008	N/A	No
Post-closure groundwater monitoring	Monitor the groundwater in accordance with the requirements of Subpart E and maintaining the groundwater monitoring system. Note: Shallow groundwater and leachate within the boundaries of the landfill unit will be monitored according to long-term monitoring plan developed as part of the CERCLA response action for this site.	Post-closure care of Class III landfill – relevant and appropriate	SCDHEC R.61-107.19 Part V Subpart F 258.61(a)(3)	No	May 2008	N/A	No
	The length of the post-closure care period may be decreased if the permittee can provide technical rationale that the decreased post-closure care period is sufficient to protect human health and the environment. Note: Navy may as part of the CERCLA remedy review process (including Five-Year Review under Section 121(c)), seek SCHDEC and U.S. EPA approval of a modification to the monitoring period.		SCDHEC R.61-107.19 Part V Subpart F 258.61(b)(2)	No	May 2008	N/A	No
Post-closure use of property	Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this Part. Disturbance of the containment system may be approved if the permittee demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment. Note: MCRD and Navy are responsible for ensuring LUCs (as part of the CERCLA remedy) prevent unauthorized activities including disturbance of landfill cover integrity. U.S. EPA and SCDHEC approval is required in the event Navy/MCRD intends to disturb the cover (other than maintenance).	Post-closure care of Class III landfill – relevant and appropriate	SCDHEC R.61-107.19 Part V Subpart F 258.61(c)(3)	No	May 2008	N/A	No

**Changes in Action Specific ARARs  
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Action	Requirements	Prerequisite	Citation	Update Since ROD (August 2011)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
Transportation of hazardous waste onsite	The generator manifesting requirements of 40 CFR 262.20262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of- way – applicable	40 CFR 262.20(f) SCDHEC R.61-79 262.20(f)	No No	July 2011  February 2007	General requirements for the manifest as it pertains to the transporter were updated. No Site 3 wastes are generated for offsite characterization/disposal. Updates do not affect protectiveness of the remedy.  N/A	No
Transportation of hazardous waste offsite	Must comply with the generator requirements of 40 CFR 262.2023 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding, Sect. 262.40, 262.41(a) for record keeping requirements, and Sect. 262.12 to obtain EPA ID number.	Generator who initiates the offsite shipment of RCRA-hazardous waste – applicable	40 CFR 262.10(h) SCDHEC R.61-79 262.10(h)	No  Yes	July 2011  September 2012	N/A  Requirements to comply with generator standards. No Site 3 wastes are generated for offsite characterization/disposal. Update do not affect the protectiveness of the remedy.	No
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and DOT HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material – applicable	49 CFR 171.1(c)	Yes	April 2013	Update in the Hazardous Materials Regulation pertaining to transportation of hazardous materials. Updates do not affect protectiveness of the remedy.	No
Transportation of samples (i.e. solid waste, soils and wastewaters)	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when: • the sample is being transported to a laboratory for the purpose of testing; or • the sample is being transported back to the sample collector after testing. • the sample is being stored by sample collector before transport to a lab for testing.	Samples of solid waste or a sample of water, soil for purpose of conducting testing to determine its characteristics or composition – applicable	40 CFR 261.4(d)(1)(i)-(iii) SCDHEC R.61-79 261.4(d)(1)	No No	June 1999 November 1990	N/A	No
	In order to qualify for the exemption in 40 CFR 261.4 (d)(1)(i) and (ii), a sample collector shipping samples to a laboratory must: • Comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements. • Assure that the information provided in (1) thru (5) of this section accompanies the sample. • Package the sample so that it does not leak, spill, or vaporize from its packaging.		40 CFR 261.4(d)(2) 40 CFR 261.4(d)(2)(ii)(A) and (B) SCDHEC R.61-79 261.4(d)(2)(ii)(A) and (B)	No No No	June 1999 July 2004 November 1990	N/A	No

**Changes in Action Specific ARARs  
Site 3, MCRD Parris Island**

Action	Requirements	Prerequisite	Citation	Update Since ROD (August 2011)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
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**References:**

**Citation**

SCDHEC R.61-9.122.41, SCDHEC R.61-9.122.28, SCDHEC R.61-62.6, SCDHEC R.61-71H.1(b), SCDHEC R.61-71H.2(.e), SCDHEC R.61-79 262.11(a), SCDHEC R.61-79 262.11(b), SCDHEC R.61-79 262.119(c), SCDHEC R.61-79 262.11(d), SCDHEC R.61-79 268.9(a), 40 CFR 262.11(a), 40 CFR 262.11(b), 40 CFR 262.11(c), 40 CFR 262.11(d), 40 CFR 268.7(a)

**Website**

<http://www.scstatehouse.gov/coderegs/statmast.php>  
<http://www.ecfr.gov/cgi-bin/ECFR?page=browse>

**Notes:**

- ARAR = Applicable or relevant and appropriate requirement
- N/A = Not applicable
- CFR = Code of Federal Regulations
- U.S. EPA = United States Environmental Protection Agency
- NPDES = National Pollutant Discharge Elimination System
- SCDHEC = South Carolina Department of Health and Environmental Control
- RCRA = Resource Conservation and Recovery Act
- CERCLA = Comprehensive Environmental Response, Compensation, & Liability Act
- DOT = Department of Transportation
- gal = Gallon
- ROD = Record of Decision
- UTS = Universal Treatment Standards
- CWA = Clean Water Act
- UHC = Underlying Hazardous Constituents
- TCLP = Toxicity Characteristic Leaching Procedure
- HMTA = Hazardous Materials Transportation Act
- HMR = Hazardous Materials Regulations

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**Changes in Location Specific ARARs  
Site 3, MCRD Parris Island**

<b>Location Characteristics</b>	<b>Requirements</b>	<b>Prerequisite</b>	<b>Citation</b>	<b>Update Since ROD (August 2011)</b>	<b>Last Updated</b>	<b>Summary of change</b>	<b>Affect protectiveness of remedy in place?</b>
Presence of wetlands	Requires Federal agencies to evaluate action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance beneficial values of wetlands.	Actions that involve potential impacts to, or take place within, wetlands – TBC	Executive Order 11990 – Protection of Wetlands Section 1.(a)	No	May 1977	N/A	No
Presence of 100-year floodplain	Must demonstrate that the unit will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment.	Owners or operators of new MSWLF units, existing MSWLF units, and lateral expansions located in 100-year floodplains, as defined in R.61-107.19 Part I, Subpart B – relevant and appropriate.	SCDHEC R.61-107.19 Part V Subpart B 258.11(a)	No	May 2008	N/A	No
Presence of floodplain designated as such on a map	Shall consider alternatives to avoid, to the extent possible adverse effects and incompatible development in the floodplain.	Federal actions that involve potential impacts to, or take place within, floodplains –TBC	Executive Order 11988 – Floodplain Management Section 2.(a)(2)	No	May 1977	N/A	No
Location encompassing navigable waters	Activities shall not block or obstruct navigation or the flow of any waters unless specifically authorized herein. No spoil, dredged material, or any other fill material shall be placed below the mean high water or ordinary high water elevation, unless specifically authorized herein.  Shall make every reasonable effort to perform the authorized work in a manner to minimize adverse impact on fish, wildlife, or water quality.	Actions that involve any dredging, filling, or construction or alteration activity in, on, or over a navigable water, as defined in R. 19-450.2.C, or in, or on the bed under navigable waters, or in, or on lands or waters subject to a public navigational servitude under Article 14 Section 4 of the South Carolina Constitution and 49-1-10 of the 1976 S.C. Code of Laws including submerged lands under the navigable waters of the state, or for any activity significantly affecting the flow of any navigable water – relevant and appropriate.	SCDHEC R.19-450.4(7)  SCDHEC R.19-450.4(8)	No	June 1995	N/A	No

**Changes in Location Specific ARARs  
Site 3, MCRD Parris Island**

Location Characteristics	Requirements	Prerequisite	Citation	Update Since ROD (August 2011)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
Location encompassing coastal waters and tidelands (including coastal wetlands, mudflats, marshes and shallows) as defined in SCDHEC R. 30-10	Roadway embankments and fill areas shall be stabilized by utilizing appropriate erosion devices and/or techniques in order to minimize erosion and water quality degradation problems. Culverts shall be required, where appropriate, in order to maintain normal tidal influence and minimize disruption of drainage patterns.	Actions that involve dredging, filling, or construction activity in, on, over critical areas as defined in SCDHEC R. 30-10 (A) – relevant and appropriate.	SCDHEC R.30-12(F)(2)(h) Transportation  Note: Jurisdictional Authority under South Carolina Coastal Tidelands and Wetlands Act (§§ 48-39-10 et seq)	No	April 2008	N/A	No
	<p>Dredging and filling in wetland areas should be undertaken only if that activity is water- dependent and there are no feasible alternatives.</p> <p>To the maximum extent feasible, dredging and filling activities should be restricted in nursery areas and shellfish grounds and during periods of migration, spawning, and early development of important sport and commercial species.</p> <p>Dredging and excavation shall not create stagnant water conditions, lethal fish entrapments, or deposit sumps or otherwise contribute to water quality degradation.</p> <p>Designs for dredging and excavation projects shall, where feasible, include protective measures such as silt curtains, diapers, and weirs to protect water quality in adjacent areas during construction by preventing the dispersal of silt materials.</p> <p>Dredged materials shall be deposited and contained in such a manner so as to prevent dispersal into adjacent wetland areas and, in all cases, new facilities must have permanent upland disposal sites. Existing facilities must have either permanent upland disposal sites or U.S. EPA approved ocean disposal sites.</p>	Actions that involve dredging, filling, or construction activity in, on, over critical areas as defined in SCDHEC R. 30-10 (A) – relevant and appropriate.	SCDHEC R.30-12(G)(2)(b)-(f) Dredging and Filling Material	No	April 2008	N/A	No
	<p>The following standards are to be utilized:</p> <p>(a) Upland disposal of dredged material shall always be sought in preference to disposal in wetlands. Vegetated wetlands and mudflats shall not be utilized for disposal of dredged materials unless there are no feasible alternatives. Any other wetlands should not be utilized for disposal of dredged materials when other alternatives exist;</p> <p>(c) Dredged materials containing hazardous levels of toxic material must be disposed of with extraordinary caution. These materials shall never be disposed of in wetland areas and only in highland areas which are lined and diked with impervious materials.</p>	Actions that involve dredging, filling, or construction activity in, on, over critical areas as defined in SCDHEC R. 30-10 (A) – relevant and appropriate	SCDHEC R.30-12(I)(2)(a) and (c) Deposition of Dredged Material	No	April 2008	N/A	No

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Site 3, MCRD Parris Island**

Location Characteristics	Requirements	Prerequisite	Citation	Update Since ROD (August 2011)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
Location encompassing aquatic ecosystem as defined in 40 CFR 230.3(c)	No discharge of dredged or fill material into an aquatic ecosystem is permitted if there is a practicable alternative that would have less adverse impact.  No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps in accordance with 40 CFR 230.70 et seq. have been taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem.	Action that involves the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands – applicable	40 CFR 230.10(a)  40 CFR 230.10(d)	No	December 1980	N/A	No
	Must comply with the substantive requirements of the NWP 38 General Conditions, as appropriate, any regional or case-specific conditions recommended by the Corps District Engineer, after consultation.  Note: Despite that consultation may be considered an administrative requirement, it should be performed to ensure activities are in compliance with substantive provisions of the permit.	Onsite CERCLA action conducted by Federal agency that involves the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands – relevant and appropriate	Nation Wide Permit (38) Cleanup of Hazardous and Toxic Waste  33 CFR 323.3(b)	No	August 1993	N/A	No
Presence of Threatened and Endangered Wildlife listed in 50 CFR 17.11(h) – or critical habitat of such species	Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary of Interior, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section.  Note: Despite that consultation may be considered an administrative requirement, it should be performed to ensure activities are in compliance with substantive provisions of the Endangered Species Act and regulations.	Agency action that may jeopardize listed wildlife species, or destroy or adversely modify critical habitat – applicable.	16 U.S.C. 1536 (a)(2) or Section 7(a)(2) of the Endangered Species Act of 1973	Yes	July 2013	Updates to section further define the mechanism by which federal agencies ensure that the actions they take do not jeopardize the existence of any listed species. MCRD Parris Island procedures are in place to monitor sensitive ecological habitats. Updates do not affect remedy protectiveness.	No
Presence of Threatened and Endangered Wildlife listed in 50 CFR 17.11(h)	It is unlawful to take threatened or endangered wildlife in the United States. No person may take any American Alligator except as provided in 50 CFR 17.42(a)(2)(i) and (ii).  Note: Under 50 CFR 10.12 Definitions the term Take means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.	Action that may jeopardize listed wildlife species – applicable.	50 CFR 17.21(c) 50 CFR 17.31(a) 50 CFR 17.42(a)(2)	Yes	July 2014 March 2005 July 2014	Updates on import / export / taking of endangered wildlife. Updates do not affect remedy protectiveness.	No

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Location Characteristics	Requirements	Prerequisite	Citation	Update Since ROD (August 2011)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
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**References:**

**Citation**

Executive Order 11988

Executive Order 11990

SCDHEC R.61-107.19 part V Subpart b 258.11(a), SCDHEC R.19-450.4(7), SCDHEC R.19-450.4(8), SCDHEC R.30-12(F)(2)(h), SCDHEC R.30-12(G)(2)(b)-(f), SCDHEC R.30-12(I)(2)(a) and (C)

16 U.S.C. 1536 (a) (2)

33 CFR 323.3(b), 50 CFR 17.21(C), 50 CFR 17.31(a), 50 CFR 17.42(a)(2)

**Website**

<http://www.fema.gov/executive-order-11988-floodplain-management>

<http://water.epa.gov/lawsregs/guidance/wetlands/eo11990.cfm>

<http://www.scstatehouse.gov/coderegs/statmast.php>

<http://uscode.house.gov/>

<http://www.ecfr.gov/cgi-bin/ECFR?page=browse>

**Notes:**

TBC

N/A

CFR

U.S. EPA

CERCLA

SCDHEC

MSWLF

MCRD

= To be considered

= Not applicable

= Code of Federal Regulations

= United States Environmental Protection Agency

= Comprehensive Environmental Response, Compensation, and Liability Act

= South Carolina Department of Health and Environmental Control

= Municipal solid waste landfill

= Marine Corps Recruit Depot

**Changes in Action Specific ARARs  
Site 12, MCRD Parris Island**

ARAR	Citation/ Reference	ARAR Type	Rationale for use at MCRD Parris Island	Update Since ROD (September 2006)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
<b>FEDERAL ARARs</b>							
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.	Yes	Multiple Updates	Several subchapters and Appendix IX have been updated since the ROD was signed. Since no waste is planned for removal the identification of Hazardous Waste does not affect the protectiveness of the remedy.	No
- Standards for Hazardous Waste Generators	40 CFR 262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.	Yes	Multiple Updates	Several subchapters and Appendices have been updated since the ROD was signed. Since no hazardous waste is generated the updates are not affecting the protectiveness of the remedy.	No
- Standards for Hazardous Waste	40 CFR 263	Potentially applicable	Applicable for site wastes determined hazardous that are transported offsite.	Yes	Multiple Updates	Several subchapters have been updated. No hazardous waste is transported from the site, therefore the protectiveness of the remedy is not affected.	No
- Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities	40 CFR 264	Potentially applicable	These regulations would be applicable to hazardous waste removed from the site including both onsite and offsite management.	Yes	Multiple Updates	Several subchapters have been updated. No hazardous waste treatment, storage or disposal occurs at Site 12. The updates do not affect the protectiveness of the remedy.	No
- RCRA Land Disposal Restrictions Requirements	40 CFR 268	Potentially applicable	If offsite 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 LDRs.	Yes	Multiple Updates	Several subchapters have been updated. No offsite management of contaminated media/treatment residuals is required. The updates do not affect the protectiveness of the remedy.	No
United States Department of Transportation Hazardous Materials Transportation Regulations	49 CFR 171-180	Applicable	These rules are applicable when hazardous materials are transported offsite for laboratory analysis, treatment, or disposal.	Yes	Multiple Updates	Several subchapters have been updated. No waste from Site 12 is transported offsite. The updates do not affect the protectiveness of the remedy.	No
Soil Conservation Act	16 U.S.C. 590 et seq.	Applicable	During remedial activities, implementation of soil conservation practices would be required.	No	February 1936	N/A	No
<b>STATE OF SOUTH CAROLINA ARARs</b>							
Well Standards	R.61-71	Applicable	Remedial action/corrective measures involve the abandonment of monitoring wells.	No	April 2002	N/A	No
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.	No	May 1993	N/A	No
Solid Waste Management: Construction, Demolition, and Land Clearing Debris Landfills	R.61-107.11	Relevant and appropriate	Construction, demolition, and land-clearing debris is commingled with other wastes.	Yes	May 2008	R.61-107.19 Solid Waste Management: Solid Waste Landfills and Structural Fill repealed four existing regulations including R.61-107.11. The updates do not affect the protectiveness of the remedy; removal actions at Site 12 were completed in 2006, and no wastes are left onsite.	No
Standards for Stormwater Management and Sediment Reduction	R.72-300 and R.72-405	Applicable	Applicable if remedial action/corrective measures involve land-disturbance activities.	No	June 2002	N/A	No
General Objectives and Components of Contamination Assessments and Remedial Actions	SCDHEC, 1994	TBC	Provides guidance for conducting remedial action activities.	Yes	Various	This TBC is no longer current. Current SCDHEC guidance is located at <a href="http://www.scdhec.gov/Environment/Guidance/index.htm">www.scdhec.gov/Environment/Guidance/index.htm</a> Ongoing LTM activities are performed in accordance with current SCDHEC guidance. The change does not affect remedy protectiveness.	No

**Changes in Action Specific ARARs  
Site 12, MCRD Parris Island**

ARAR	Citation/ Reference	ARAR Type	Rationale for use at MCRD Parris Island	Update Since ROD (September 2006)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
Soil/Groundwater Remediation Guidance Document	SCDHEC, 1992	TBC	Provides guidance for conducting groundwater and soil remediation.	Yes	Various	This TBC is no longer current. Current SCDHEC guidance is located at <a href="http://www.scdhec.gov/Environment/Guidance/index.htm">www.scdhec.gov/Environment/Guidance/index.htm</a> Ongoing LTM activities are performed in accordance with current SCDHEC guidance. The change does not affect remedy protectiveness.	No
Stormwater and Management and Sediment Control Handbook for Land Disturbance Activities	SCDHEC, 1997	TBC	Guidance document to be followed if remedial action/corrective measures involve land-disturbance activities.	Yes	Multiple Updates	This guidance is no longer current. The current document is the SCDHEC Storm Water Management BMP Field Manual, maintained online at <a href="http://www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/">www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/</a> . These updates do not affect the protectiveness of the remedy.	No
<b>Hazardous Waste Management Act (§44-56-30)</b>							
- Standards for Hazardous Waste Generators	R.61-79.262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.	Yes	June 2015	No hazardous waste is transported from Site 12. Updates do not affect the protectiveness of the remedy.	No
- Standards for Hazardous Waste Transporters	R.61-79.263	Potentially applicable	Applicable for removed site wastes determined to be hazardous that are transported offsite.	Yes	June 2015	No hazardous waste is transported from Site 12. Updates do not affect the protectiveness of the remedy.	No
- Standards for Owners and Operators of Hazardous Waste TSD Facilities	R.61-79.264	Potentially applicable	These regulations would be applicable to waste removed from the site including both onsite and offsite management.	Yes	June 2015	Hazardous waste is not stored at Site 12. Updates do not affect the protectiveness of the remedy.	No
- Land Disposal Restrictions (LDR) Requirements	R.61-79.268	Potentially applicable	If offsite 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 LDRs.	Yes	June 2015	Waste from Site 12 is not managed offsite. Updates do not affect the protectiveness of the remedy.	No

**References:**

<b>Citation</b> 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 268, 49 16 U.S.C. 590 et seq.  R.61-71, R.61-107.5, R.61-107.11, R.61-107.258, R.72-300, R.72- 405, R.61-79.263, R.61-79.264, R.61-79.268  SCDHEC, 1994 and SCDHEC, 1996 SCDHEC, 1997	<b>Website</b> <a href="http://www.ecfr.gov/cgi-bin/ECFR?page=browse">http://www.ecfr.gov/cgi-bin/ECFR?page=browse</a> <a href="http://uscode.house.gov/">http://uscode.house.gov/</a>  <a href="http://www.scstatehouse.gov/coderegs/statmast.php">http://www.scstatehouse.gov/coderegs/statmast.php</a>  <a href="http://www.scdhec.gov/Environment/Guidance/index.htm">www.scdhec.gov/Environment/Guidance/index.htm</a> <a href="http://www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/">www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/</a>
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**Note:**

1) South Carolina Department of Health and Environmental Control (SCDHEC) updated several sections of R. 61-79.261, R.61-69.262, R.61-79.263, R.61-69.264, R.61-69.268. Please refer to document 4541 (<http://www.scstatehouse.gov/regs/4541.docx>) for detailed changes.

TBC	= To be considered
ARAR	= Applicable or relevant and appropriate requirement
ROD	= Record of Decision
N/A	= Not applicable
MCRD	= Marine Corps Recruit Depot
CFR	= Code of Federal Regulations
RCRA	= Resource Conservation and Recovery Act
LDR	= Land Disposal Restrictions

**Changes in Location Specific ARARs  
Site 12, MCRD Parris Island**

ARAR	Citation/ Reference	ARAR Type	Rationale for use at MCRD Parris Island	Update Since ROD (September 2006)	Last Updated	Summary of change	Affect protectiveness of remedy in place?
<b>FEDERAL ARARs</b>							
U.S. EPA's Groundwater Protection Strategy and Guidelines for Ground Water Classification	U.S. EPA, 1984 U.S. EPA, 1986	TBC	Surficial groundwater at Site 12 is considered Class III [Ground Water Not a Potential Source of Drinking Water] because of high salinity and TDS in excess of 13,000 mg/l.	No	November 1986	N/A	No
CWA Section 404 Rivers and Harbors Act, Section 10	40 CFR 230, 33 CFR 320-330	Applicable	Prohibits the unauthorized obstruction or alteration of any U.S. Navigable water. The waters within the vicinity of Site 12, most notable Archers Creek, are classified as navigable waters and therefore the act is applicable	No	July 1997	N/A	No
Floodplain Management	Executive Order 11988	TBC	Site 12 is located within a 100-year floodplain.	No	May 1977	N/A	No
Protection of Wetlands	Executive Order 11990	TBC	Site 12 is located within a saltwater marshland.	No	May 1977	N/A	No
Endangered Species Act Section 7	16 United States Code (U.S.C) 1531 et seq. 50 CFR 402 et seq.	Applicable	Wood storks and alligators are known to live in the ge	Yes	July 2013	Updates to section further define the mechanism by which federal agencies ensure that the actions they take do not jeopardize the existence of any listed species, or destroy or adversely modify designated critical habitat. MCRD Parris Island procedures are in place to monitor sensitive ecological habitats. Updates do not affect remedy protectiveness.	No
Fish and Wildlife Coordination Act	16 U.S.C 661 et seq., 33 CFR 320-330	Applicable	Ensures that remedial action/corrective measures protect nearby wetlands and protected habitats.	No	July 1965	N/A	No
Coastal Zone Management Act Section 301	16 U.S.C. 1451 et seq.	Applicable	Ensures that remedial action/corrective measures protect coastal resources.	No	November 1992	N/A	No
<b>STATE OF SOUTH CAROLINA ARARs</b>							
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 high salinity and TDS. The surface water at Site 12 is classified as SA (tidal saltwaters).	Yes	February 2012 June 2015	Updates to use best demonstrated available technologies for treatment of a specific type of waste while reducing compliance costs for industry, revise the definition of solid waste, and make technical corrections and correct typographical errors. Updates do not affect remedy protectiveness.	No. No action levels were identified in the ROD.
Coastal Zone Management Act	§48-39-10	Applicable	Ensures that remedial action/corrective measures protect coastal resources.	Yes	June 2011	Several definitions updated in §48-39-10	No

**References:**

**Citation**

U.S. EPA, 1984, U.S. EPA, 1986  
Executive Order 11988  
Executive Order 11990

16 United States Code (U.S.C) 1531 et seq, 16 U.S.C 661 et seq, 16 U.S.C. 1451 et seq  
40 CFR 230, 33 CFR 320-330, 50 CFR 402 et seq  
R.61-68, R.61-69, §48-39-10

**Website**

<http://www.epa.gov/wastes/hazard/correctiveaction/resources/guidance/gw/gwclass.htm>  
<http://www.fema.gov/executive-order-11988-floodplain-management>  
<http://water.epa.gov/lawsregs/guidance/wetlands/eo11990.cfm>  
<http://uscode.house.gov/>  
<http://www.ecfr.gov/cgi-bin/ECFR?page=browse>  
<http://www.scstatehouse.gov/coderegs/statmast.php>

**Note:**

1) South Carolina Department of Health and Environmental Control (SCDHEC) updated several sections of R. 61-79. Please refer to document 4541 (<http://www.scstatehouse.gov/regs/4541.docx>) for detailed changes.

TBC = To be considered  
ARAR = Applicable or relevant and appropriate requirement  
ROD = Record of Decision  
NA = Not applicable  
MCRD = Marine Corps Recruit Depot  
CWA = Clean Water Act  
CFR = Code of Federal Regulations  
U.S. EPA = United States Environmental Protection Agency  
mg/l = Milligram per liter

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**Appendix G**  
**Risk Evaluation**

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**Comparison of ROD Remediation Levels with  
Example Upper-Bound RGOs  
Calculated during 2015 Five Year Review**

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**Remediation Level Comparisons  
MCRD Parris Island  
Site 1 and Site 41**

Chemical	ROD Human Health Remediation Levels (mg/kg)	Present-Day Upper Bound Remedial Goal Option (mg/kg)
Aluminum	NR	365000
Antimony (metallic)	31	146
Aroclor 1260	NR	5.3
Arsenic, Inorganic	12.4 Sediment 1.83 Soil	101
Barium	NR	72900
Benzo[a]pyrene equivalents	0.434	7.14
Cadmium (Diet)	NR	329
Chlordane	NR	165
Chromium(VI)	NR	143
Chromium, Total	NR	120000
DDD	1.7	575
DDE, p,p'-	NR	731
DDT	1.7	169
DDT/DDE/DDD (total)	5.8	Not Applicable
Iron	26920	256000
Lead and Compounds	412.5	400
Manganese (Non-diet)	NR	8750
Mercury (elemental)	NR	35.8
Mercury, Inorganic Salts	NR	110
Nickel Soluble Salts	NR	7300
Selenium	NR	1820
Vanadium	NR	1840
Vanadium and Compounds	NR	1840
Zinc and Compounds	NR	110000

**Notes:**

RGO = Remedial goal option

mg/kg = Milligrams per kilogram

In the ROD, the total chlordane value was applied to both alpha and gamma isomers.

NR indicates previously reported as not relevant.

Residential risks are mitigated by land use controls; the remaining upper-bound RGOs facilitate the five year review.

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**Example Upper-Bound RGOs**  
**Calculated during 2015 Five Year Review**

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**Revised Example Upper-Bound Remedial Goal Options  
MCRD Parris Island  
Site 1 and Site 41**

Chemical	<i>Resident</i>		<i>Indoor Worker</i>		<i>Excavation Worker</i>		<i>Recreationist</i>	
	Carcinogenic RGO	Noncarcinogenic Child RGO	Carcinogenic RGO	Noncarcinogenic RGO	Carcinogenic RGO	Noncarcinogenic RGO	Carcinogenic RGO	Noncarcinogenic Child RGO
	TR=1.0E-4 (mg/kg)	THI=1 (mg/kg)	TR=1.0E-4 (mg/kg)	THI=1 (mg/kg)	TR=1.0E-4 (mg/kg)	THI=1 (mg/kg)	TR=1.0E-4 (mg/kg)	THI=1 (mg/kg)
Aluminum	-	77400	-	2170000	-	4370000	-	365000
Antimony (metallic)	-	31.3	-	934	-	1770	-	146
Aroclor 1260	24.3	1.14	327	46.7	10700	61.4	114	5.3
Arsenic, Inorganic	42.4	21.7	436	695	18900	1210	198	101
Barium	-	15300	-	404000	-	864000	-	72900
Benzo[a]pyrene	1.53	-	89.6	-	3010	-	7.14	-
Cadmium (Diet)	212000	70.3	926000	2250	289000000	3910	23700000	329
Chlordane	177	35.3	1870	1170	78600	1960	826	165
Chromium(VI)	30.1	234	1230	6930	61300	13200	143	1090
Chromium, Total <sup>RSL</sup>	-	120000	-	1800000	-	1800000	-	120000
DDD	222	123	2730	4670	98100	6730	1040	575
DDE, p,p'-	157	-	1920	-	69200	-	731	-
DDT	187	36.2	1920	1170	83200	2020	874	169
DDT/DDE/DDD (total)	-	-	-	-	-	-	-	-
Iron	-	54800	-	1640000	-	3100000	-	256000
Lead and Compounds <sup>RSL</sup>	400	-	800	-	800	-	400	-
Manganese (Non-diet)	-	1830	-	47200	-	103000	-	8750
Mercury (elemental)	-	5.38	-	35.8	-	291	-	55.3
Mercury, Inorganic Salts	-	23.5	-	701	-	1330	-	110
Nickel Soluble Salts	1470000	1550	6410000	43000	200000000	87300	16400000	7300
Selenium	-	391	-	11700	-	22100	-	1820
Vanadium	-	394	-	11800	-	22300	-	1840
Vanadium and Compounds	-	393	-	11500	-	22200	-	1840
Zinc and Compounds	-	23500	-	701000	-	1330000	-	110000

**Notes:**

- RGO = Upper-bound remedial goal option
- = Not applicable
- RSL = Regional screening level for soil used as RGO for the lead model and trivalent chromium

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**Evaluation Basis — Indoor Worker Scenario**

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**Indoor Worker Equation  
Inputs for Soil**

Variable	Value
TR (target cancer risk) unitless	0.0001
THQ (target hazard quotient) unitless	1
AT <sub>iw</sub> (averaging time - indoor worker)	365
EF <sub>iw</sub> (exposure frequency - indoor worker) day/year	250
ED <sub>iw</sub> (exposure duration - indoor worker) year	25
ET <sub>iw</sub> (exposure time - indoor worker) hour	8
LT (lifetime) year	70
BW <sub>iw</sub> (body weight - indoor worker)	80
IR <sub>iw</sub> (soil ingestion rate - indoor worker) mg/day	50
City (Climate Zone) PEF Selection	Default
A <sub>s</sub> (acres) PEF Selection	0.5
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) PEF Selection	93.77
PEF (particulate emission factor) m <sup>3</sup> /kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U <sub>m</sub> (mean annual wind speed) m/s	4.69
U <sub>t</sub> (equivalent threshold value)	11.32
F(x) (function dependant on U <sub>m</sub> /U <sub>t</sub> ) unitless	0.194
City (Climate Zone) VF Selection	Default
A <sub>s</sub> (acres) VF Selection	0.5
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) VF Selection	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ <sub>b</sub> (dry soil bulk density) g/cm <sup>3</sup>	1.5
ρ <sub>s</sub> (soil particle density) g/cm <sup>3</sup>	2.65
θ <sub>w</sub> (water-filled soil porosity) L <sub>water</sub> /L <sub>soil</sub>	0.15
T (exposure interval) s	819936000

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**Indoor Worker PRG  
For Soil**

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Reference	Chronic RfC (mg/m <sup>3</sup> )	RfC Reference	Ingestion SF (mg/kg-day) <sup>-1</sup>	SFO Reference	Inhalation Unit Risk (ug/m <sup>3</sup> ) <sup>-1</sup>	IUR Reference	Volatilization Factor (m <sup>3</sup> /kg)	Particulate Emission Factor (m <sup>3</sup> /kg)	Soil Saturation Concentration (mg/kg)
Aluminum	7429-90-5	No	No	1	PPRTV C	0.005	PPRTV C	-		-		-	1360000000	-
Antimony (metallic)	7440-36-0	No	No	0.0004	IRIS	-		-		-		-	1360000000	-
Aroclor 1254	11097-69-1	No	No	0.00002	IRIS	-		2	SURROGA	0.000571	SURROGA	-	1360000000	-
Arsenic, Inorganic	7440-38-2	No	No	0.0003	IRIS	0.000015	CALEPA	1.5	IRIS	0.0043	IRIS	-	1360000000	-
Barium	7440-39-3	No	No	0.2	IRIS	0.0005	HEAST	-		-		-	1360000000	-
Benzo[a]pyrene	50-32-8	Yes	No	-		-		7.3	IRIS	0.0011	CALEPA	-	1360000000	-
Bis(2-ethylhexyl)phthalate	117-81-7	No	No	0.02	IRIS	-		0.014	IRIS	0.0000024	CALEPA	-	1360000000	-
Cadmium (Diet)	7440-43-9	No	No	0.001	IRIS	0.00001	ATSDR F	-		0.0018	IRIS	-	1360000000	-
Chlordane	12789-03-6	No	No	0.0005	IRIS	0.0007	IRIS	0.35	IRIS	0.0001	IRIS	-	1360000000	-
Chlordane (alpha)	5103-71-9	No	No	-		-		-		-		-	1360000000	-
Chlordane (gamma)	5103-74-2	No	No	-		-		-		-		-	1360000000	-
Chloroform	67-66-3	No	Yes	0.01	IRIS	0.0977	ATSDR F	0.031	CALEPA	0.000023	IRIS	2630	1360000000	2540
Chromium(VI)	18540-29-9	Yes	No	0.003	IRIS	0.0001	IRIS	0.5	NJEPA	0.084	SURROGA	-	1360000000	-
Chromium, Total	7440-47-3	No	No	-		-		-		-		-	1360000000	-
DDD	72-54-8	No	No	0.002	PPRTV A	-		0.24	IRIS	0.000069	CALEPA	-	1360000000	-
DDE, p,p'	72-55-9	No	No	-		-		0.34	IRIS	0.000097	CALEPA	-	1360000000	-
DDT	50-29-3	No	No	0.0005	IRIS	-		0.34	IRIS	0.000097	IRIS	-	1360000000	-
DDT/DDE/DDD (total)	-05-1	No	No	-		-		-		-		-	1360000000	-
Dieldrin	60-57-1	No	No	0.00005	IRIS	-		16	IRIS	0.0046	IRIS	-	1360000000	-
Endrin	72-20-8	No	No	0.0003	IRIS	-		-		-		-	1360000000	-
Iron	7439-89-6	No	No	0.7	PPRTV C	-		-		-		-	1360000000	-
Lead and Compounds	7439-92-1	No	No	-		-		0.0085	CALEPA	0.000012	CALEPA	-	1360000000	-
Manganese (Non-diet)	7439-96-5	No	No	0.024	SURROGA	0.00005	IRIS	-		-		-	1360000000	-
Mercury (elemental)	7439-97-6	No	Yes	0.00016	CALEPA	0.0003	IRIS	-		-		30100	1360000000	3.13
Mercury, Inorganic Salts	-01-7	No	No	0.0003	SURROGA	-		-		-		-	1360000000	-
Nickel Soluble Salts	7440-02-0	No	No	0.02	IRIS	0.00009	ATSDR F	-		0.00026	CALEPA	-	1360000000	-
Pentachlorophenol	87-86-5	No	No	0.005	IRIS	-		0.4	IRIS	0.0000051	CALEPA	-	1360000000	-
Selenium	7782-49-2	No	No	0.005	IRIS	0.02	CALEPA	-		-		-	1360000000	-
Vanadium	-06-6	No	No	0.00504	SURROGA	-		-		-		-	1360000000	-
Vanadium and Compounds	7440-62-2	No	No	0.00504	SURROGA	0.0001	ATSDR F	-		-		-	1360000000	-
Zinc and Compounds	7440-66-6	No	No	0.3	IRIS	-		-		-		-	1360000000	-

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**Indoor Worker PRG  
For Soil**

Chemical	CAS Number	Ingestion PRG TR=1.0E-4 (mg/kg)	Inhalation PRG TR=1.0E-4 (mg/kg)	Carcinogenic PRG TR=1.0E-4 (mg/kg)	Ingestion PRG HQ=1 (mg/kg)	Inhalation PRG HQ=1 (mg/kg)	Noncarcinogenic PRG HI=1 (mg/kg)
Aluminum	7429-90-5	-	-	-	2340000	29800000	2170000
Antimony (metallic)	7440-36-0	-	-	-	934	-	934
Aroclor 1254	11097-69-1	327	2920000	327	46.7	-	46.7
Arsenic, Inorganic	7440-38-2	436	388000	436	701	89300	695
Barium	7440-39-3	-	-	-	467000	2980000	404000
Benzo[a]pyrene	50-32-8	89.6	1520000	89.6	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	46700	695000000	46700	46700	-	46700
Cadmium (Diet)	7440-43-9	-	926000	926000	2340	59500	2250
Chlordane	12789-03-6	1870	16700000	1870	1170	4170000	1170
Chlordane (alpha)	5103-71-9	-	-	-	-	-	-
Chlordane (gamma)	5103-74-2	-	-	-	-	-	-
Chloroform	67-66-3	21100	140	139	23400	1120	1070
Chromium(VI)	18540-29-9	1310	19800	1230	7010	595000	6930
Chromium, Total	7440-47-3	-	-	-	-	-	-
DDD	72-54-8	2730	24200000	2730	4670	-	4670
DDE, p,p'	72-55-9	1920	17200000	1920	-	-	-
DDT	50-29-3	1920	17200000	1920	1170	-	1170
DDT/DDE/DDD (total)	-05-1	-	-	-	-	-	-
Dieldrin	60-57-1	40.9	362000	40.9	117	-	117
Endrin	72-20-8	-	-	-	701	-	701
Iron	7439-89-6	-	-	-	1640000	-	1640000
Lead and Compounds	7439-92-1	77000	139000000	76900	-	-	-
Manganese (Non-diet)	7439-96-5	-	-	-	56100	298000	47200
Mercury (elemental)	7439-97-6	-	-	-	374	39.6	35.8
Mercury, Inorganic Salts	-01-7	-	-	-	701	-	701
Nickel Soluble Salts	7440-02-0	-	6410000	6410000	46700	536000	43000
Pentachlorophenol	87-86-5	1640	327000000	1640	11700	-	11700
Selenium	7782-49-2	-	-	-	11700	119000000	11700
Vanadium	-06-6	-	-	-	11800	-	11800
Vanadium and Compounds	7440-62-2	-	-	-	11800	595000	11500
Zinc and Compounds	7440-66-6	-	-	-	701000	-	701000

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**Evaluation Basis — Excavation Worker Scenario**

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**Excavation Worker Equation Inputs  
For Soil**

Variable	Value
TR (target cancer risk) unitless	0.0001
THQ (target hazard quotient) unitless	1
AT <sub>cw</sub> (averaging time - excavation worker)	365
EF <sub>cw</sub> (exposure frequency - excavation worker) day/yr	20
ED <sub>cw</sub> (exposure duration - excavation worker) yr	1
ET <sub>cw</sub> (exposure time - excavation worker) hr	8
LT (lifetime) yr	70
BW <sub>cw</sub> (body weight - excavation worker) kg	80
IR <sub>cw</sub> (soil ingestion rate - excavation worker) mg/day	330
SA <sub>cw</sub> (surface area - excavation worker) cm <sup>2</sup> /day	3470
AF <sub>cw</sub> (skin adherence factor - excavation worker) mg/cm <sup>2</sup>	0.3
City (Climate Zone) PEF Selection	Default
A <sub>s</sub> (acres) PEF Selection	0.5
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) PEF Selection	93.77
PEF (particulate emission factor) m <sup>3</sup> /kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U <sub>m</sub> (mean annual wind speed) m/s	4.69
U <sub>t</sub> (equivalent threshold value)	11.32
F(x) (function dependant on U <sub>m</sub> /U <sub>t</sub> ) unitless	0.194
City (Climate Zone) VF Selection	Default
A <sub>s</sub> (acres) VF Selection	0.5
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) VF Selection	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ <sub>b</sub> (dry soil bulk density) g/cm <sup>3</sup>	1.5
ρ <sub>s</sub> (soil particle density) g/cm <sup>3</sup>	2.65
θ <sub>w</sub> (water-filled soil porosity) L <sub>water</sub> /L <sub>soil</sub>	0.15
T (exposure interval) s	819936000

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**Excavation Worker PRG  
For Soil**

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Reference	Chronic RfC (mg/m <sup>3</sup> )	RfC Reference	Ingestion SF (mg/kg-day) <sup>-1</sup>	SFO Reference	Inhalation Unit Risk (ug/m <sup>3</sup> ) <sup>-1</sup>	IUR Reference	ABS <sub>d</sub>	ABS <sub>gi</sub>	Volatilization Factor (m <sup>3</sup> /kg)	Particulate Emission Factor (m <sup>3</sup> /kg)
Aluminum	7429-90-5	No	No	1	PPRTV C	0.005	PPRTV C	-	-	-	-	-	1	-	1360000000
Antimony (metallic)	7440-36-0	No	No	0.0004	IRIS	-	-	-	-	-	-	-	0.15	-	1360000000
Aroclor 1254	11097-69-1	No	No	0.00002	IRIS	-	-	2	SURROGA	0.000571	SURROGA	0.14	1	-	1360000000
Arsenic, Inorganic	7440-38-2	No	No	0.0003	IRIS	0.000015	CALEPA	1.5	IRIS	0.0043	IRIS	0.03	1	-	1360000000
Barium	7440-39-3	No	No	0.2	IRIS	0.0005	HEAST	-	-	-	-	-	0.07	-	1360000000
Benzo[a]pyrene	50-32-8	Yes	No	-	-	-	-	7.3	IRIS	0.0011	CALEPA	0.13	1	-	1360000000
Bis(2-ethylhexyl)phthalate	117-81-7	No	No	0.02	IRIS	-	-	0.014	IRIS	0.0000024	CALEPA	0.1	1	-	1360000000
Cadmium (Diet)	7440-43-9	No	No	0.001	IRIS	0.00001	ATSDR F	-	-	0.0018	IRIS	0.001	0.025	-	1360000000
Chlordane	12789-03-6	No	No	0.0005	IRIS	0.0007	IRIS	0.35	IRIS	0.0001	IRIS	0.04	1	-	1360000000
Chlordane (alpha)	5103-71-9	No	No	-	-	-	-	-	-	-	-	0.1	1	-	1360000000
Chlordane (gamma)	5103-74-2	No	No	-	-	-	-	-	-	-	-	0.1	1	-	1360000000
Chloroform	67-66-3	No	Yes	0.01	IRIS	0.0977	ATSDR F	0.031	CALEPA	0.000023	IRIS	-	1	2630	1360000000
Chromium(VI)	18540-29-9	Yes	No	0.003	IRIS	0.0001	IRIS	0.5	NJEPA	0.084	SURROGA	-	0.025	-	1360000000
Chromium, Total	7440-47-3	No	No	-	-	-	-	-	-	-	-	-	0.013	-	1360000000
DDD	72-54-8	No	No	0.002	PPRTV A	-	-	0.24	IRIS	0.000069	CALEPA	0.1	1	-	1360000000
DDE, p,p'	72-55-9	No	No	-	-	-	-	0.34	IRIS	0.000097	CALEPA	0.1	1	-	1360000000
DDT	50-29-3	No	No	0.0005	IRIS	-	-	0.34	IRIS	0.000097	IRIS	0.03	1	-	1360000000
DDT/DDE/DDD (total)	-05-1	No	No	-	-	-	-	-	-	-	-	0.1	1	-	1360000000
Dieldrin	60-57-1	No	No	0.00005	IRIS	-	-	16	IRIS	0.0046	IRIS	0.1	1	-	1360000000
Endrin	72-20-8	No	No	0.0003	IRIS	-	-	-	-	-	-	0.1	1	-	1360000000
Iron	7439-89-6	No	No	0.7	PPRTV C	-	-	-	-	-	-	-	1	-	1360000000
Lead and Compounds	7439-92-1	No	No	-	-	-	-	0.0085	CALEPA	0.000012	CALEPA	-	1	-	1360000000
Manganese (Non-diet)	7439-96-5	No	No	0.024	SURROGA	0.00005	IRIS	-	-	-	-	-	0.04	-	1360000000
Mercury (elemental)	7439-97-6	No	Yes	0.00016	CALEPA	0.0003	IRIS	-	-	-	-	-	1	30100	1360000000
Mercury, Inorganic Salts	-01-7	No	No	0.0003	SURROGA	-	-	-	-	-	-	-	0.07	-	1360000000
Nickel Soluble Salts	7440-02-0	No	No	0.02	IRIS	0.00009	ATSDR F	-	-	0.00026	CALEPA	-	0.04	-	1360000000
Pentachlorophenol	87-86-5	No	No	0.005	IRIS	-	-	0.4	IRIS	0.0000051	CALEPA	0.25	1	-	1360000000
Selenium	7782-49-2	No	No	0.005	IRIS	0.02	CALEPA	-	-	-	-	-	1	-	1360000000
Vanadium	-06-6	No	No	0.00504	SURROGA	-	-	-	-	-	-	-	0.026	-	1360000000
Vanadium and Compounds	7440-62-2	No	No	0.00504	SURROGA	0.0001	ATSDR F	-	-	-	-	-	0.026	-	1360000000
Zinc and Compounds	7440-66-6	No	No	0.3	IRIS	-	-	-	-	-	-	-	1	-	1360000000

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**Excavation Worker PRG  
For Soil**

Chemical	CAS Number	Soil Saturation Concentration (mg/kg)	Ingestion PRG TR=1.0E-4 (mg/kg)	Inhalation PRG TR=1.0E-4 (mg/kg)	Dermal PRG TR=1.0E-4 (mg/kg)	Carcinogenic PRG TR=1.0E-4 (mg/kg)	Ingestion PRG HQ=1 (mg/kg)	Inhalation PRG HQ=1 (mg/kg)	Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic PRG HI=1 (mg/kg)
Aluminum	7429-90-5	-	-	-	-	-	4420000	372000000	-	4370000
Antimony (metallic)	7440-36-0	-	-	-	-	-	1770	-	-	1770
Aroclor 1254	11097-69-1	-	15500	912000000	35100	10700	88.5	-	200	61.4
Arsenic, Inorganic	7440-38-2	-	20600	121000000	218000	18900	1330	1120000	14000	1210
Barium	7440-39-3	-	-	-	-	-	885000	37200000	-	864000
Benzo[a]pyrene	50-32-8	-	4240	474000000	10300	3010	-	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	-	2210000	2.17E+11	7010000	1680000	88500	-	280000	67300
Cadmium (Diet)	7440-43-9	-	-	289000000	-	289000000	4420	744000	35100	3910
Chlordane	12789-03-6	-	88500	521000000	701000	78600	2210	52100000	17500	1960
Chlordane (alpha)	5103-71-9	-	-	-	-	-	-	-	-	-
Chlordane (gamma)	5103-74-2	-	-	-	-	-	-	-	-	-
Chloroform	67-66-3	2540	999000	43800	-	41900	44200	14000	-	10700
Chromium(VI)	18540-29-9	-	61900	6200000	-	61300	13300	7440000	-	13200
Chromium, Total	7440-47-3	-	-	-	-	-	-	-	-	-
DDD	72-54-8	-	129000	755000000	409000	98100	8850	-	28000	6730
DDE, p,p'	72-55-9	-	91100	537000000	289000	69200	-	-	-	-
DDT	50-29-3	-	91100	537000000	962000	83200	2210	-	23400	2020
DDT/DDE/DDD (total)	-05-1	-	-	-	-	-	-	-	-	-
Dieldrin	60-57-1	-	1940	113000000	6140	1470	221	-	701	168
Endrin	72-20-8	-	-	-	-	-	1330	-	4210	1010
Iron	7439-89-6	-	-	-	-	-	3100000	-	-	3100000
Lead and Compounds	7439-92-1	-	3640000	4340000000	-	3640000	-	-	-	-
Manganese (Non-diet)	7439-96-5	-	-	-	-	-	106000	3720000	-	103000
Mercury (elemental)	7439-97-6	3.13	-	-	-	-	708	495	-	291
Mercury, Inorganic Salts	-01-7	-	-	-	-	-	1330	-	-	1330
Nickel Soluble Salts	7440-02-0	-	-	200000000	-	200000000	88500	6700000	-	87300
Pentachlorophenol	87-86-5	-	77400	1.02E+11	98200	43300	22100	-	28000	12400
Selenium	7782-49-2	-	-	-	-	-	22100	149000000	-	22100
Vanadium	-06-6	-	-	-	-	-	22300	-	-	22300
Vanadium and Compounds	7440-62-2	-	-	-	-	-	22300	7440000	-	22200
Zinc and Compounds	7440-66-6	-	-	-	-	-	1330000	-	-	1330000

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**Evaluation Basis — Recreationist Scenario**

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**Recreator Equation Inputs  
For Soil/Sediment**

Variable	Value
TR (target cancer risk) unitless	0.0001
ED <sub>r</sub> (exposure duration - recreator) years	26
ET <sub>r</sub> (exposure time - recreator) hours	1
ED <sub>c</sub> (exposure duration - child) years	6
BW <sub>a</sub> (body weight - adult) kg	80
BW <sub>c</sub> (body weight - child) kg	15
SA <sub>a</sub> (skin surface area - adult) cm <sup>2</sup> /day	6032
SA <sub>c</sub> (skin surface area - child) cm <sup>2</sup> /day	2690
THQ (target hazard quotient) unitless	1
LT (lifetime - recreator) yr	70
EF <sub>r</sub> (exposure frequency) d/yr	75
IRS <sub>a</sub> (soil intake rate - adult) mg/day	100
IRS <sub>c</sub> (soil intake rate - child) mg/day	200
AF <sub>a</sub> (skin adherence factor - adult) mg/cm <sup>2</sup>	0.07
AF <sub>c</sub> (skin adherence factor - child) mg/cm <sup>2</sup>	0.2
IFS <sub>adj</sub> (age-adjusted soil ingestion factor) mg/kg	7875
DFS <sub>adj</sub> (age-adjusted soil dermal factor) mg/kg	24057
IFSM <sub>adj</sub> (mutagenic age-adjusted soil ingestion factor) mg/kg	35750
DFSM <sub>adj</sub> (mutagenic age-adjusted soil dermal factor) mg/kg	101914
AF <sub>0-2</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.2
AF <sub>2-6</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.2
AF <sub>6-16</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.07
AF <sub>16-30</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.07
BW <sub>0-2</sub> (body weight) kg	15
BW <sub>2-6</sub> (body weight) kg	15
BW <sub>6-16</sub> (body weight) kg	80
BW <sub>16-30</sub> (body weight) kg	80
ED <sub>0-2</sub> (exposure duration) year	2
ED <sub>2-6</sub> (exposure duration) year	4
ED <sub>6-16</sub> (exposure duration) year	10
ED <sub>16-30</sub> (exposure duration) year	10
EF <sub>0-2</sub> (exposure frequency) day/year	75
EF <sub>2-6</sub> (exposure frequency) day/year	75
EF <sub>6-16</sub> (exposure frequency) day/year	75
EF <sub>16-30</sub> (exposure frequency) day/year	75
ET <sub>0-2</sub> (exposure time) hour/day	1
ET <sub>2-6</sub> (exposure time) hour/day	1
ET <sub>6-16</sub> (exposure time) hour/day	1
ET <sub>16-30</sub> (exposure time) hour/day	1
IRS <sub>0-2</sub> (soil intake rate) mg/day	200
IRS <sub>2-6</sub> (soil intake rate) mg/day	200
IRS <sub>6-16</sub> (soil intake rate) mg/day	100

**Recreator Equation Inputs  
For Soil/Sediment**

Variable	Value
IRS <sub>16-30</sub> (soil intake rate) mg/day	100
SA <sub>0-2</sub> (skin surface area) cm <sup>2</sup> /day	2690
SA <sub>2-6</sub> (skin surface area) cm <sup>2</sup> /day	2690
SA <sub>6-16</sub> (skin surface area) cm <sup>2</sup> /day	6032
SA <sub>16-30</sub> (skin surface area) cm <sup>2</sup> /day	6032
City (Climate Zone) PEF Selection	Default
A <sub>s</sub> (acres) PEF Selection	0.5
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) PEF Selection	93.77
PEF (particulate emission factor) m <sup>3</sup> /kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U <sub>m</sub> (mean annual wind speed) m/s	4.69
U <sub>t</sub> (equivalent threshold value)	11.32
F(x) (function dependant on U <sub>m</sub> /U <sub>t</sub> ) unitless	0.194
City (Climate Zone) VF Selection	Default
A <sub>s</sub> (acres) VF Selection	0.5
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) VF Selection	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ <sub>b</sub> (dry soil bulk density) g/cm <sup>3</sup>	1.5
ρ <sub>s</sub> (soil particle density) g/cm <sup>3</sup>	2.65
θ <sub>w</sub> (water-filled soil porosity) L <sub>water</sub> /L <sub>soil</sub>	0.15
T (exposure interval) s	819936000

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**Recreator PRG  
For Soil/Sediment**

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Reference	Chronic RfC (mg/m <sup>3</sup> )	RfC Reference	Ingestion SF (mg/kg-day) <sup>-1</sup>	SFO Reference	Inhalation Unit Risk (ug/m <sup>3</sup> ) <sup>-1</sup>	IUR Reference	ABS <sub>derm</sub>	ABS <sub>gi</sub>	Volatilization Factor (m <sup>3</sup> /kg)
Aluminum	7429-90-5	No	No	1	PPRTV C	0.005	PPRTV C	-	-	-	-	-	1	-
Antimony (metallic)	7440-36-0	No	No	0.0004	IRIS	-	-	-	-	-	-	-	0.15	-
Aroclor 1254	11097-69-1	No	No	0.00002	IRIS	-	-	2	SURROGA	0.000571	SURROGA	0.14	1	-
Arsenic, Inorganic	7440-38-2	No	No	0.0003	IRIS	0.000015	CALEPA	1.5	IRIS	0.0043	IRIS	0.03	1	-
Barium	7440-39-3	No	No	0.2	IRIS	0.0005	HEAST	-	-	-	-	-	0.07	-
Benzo[a]pyrene	50-32-8	Yes	No	-	-	-	-	7.3	IRIS	0.0011	CALEPA	0.13	1	-
Bis(2-ethylhexyl)phthalate	117-81-7	No	No	0.02	IRIS	-	-	0.014	IRIS	0.0000024	CALEPA	0.1	1	-
Cadmium (Diet)	7440-43-9	No	No	0.001	IRIS	0.00001	ATSDR F	-	-	0.0018	IRIS	0.001	0.025	-
Chlordane	12789-03-6	No	No	0.0005	IRIS	0.0007	IRIS	0.35	IRIS	0.0001	IRIS	0.04	1	-
Chlordane (alpha)	5103-71-9	No	No	-	-	-	-	-	-	-	-	0.1	1	-
Chlordane (gamma)	5103-74-2	No	No	-	-	-	-	-	-	-	-	0.1	1	-
Chloroform	67-66-3	No	Yes	0.01	IRIS	0.0977	ATSDR F	0.031	CALEPA	0.000023	IRIS	-	1	2630
Chromium(VI)	18540-29-9	Yes	No	0.003	IRIS	0.0001	IRIS	0.5	NJEPA	0.084	SURROGA	-	0.025	-
Chromium, Total	7440-47-3	No	No	-	-	-	-	-	-	-	-	-	0.013	-
DDD	72-54-8	No	No	0.002	PPRTV A	-	-	0.24	IRIS	0.000069	CALEPA	0.1	1	-
DDE, p,p'	72-55-9	No	No	-	-	-	-	0.34	IRIS	0.000097	CALEPA	0.1	1	-
DDT	50-29-3	No	No	0.0005	IRIS	-	-	0.34	IRIS	0.000097	IRIS	0.03	1	-
DDT/DDE/DDD (total)	-05-1	No	No	-	-	-	-	-	-	-	-	0.1	1	-
Dieldrin	60-57-1	No	No	0.00005	IRIS	-	-	16	IRIS	0.0046	IRIS	0.1	1	-
Endrin	72-20-8	No	No	0.0003	IRIS	-	-	-	-	-	-	0.1	1	-
Iron	7439-89-6	No	No	0.7	PPRTV C	-	-	-	-	-	-	-	1	-
Lead and Compounds	7439-92-1	No	No	-	-	-	-	0.0085	CALEPA	0.000012	CALEPA	-	1	-
Manganese (Non-diet)	7439-96-5	No	No	0.024	SURROGA	0.00005	IRIS	-	-	-	-	-	0.04	-
Mercury (elemental)	7439-97-6	No	Yes	0.00016	CALEPA	0.0003	IRIS	-	-	-	-	-	1	30100
Mercury, Inorganic Salts	-01-7	No	No	0.0003	SURROGA	-	-	-	-	-	-	-	0.07	-
Nickel Soluble Salts	7440-02-0	No	No	0.02	IRIS	0.00009	ATSDR F	-	-	0.00026	CALEPA	-	0.04	-
Pentachlorophenol	87-86-5	No	No	0.005	IRIS	-	-	0.4	IRIS	0.0000051	CALEPA	0.25	1	-
Selenium	7782-49-2	No	No	0.005	IRIS	0.02	CALEPA	-	-	-	-	-	1	-
Vanadium	-06-6	No	No	0.00504	SURROGA	-	-	-	-	-	-	-	0.026	-
Vanadium and Compounds	7440-62-2	No	No	0.00504	SURROGA	0.0001	ATSDR F	-	-	-	-	-	0.026	-
Zinc and Compounds	7440-66-6	No	No	0.3	IRIS	-	-	-	-	-	-	-	1	-

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**Recreator PRG  
For Soil/Sediment**

Chemical	CAS Number	Particulate Emission Factor (m <sup>3</sup> /kg)	Soil Saturation Concentration (mg/kg)	Ingestion PRG TR=1.0E-4 (mg/kg)	Inhalation PRG TR=1.0E-4 (mg/kg)	Dermal PRG TR=1.0E-4 (mg/kg)	Carcinogenic PRG TR=1.0E-4 (mg/kg)	Child Ingestion PRG HQ=1 (mg/kg)	Child Inhalation PRG HQ=1 (mg/kg)	Child Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Child PRG HI=1 (mg/kg)
Aluminum	7429-90-5	1360000000	-	-	-	-	-	365000	794000000	-	365000
Antimony (metallic)	7440-36-0	1360000000	-	-	-	-	-	146	-	-	146
Aroclor 1254	11097-69-1	1360000000	-	162	74800000	379	114	7.3	-	19.4	5.3
Arsenic, Inorganic	7440-38-2	1360000000	-	216	9940000	2360	198	110	2380000	1360	101
Barium	7440-39-3	1360000000	-	-	-	-	-	73000	79400000	-	72900
Benzo[a]pyrene	50-32-8	1360000000	-	9.79	14000000	26.4	7.14	-	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	1360000000	-	23200	17800000000	75900	17800	7300	-	27100	5750
Cadmium (Diet)	7440-43-9	1360000000	-	-	23700000	-	23700000	365	1590000	3390	329
Chlordane	12789-03-6	1360000000	-	927	427000000	7590	826	183	111000000	1700	165
Chlordane (alpha)	5103-71-9	1360000000	-	-	-	-	-	-	-	-	-
Chlordane (gamma)	5103-74-2	1360000000	-	-	-	-	-	-	-	-	-
Chloroform	67-66-3	1360000000	2540	10500	3590	-	2670	3650	30000	-	3250
Chromium(VI)	18540-29-9	1360000000	-	143	184000	-	143	1100	15900000	-	1090
Chromium, Total	7440-47-3	1360000000	-	-	-	-	-	-	-	-	-
DDD	72-54-8	1360000000	-	1350	619000000	4430	1040	730	-	2710	575
DDE, p,p'	72-55-9	1360000000	-	954	441000000	3120	731	-	-	-	-
DDT	50-29-3	1360000000	-	954	441000000	10400	874	183	-	2260	169
DDT/DDE/DDD (total)	-05-1	1360000000	-	-	-	-	-	-	-	-	-
Dieldrin	60-57-1	1360000000	-	20.3	9290000	66.4	15.5	18.3	-	67.8	14.4
Endrin	72-20-8	1360000000	-	-	-	-	-	110	-	407	86.3
Iron	7439-89-6	1360000000	-	-	-	-	-	256000	-	-	256000
Lead and Compounds	7439-92-1	1360000000	-	38200	3560000000	-	38200	-	-	-	-
Manganese (Non-diet)	7439-96-5	1360000000	-	-	-	-	-	8760	7940000	-	8750
Mercury (elemental)	7439-97-6	1360000000	3.13	-	-	-	-	58.4	1060	-	55.3
Mercury, Inorganic Salts	-01-7	1360000000	-	-	-	-	-	110	-	-	110
Nickel Soluble Salts	7440-02-0	1360000000	-	-	164000000	-	164000000	7300	14300000	-	7300
Pentachlorophenol	87-86-5	1360000000	-	811	8380000000	1060	460	1830	-	2710	1090
Selenium	7782-49-2	1360000000	-	-	-	-	-	1830	3180000000	-	1820
Vanadium	-06-6	1360000000	-	-	-	-	-	1840	-	-	1840
Vanadium and Compounds	7440-62-2	1360000000	-	-	-	-	-	1840	15900000	-	1840
Zinc and Compounds	7440-66-6	1360000000	-	-	-	-	-	110000	-	-	110000

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**Recreator PRG  
For Soil/Sediment**

Chemical	CAS Number	Adult Ingestion PRG HQ=1 (mg/kg)	Adult Inhalation PRG HQ=1 (mg/kg)	Adult Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Adult PRG HI=1 (mg/kg)	Adjusted Ingestion PRG HQ=1 (mg/kg)	Adjusted Inhalation PRG HQ=1 (mg/kg)	Adjusted Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Adjusted PRG HI=1 (mg/kg)
Aluminum	7429-90-5	3890000	794000000	-	3870000	1210000	794000000	-	1200000
Antimony (metallic)	7440-36-0	1560	-	-	1560	482	-	-	482
Aroclor 1254	11097-69-1	77.9	-	132	48.9	24.1	-	56.4	16.9
Arsenic, Inorganic	7440-38-2	1170	2380000	9220	1040	362	2380000	3940	331
Barium	7440-39-3	779000	79400000	-	771000	241000	79400000	-	240000
Benzo[a]pyrene	50-32-8	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	77900	-	184000	54700	24100	-	78900	18500
Cadmium (Diet)	7440-43-9	3890	1590000	23100	3320	1210	1590000	9860	1070
Chlordane	12789-03-6	1950	111000000	11500	1670	603	111000000	4930	537
Chlordane (alpha)	5103-71-9	-	-	-	-	-	-	-	-
Chlordane (gamma)	5103-74-2	-	-	-	-	-	-	-	-
Chloroform	67-66-3	38900	30000	-	16900	12100	30000	-	8590
Chromium(VI)	18540-29-9	11700	15900000	-	11700	3620	15900000	-	3610
Chromium, Total	7440-47-3	-	-	-	-	-	-	-	-
DDD	72-54-8	7790	-	18400	5470	2410	-	7890	1850
DDE, p,p'	72-55-9	-	-	-	-	-	-	-	-
DDT	50-29-3	1950	-	15400	1730	603	-	6570	552
DDT/DDE/DDD (total)	-05-1	-	-	-	-	-	-	-	-
Dieldrin	60-57-1	195	-	461	137	60.3	-	197	46.2
Endrin	72-20-8	1170	-	2770	821	362	-	1180	277
Iron	7439-89-6	2730000	-	-	2730000	844000	-	-	844000
Lead and Compounds	7439-92-1	-	-	-	-	-	-	-	-
Manganese (Non-diet)	7439-96-5	93400	7940000	-	92400	28900	7940000	-	28800
Mercury (elemental)	7439-97-6	623	1060	-	392	193	1060	-	163
Mercury, Inorganic Salts	-01-7	1170	-	-	1170	362	-	-	362
Nickel Soluble Salts	7440-02-0	77900	14300000	-	77400	24100	14300000	-	24100
Pentachlorophenol	87-86-5	19500	-	18400	9470	6030	-	7890	3420
Selenium	7782-49-2	19500	3180000000	-	19500	6030	3180000000	-	6030
Vanadium	-06-6	19600	-	-	19600	6070	-	-	6070
Vanadium and Compounds	7440-62-2	19600	15900000	-	19600	6070	15900000	-	6070
Zinc and Compounds	7440-66-6	1170000	-	-	1170000	362000	-	-	362000

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**Evaluation Basis — Resident Scenario**

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**Resident Equation Inputs  
For Soil**

Variable	Value
TR (target cancer risk) unitless	0.0001
ED <sub>ress</sub> (exposure duration - resident) year	26
ED <sub>ressc</sub> (exposure duration - child) year	6
ED <sub>ressa</sub> (exposure duration - adult) year	20
ET <sub>ress</sub> (exposure time - resident) hour	24
ET <sub>ressc</sub> (exposure time - child) hour	24
ET <sub>ressa</sub> (exposure time - adult) hour	24
BW <sub>ressa</sub> (body weight - adult) kg	80
BW <sub>ressc</sub> (body weight - child) kg	15
SA <sub>ressa</sub> (skin surface area - adult) cm <sup>2</sup> /day	6032
SA <sub>ressc</sub> (skin surface area - child) cm <sup>2</sup> /day	2690
THQ (target hazard quotient) unitless	1
LT (lifetime - resident) year	70
EF <sub>ress</sub> (exposure frequency - resident) day/year	350
EF <sub>ressc</sub> (exposure frequency - child) day/year	350
EF <sub>ressa</sub> (exposure frequency - adult) day/year	350
IRS <sub>ressa</sub> (soil intake rate - adult) mg/day	100
IRS <sub>ressc</sub> (soil intake rate - child) mg/day	200
AF <sub>ressa</sub> (skin adherence factor - adult) mg/cm <sup>2</sup>	0.07
AF <sub>ressc</sub> (skin adherence factor - child) mg/cm <sup>2</sup>	0.2
IFS <sub>res-adj</sub> (age-adjusted soil ingestion factor) mg/kg	36750
DFS <sub>res-adj</sub> (age-adjusted soil dermal factor) mg/kg	112266
IFSM <sub>res-adj</sub> (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3
DFSM <sub>res-adj</sub> (mutagenic age-adjusted soil dermal factor) mg/kg	475598.7
AF <sub>0-2</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.2
AF <sub>2-6</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.2
AF <sub>6-16</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.07
AF <sub>16-30</sub> (skin adherence factor) mg/cm <sup>2</sup>	0.07
BW <sub>0-2</sub> (body weight) kg	15
BW <sub>2-6</sub> (body weight) kg	15
BW <sub>6-16</sub> (body weight) kg	80
BW <sub>16-30</sub> (body weight) kg	80
ED <sub>0-2</sub> (exposure duration) year	2
ED <sub>2-6</sub> (exposure duration) year	4
ED <sub>6-16</sub> (exposure duration) year	10
ED <sub>16-30</sub> (exposure duration) year	10
EF <sub>0-2</sub> (exposure frequency) day/year	350
EF <sub>2-6</sub> (exposure frequency) day/year	350
EF <sub>6-16</sub> (exposure frequency) day/year	350
EF <sub>16-30</sub> (exposure frequency) day/year	350
ET <sub>0-2</sub> (exposure time) hour/day	24
ET <sub>2-6</sub> (exposure time) hour/day	24
ET <sub>6-16</sub> (exposure time) hour/day	24

**Resident Equation Inputs  
For Soil**

Variable	Value
ET <sub>16-30</sub> (exposure time) hour/day	24
IRS <sub>0-2</sub> (soil intake rate) mg/day	200
IRS <sub>2-6</sub> (soil intake rate) mg/day	200
IRS <sub>6-16</sub> (soil intake rate) mg/day	100
IRS <sub>16-30</sub> (soil intake rate) mg/day	100
SA <sub>0-2</sub> (skin surface area) cm <sup>2</sup> /day	2690
SA <sub>2-6</sub> (skin surface area) cm <sup>2</sup> /day	2690
SA <sub>6-16</sub> (skin surface area) cm <sup>2</sup> /day	6032
SA <sub>16-30</sub> (skin surface area) cm <sup>2</sup> /day	6032
City (Climate Zone) PEF Selection	Default
A <sub>s</sub> (acres) PEF Selection	0.5
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) PEF Selection	93.77
PEF (particulate emission factor) m <sup>3</sup> /kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U <sub>m</sub> (mean annual wind speed) m/s	4.69
U <sub>t</sub> (equivalent threshold value)	11.32
F(x) (function dependant on U <sub>m</sub> /U <sub>t</sub> ) unitless	0.194
City (Climate Zone) VF Selection	Default
A <sub>s</sub> (acres) VF Selection	0.5
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
Q/C <sub>wp</sub> (g/m <sup>2</sup> -s per kg/m <sup>3</sup> ) VF Selection	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ <sub>b</sub> (dry soil bulk density) g/cm <sup>3</sup>	1.5
ρ <sub>s</sub> (soil particle density) g/cm <sup>3</sup>	2.65
θ <sub>w</sub> (water-filled soil porosity) L <sub>water</sub> /L <sub>soil</sub>	0.15
T (exposure interval) s	819936000

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**Resident PRG  
For Soil**

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Reference	Chronic RfC (mg/m <sup>3</sup> )	RfC Reference	Ingestion SF (mg/kg-day) <sup>-1</sup>	SFO Reference	Inhalation Unit Risk (ug/m <sup>3</sup> ) <sup>-1</sup>	IUR Reference	ABS <sub>derm</sub>	ABS <sub>gi</sub>	Volatilization Factor (m <sup>3</sup> /kg)
Aluminum	7429-90-5	No	No	1	PPRTV C	0.005	PPRTV C	-		-		-	1	-
Antimony (metallic)	7440-36-0	No	No	0.0004	IRIS	-		-		-		-	0.15	-
Aroclor 1254	11097-69-1	No	No	0.00002	IRIS	-		2	SURROGA	0.000571	SURROGA	0.14	1	-
Arsenic, Inorganic	7440-38-2	No	No	0.0003	IRIS	0.000015	CALEPA	1.5	IRIS	0.0043	IRIS	0.03	1	-
Barium	7440-39-3	No	No	0.2	IRIS	0.0005	HEAST	-		-		-	0.07	-
Benzo[a]pyrene	50-32-8	Yes	No	-		-		7.3	IRIS	0.0011	CALEPA	0.13	1	-
Bis(2-ethylhexyl)phthalate	117-81-7	No	No	0.02	IRIS	-		0.014	IRIS	0.0000024	CALEPA	0.1	1	-
Cadmium (Diet)	7440-43-9	No	No	0.001	IRIS	0.00001	ATSDR F	-		0.0018	IRIS	0.001	0.025	-
Chlordane	12789-03-6	No	No	0.0005	IRIS	0.0007	IRIS	0.35	IRIS	0.0001	IRIS	0.04	1	-
Chlordane (alpha)	5103-71-9	No	No	-		-		-		-		0.1	1	-
Chlordane (gamma)	5103-74-2	No	No	-		-		-		-		0.1	1	-
Chloroform	67-66-3	No	Yes	0.01	IRIS	0.0977	ATSDR F	0.031	CALEPA	0.000023	IRIS	-	1	2630
Chromium(VI)	18540-29-9	Yes	No	0.003	IRIS	0.0001	IRIS	0.5	NJEPA	0.084	SURROGA	-	0.025	-
Chromium, Total	7440-47-3	No	No	-		-		-		-		-	0.013	-
DDD	72-54-8	No	No	0.002	PPRTV A	-		0.24	IRIS	0.000069	CALEPA	0.1	1	-
DDE, p,p'	72-55-9	No	No	-		-		0.34	IRIS	0.000097	CALEPA	0.1	1	-
DDT	50-29-3	No	No	0.0005	IRIS	-		0.34	IRIS	0.000097	IRIS	0.03	1	-
DDT/DDE/DDD (total)	-05-1	No	No	-		-		-		-		0.1	1	-
Dieldrin	60-57-1	No	No	0.00005	IRIS	-		16	IRIS	0.0046	IRIS	0.1	1	-
Endrin	72-20-8	No	No	0.0003	IRIS	-		-		-		0.1	1	-
Iron	7439-89-6	No	No	0.7	PPRTV C	-		-		-		-	1	-
Lead and Compounds	7439-92-1	No	No	-		-		0.0085	CALEPA	0.000012	CALEPA	-	1	-
Manganese (Non-diet)	7439-96-5	No	No	0.024	SURROGA	0.00005	IRIS	-		-		-	0.04	-
Mercury (elemental)	7439-97-6	No	Yes	0.00016	CALEPA	0.0003	IRIS	-		-		-	1	30100
Mercury, Inorganic Salts	-01-7	No	No	0.0003	SURROGA	-		-		-		-	0.07	-
Nickel Soluble Salts	7440-02-0	No	No	0.02	IRIS	0.00009	ATSDR F	-		0.00026	CALEPA	-	0.04	-
Pentachlorophenol	87-86-5	No	No	0.005	IRIS	-		0.4	IRIS	0.0000051	CALEPA	0.25	1	-
Selenium	7782-49-2	No	No	0.005	IRIS	0.02	CALEPA	-		-		-	1	-
Vanadium	-06-6	No	No	0.00504	SURROGA	-		-		-		-	0.026	-
Vanadium and Compounds	7440-62-2	No	No	0.00504	SURROGA	0.0001	ATSDR F	-		-		-	0.026	-
Zinc and Compounds	7440-66-6	No	No	0.3	IRIS	-		-		-		-	1	-

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**Resident PRG  
For Soil**

Chemical	CAS Number	Particulate Emission Factor (m <sup>3</sup> /kg)	Soil Saturation Concentration (mg/kg)	Ingestion PRG TR=1.0E-4 (mg/kg)	Inhalation PRG TR=1.0E-4 (mg/kg)	Dermal PRG TR=1.0E-4 (mg/kg)	Carcinogenic PRG TR=1.0E-4 (mg/kg)	Child Ingestion PRG HQ=1 (mg/kg)	Child Inhalation PRG HQ=1 (mg/kg)	Child Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Child PRG HI=1 (mg/kg)	Adult Ingestion PRG HQ=1 (mg/kg)	Adult Inhalation PRG HQ=1 (mg/kg)
Aluminum	7429-90-5	1360000000	-	-	-	-	-	78200	7090000	-	77400	834000	7090000
Antimony (metallic)	7440-36-0	1360000000	-	-	-	-	-	31.3	-	-	31.3	334	-
Aroclor 1254	11097-69-1	1360000000	-	34.8	668000	81.3	24.3	1.56	-	4.15	1.14	16.7	-
Arsenic, Inorganic	7440-38-2	1360000000	-	46.3	88800	506	42.4	23.5	21300	291	21.7	250	21300
Barium	7440-39-3	1360000000	-	-	-	-	-	15600	709000	-	15300	167000	709000
Benzo[a]pyrene	50-32-8	1360000000	-	2.1	125000	5.66	1.53	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	1360000000	-	4970	159000000	16300	3800	1560	-	5820	1230	16700	-
Cadmium (Diet)	7440-43-9	1360000000	-	-	212000	-	212000	78.2	14200	727	70.3	834	14200
Chlordane	12789-03-6	1360000000	-	199	3820000	1630	177	39.1	992000	363	35.3	417	992000
Chlordane (alpha)	5103-71-9	1360000000	-	-	-	-	-	-	-	-	-	-	-
Chlordane (gamma)	5103-74-2	1360000000	-	-	-	-	-	-	-	-	-	-	-
Chloroform	67-66-3	1360000000	2540	2240	32.1	-	31.6	782	268	-	199	8340	268
Chromium(VI)	18540-29-9	1360000000	-	30.6	1640	-	30.1	235	142000	-	234	2500	142000
Chromium, Total	7440-47-3	1360000000	-	-	-	-	-	-	-	-	-	-	-
DDD	72-54-8	1360000000	-	290	5530000	948	222	156	-	582	123	1670	-
DDE, p,p'	72-55-9	1360000000	-	204	3930000	669	157	-	-	-	-	-	-
DDT	50-29-3	1360000000	-	204	3930000	2230	187	39.1	-	485	36.2	417	-
DDT/DDE/DDD (total)	-05-1	1360000000	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	60-57-1	1360000000	-	4.35	83000	14.2	3.33	3.91	-	14.5	3.08	41.7	-
Endrin	72-20-8	1360000000	-	-	-	-	-	23.5	-	87.2	18.5	250	-
Iron	7439-89-6	1360000000	-	-	-	-	-	54800	-	-	54800	584000	-
Lead and Compounds	7439-92-1	1360000000	-	8180	31800000	-	8180	-	-	-	-	-	-
Manganese (Non-diet)	7439-96-5	1360000000	-	-	-	-	-	1880	70900	-	1830	20000	70900
Mercury (elemental)	7439-97-6	1360000000	3.13	-	-	-	-	12.5	9.43	-	5.38	133	9.43
Mercury, Inorganic Salts	-01-7	1360000000	-	-	-	-	-	23.5	-	-	23.5	250	-
Nickel Soluble Salts	7440-02-0	1360000000	-	-	1470000	-	1470000	1560	128000	-	1550	16700	128000
Pentachlorophenol	87-86-5	1360000000	-	174	74800000	228	98.5	391	-	582	234	4170	-
Selenium	7782-49-2	1360000000	-	-	-	-	-	391	28400000	-	391	4170	28400000
Vanadium	-06-6	1360000000	-	-	-	-	-	394	-	-	394	4200	-
Vanadium and Compounds	7440-62-2	1360000000	-	-	-	-	-	394	142000	-	393	4200	142000
Zinc and Compounds	7440-66-6	1360000000	-	-	-	-	-	23500	-	-	23500	250000	-

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**Resident PRG  
For Soil**

Chemical	CAS Number	Adult Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Adult PRG HI=1 (mg/kg)	Adjusted Ingestion PRG HQ=1 (mg/kg)	Adjusted Inhalation PRG HQ=1 (mg/kg)	Adjusted Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Adjusted PRG HI=1 (mg/kg)
Aluminum	7429-90-5	-	746000	258000	7090000	-	249000
Antimony (metallic)	7440-36-0	-	334	103	-	-	103
Aroclor 1254	11097-69-1	28.2	10.5	5.16	-	12.1	3.62
Arsenic, Inorganic	7440-38-2	1980	220	77.5	21300	845	70.7
Barium	7440-39-3	-	135000	51600	709000	-	48100
Benzo[a]pyrene	50-32-8	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	39500	11700	5160	-	16900	3960
Cadmium (Diet)	7440-43-9	4940	680	258	14200	2110	226
Chlordane	12789-03-6	2470	357	129	992000	1060	115
Chlordane (alpha)	5103-71-9	-	-	-	-	-	-
Chlordane (gamma)	5103-74-2	-	-	-	-	-	-
Chloroform	67-66-3	-	259	2580	268	-	242
Chromium(VI)	18540-29-9	-	2460	775	142000	-	770
Chromium, Total	7440-47-3	-	-	-	-	-	-
DDD	72-54-8	3950	1170	516	-	1690	396
DDE, p,p'	72-55-9	-	-	-	-	-	-
DDT	50-29-3	3290	370	129	-	1410	118
DDT/DDE/DDD (total)	-05-1	-	-	-	-	-	-
Dieldrin	60-57-1	98.8	29.3	12.9	-	42.3	9.89
Endrin	72-20-8	593	176	77.5	-	254	59.3
Iron	7439-89-6	-	584000	181000	-	-	181000
Lead and Compounds	7439-92-1	-	-	-	-	-	-
Manganese (Non-diet)	7439-96-5	-	15600	6200	70900	-	5700
Mercury (elemental)	7439-97-6	-	8.81	41.3	9.43	-	7.68
Mercury, Inorganic Salts	-01-7	-	250	77.5	-	-	77.5
Nickel Soluble Salts	7440-02-0	-	14800	5160	128000	-	4960
Pentachlorophenol	87-86-5	3950	2030	1290	-	1690	732
Selenium	7782-49-2	-	4170	1290	28400000	-	1290
Vanadium	-06-6	-	4200	1300	-	-	1300
Vanadium and Compounds	7440-62-2	-	4080	1300	142000	-	1290
Zinc and Compounds	7440-66-6	-	250000	77500	-	-	77500

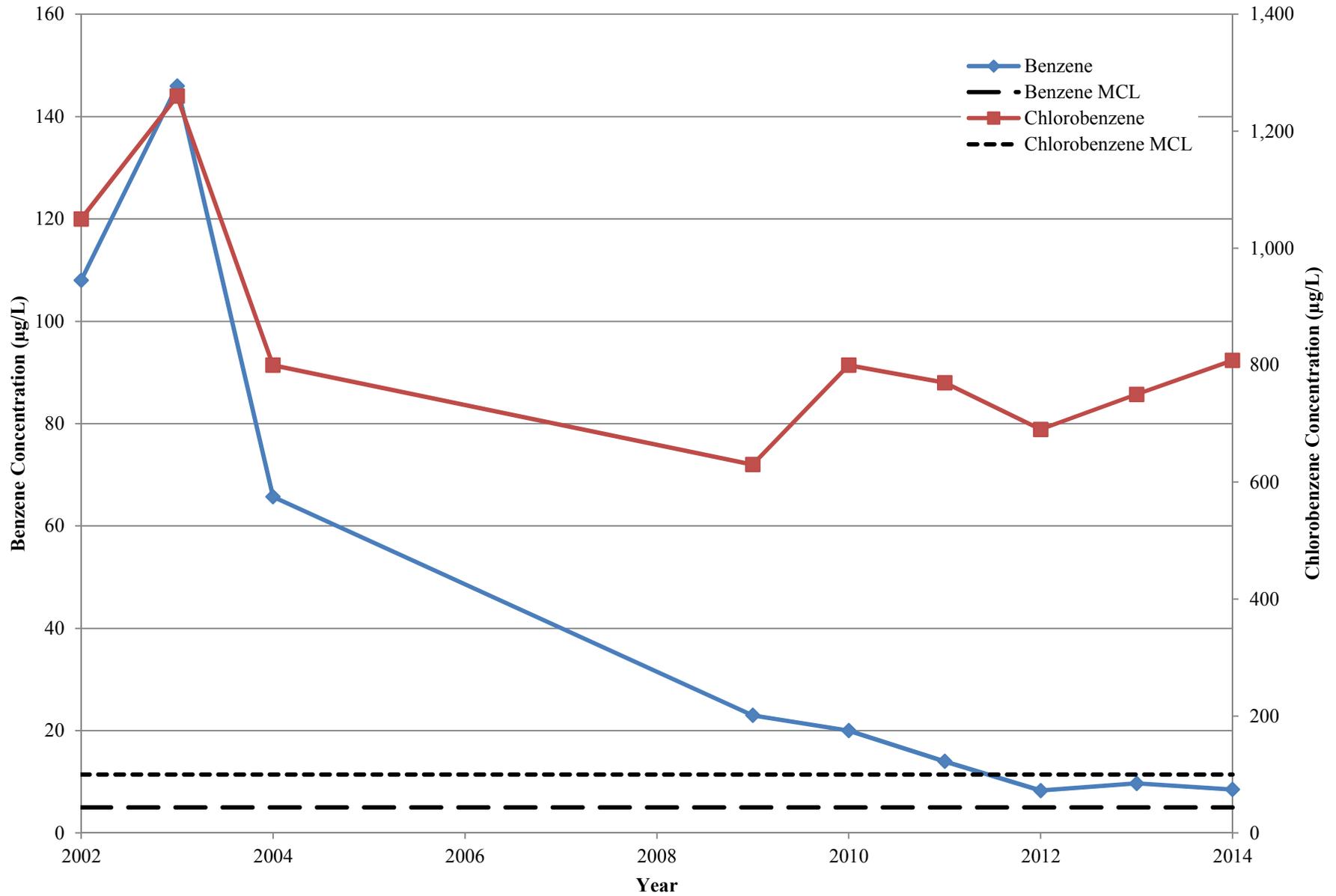
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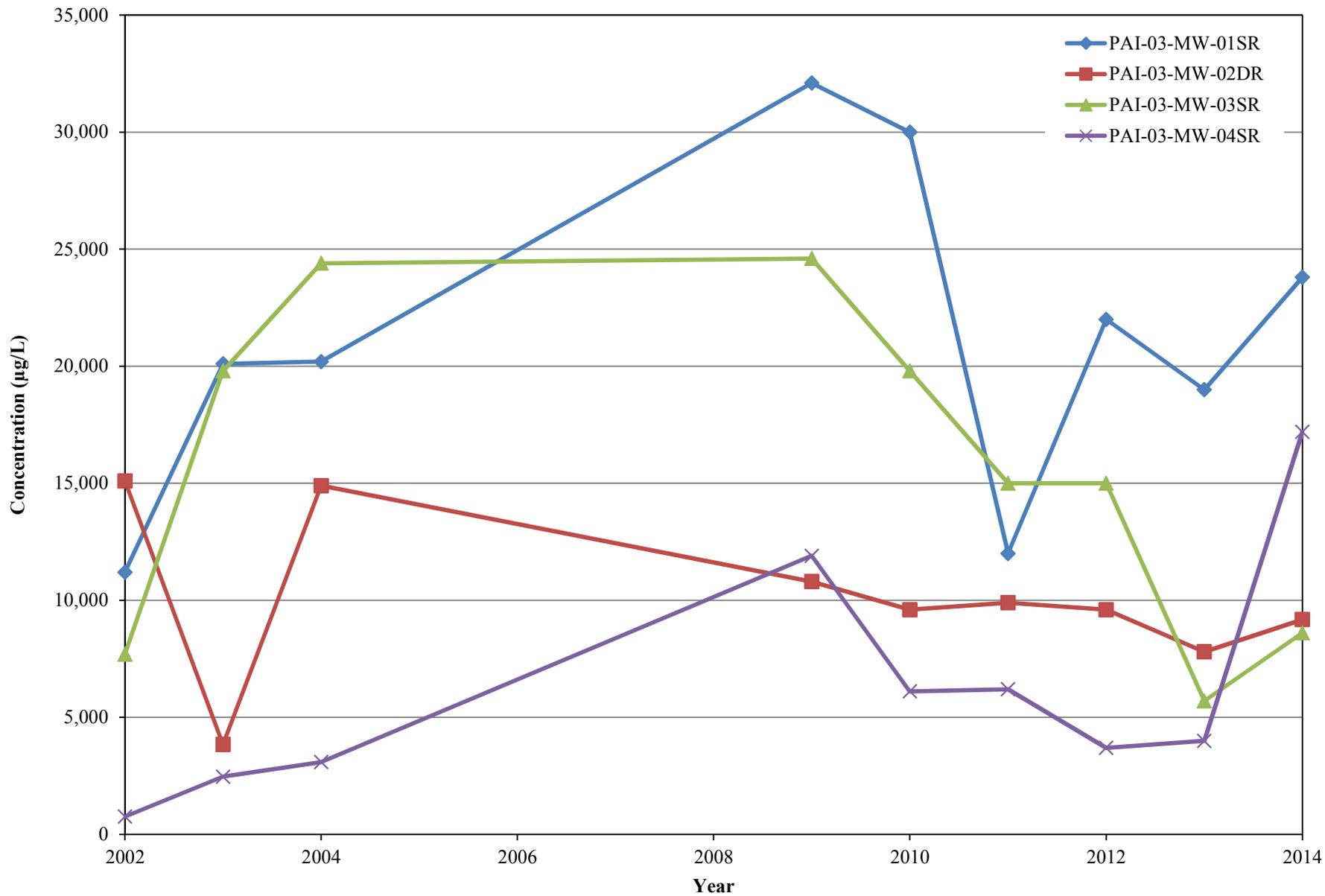
**Appendix H**  
**Site 3 Trend Graphs**

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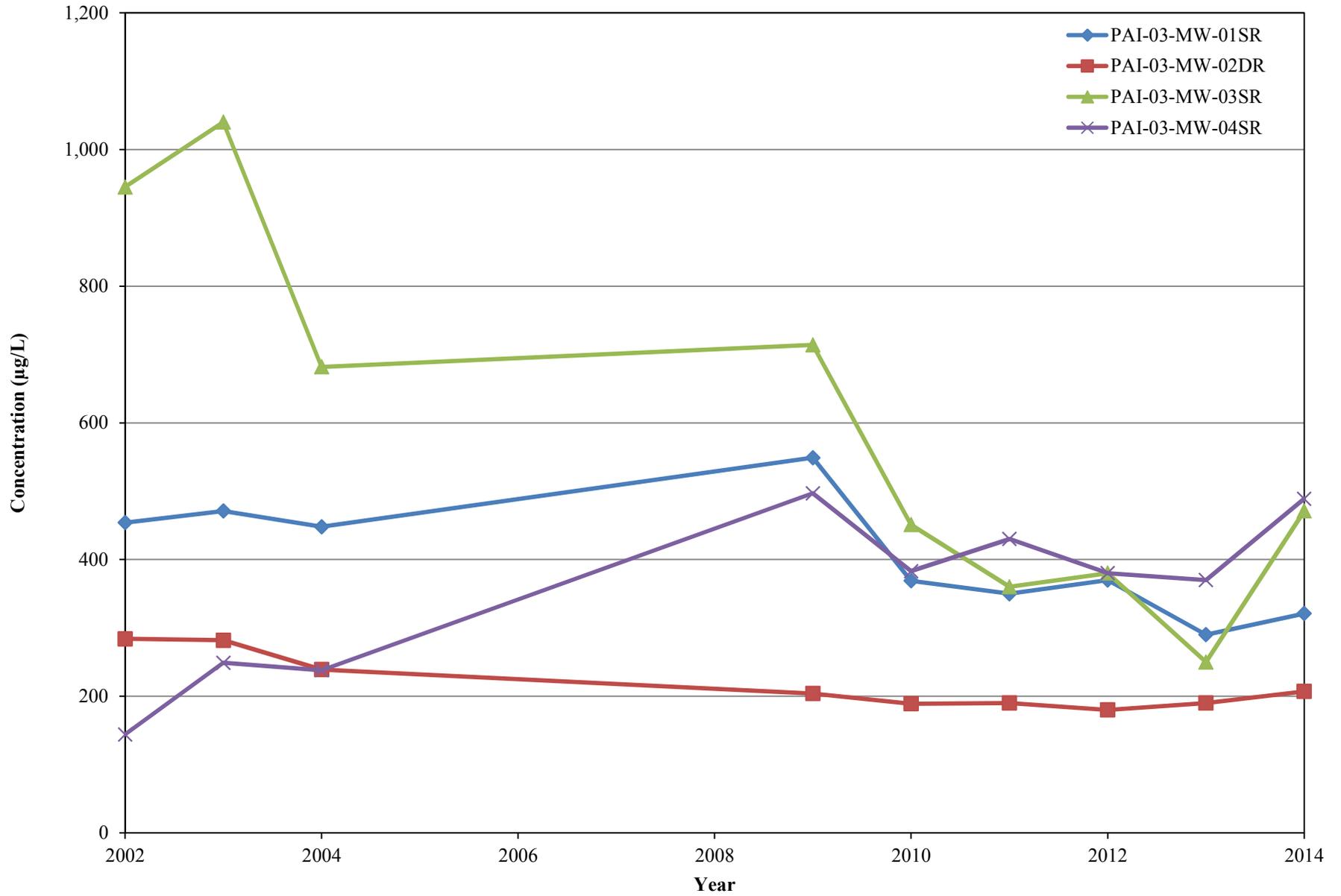
Figure 4 - Historical Benzene and Chlorobenzene Concentrations in PAI-03-MW-01SR



**Figure 5 - Historical Iron Concentrations in SWMU 3 Wells**



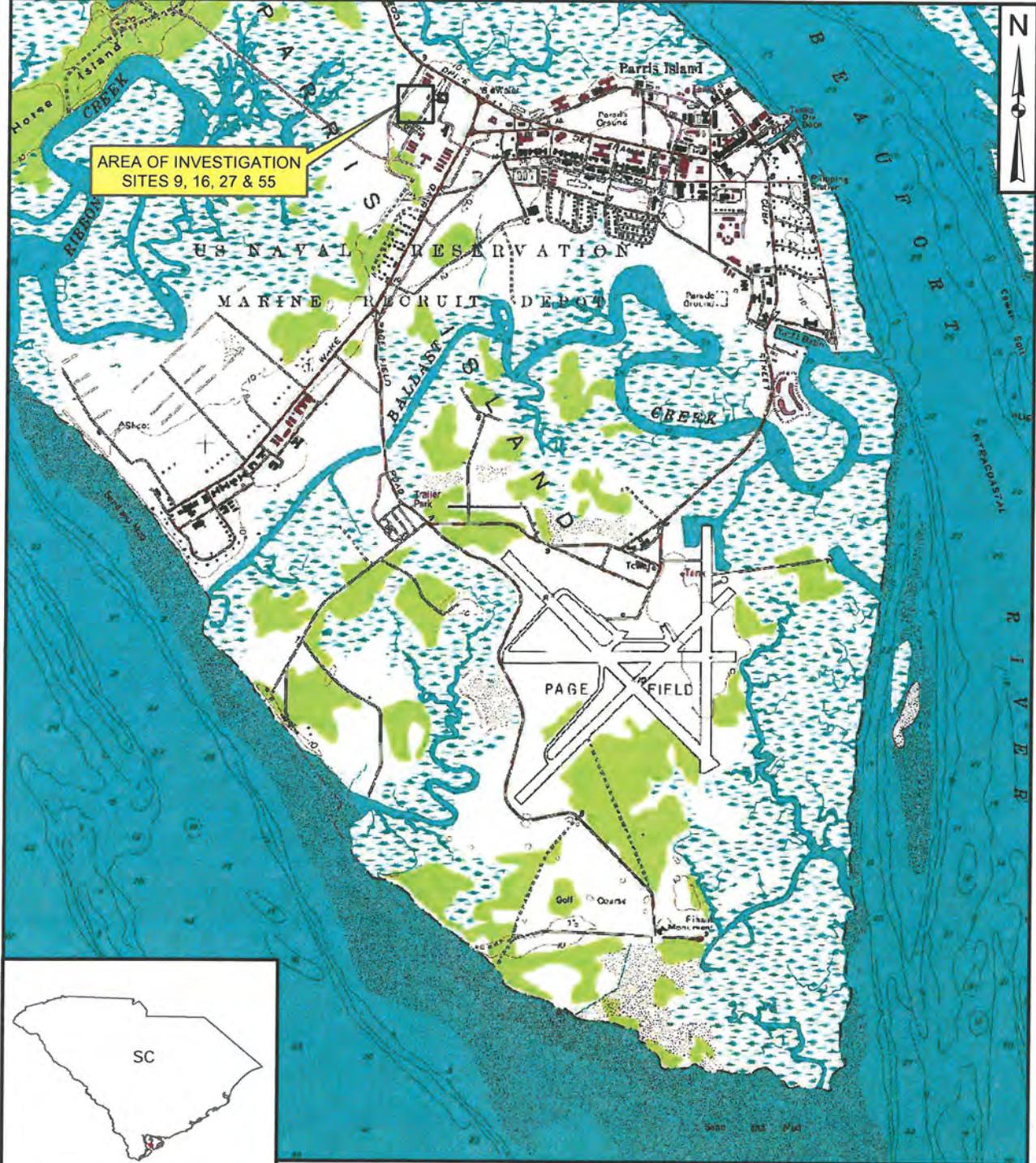
**Figure 6 - Historical Manganese Concentrations in SWMU 3 Wells**



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**Appendix I**  
**Figures (Sites 9, 16, 27, and 55)**  
**Feasibility Study (Tetra Tech 2013)**

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QUADRANGLE LOCATION

SOURCE: USGS 7.5 MINUTE  
PARRIS ISLAND QUADRANGLE, 1979

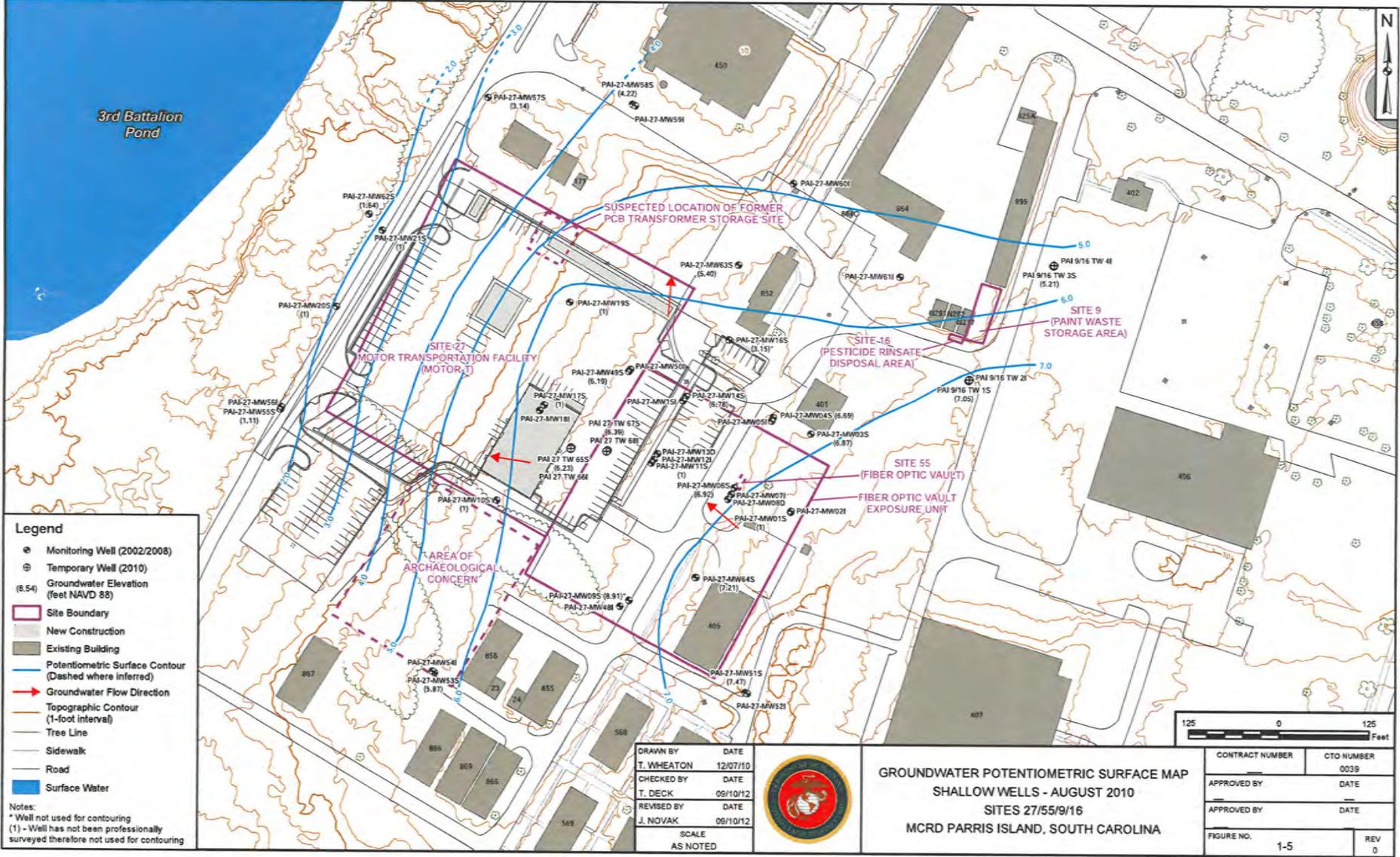


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K. MOORE	8/23/12
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J. NOVAK	09/10/12
SCALE AS NOTED	



DEPOT & SITE LOCATION MAP  
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	CTO NUMBER
0039	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 1-2	0



**Legend**

- Monitoring Well (2002/2008)
- Temporary Well (2010)
- Groundwater Elevation (feet NAVD 88)
- Site Boundary
- New Construction
- Existing Building
- Potentiometric Surface Contour (Dashed where inferred)
- Groundwater Flow Direction
- Topographic Contour (1-foot interval)
- Tree Line
- Sidewalk
- Road
- Surface Water

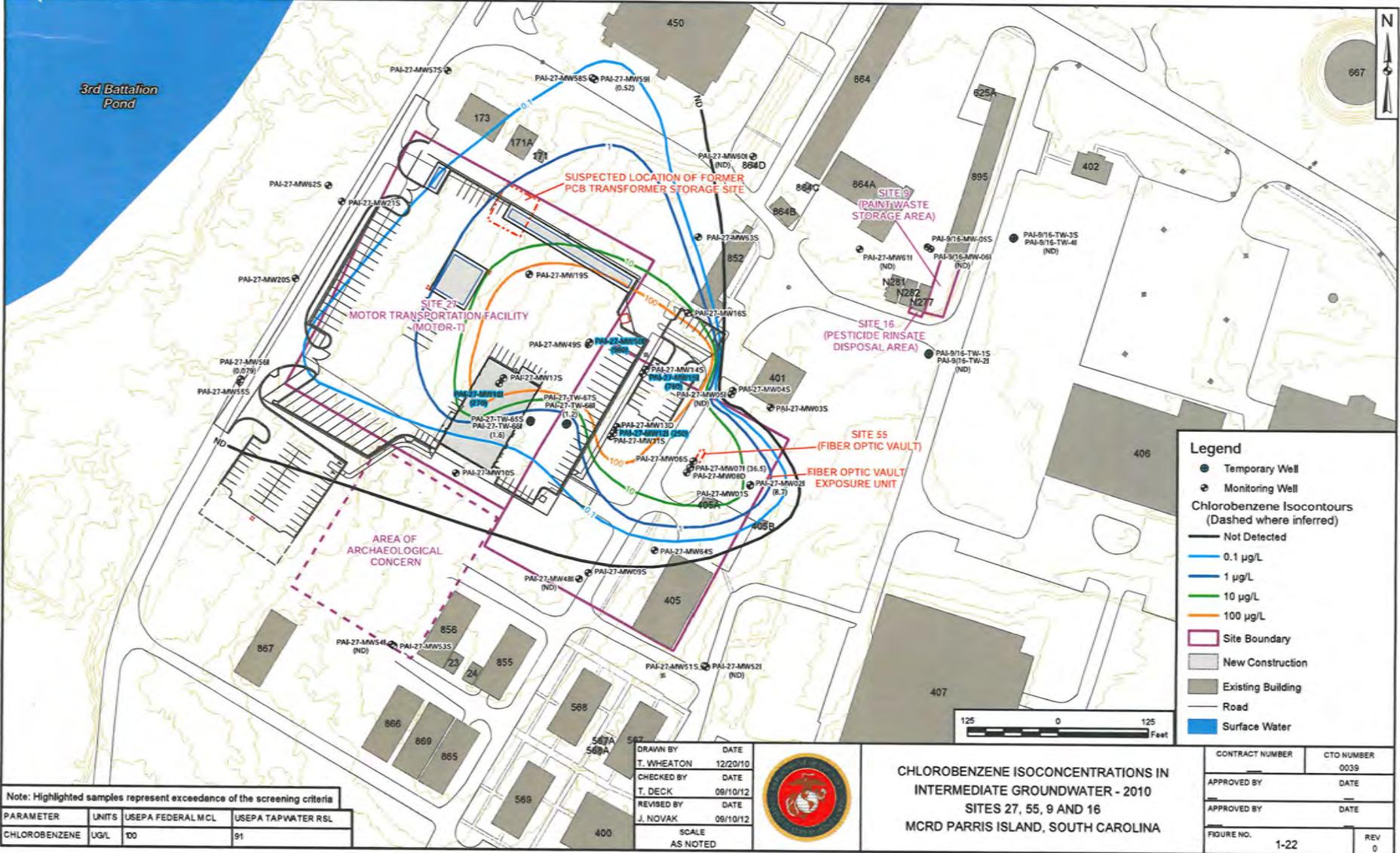
Notes:  
 \* Well not used for contouring  
 (1) - Well has not been professionally surveyed therefore not used for contouring

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**GROUNDWATER POTENTIOMETRIC SURFACE MAP**  
**SHALLOW WELLS - AUGUST 2010**  
**SITES 27/55/9/16**  
**MCRD PARRIS ISLAND, SOUTH CAROLINA**

CONTRACT NUMBER	CTO NUMBER
	0039
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
1-5	0



Note: Highlighted samples represent exceedance of the screening criteria

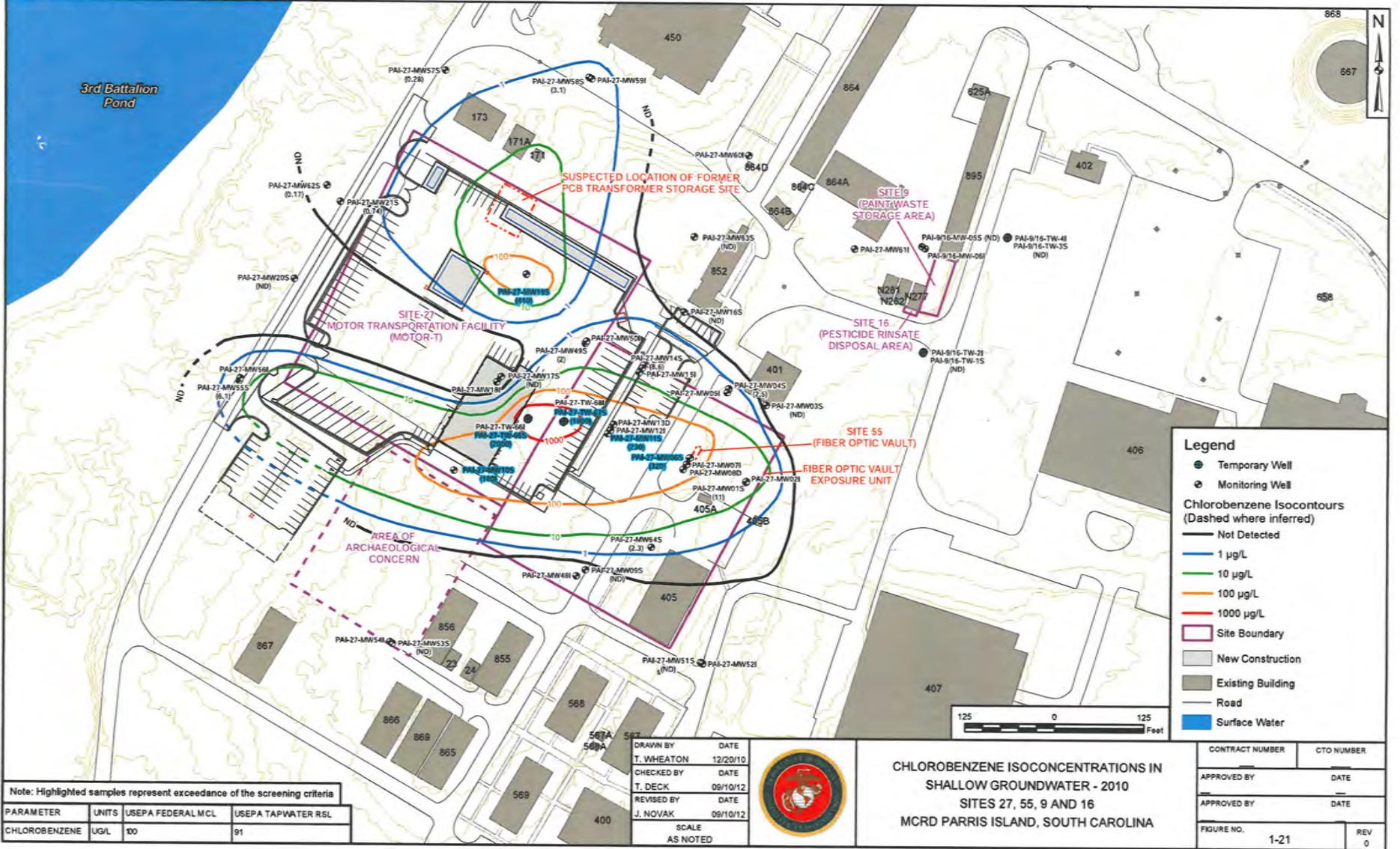
PARAMETER	UNITS	USEPA FEDERAL MCL	USEPA TAPWATER RSL
CHLOROBENZENE	UG/L	100	91

DRAWN BY T. WHEATON	DATE 12/20/10
CHECKED BY T. DECK	DATE 08/10/12
REVISED BY J. NOVAK	DATE 08/10/12
SCALE AS NOTED	



**CHLOROBENZENE ISOCONCENTRATIONS IN INTERMEDIATE GROUNDWATER - 2010**  
**SITES 27, 55, 9 AND 16**  
**MCRD PARRIS ISLAND, SOUTH CAROLINA**

CONTRACT NUMBER	CTO NUMBER
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. 1-22	REV 0



Note: Highlighted samples represent exceedance of the screening criteria

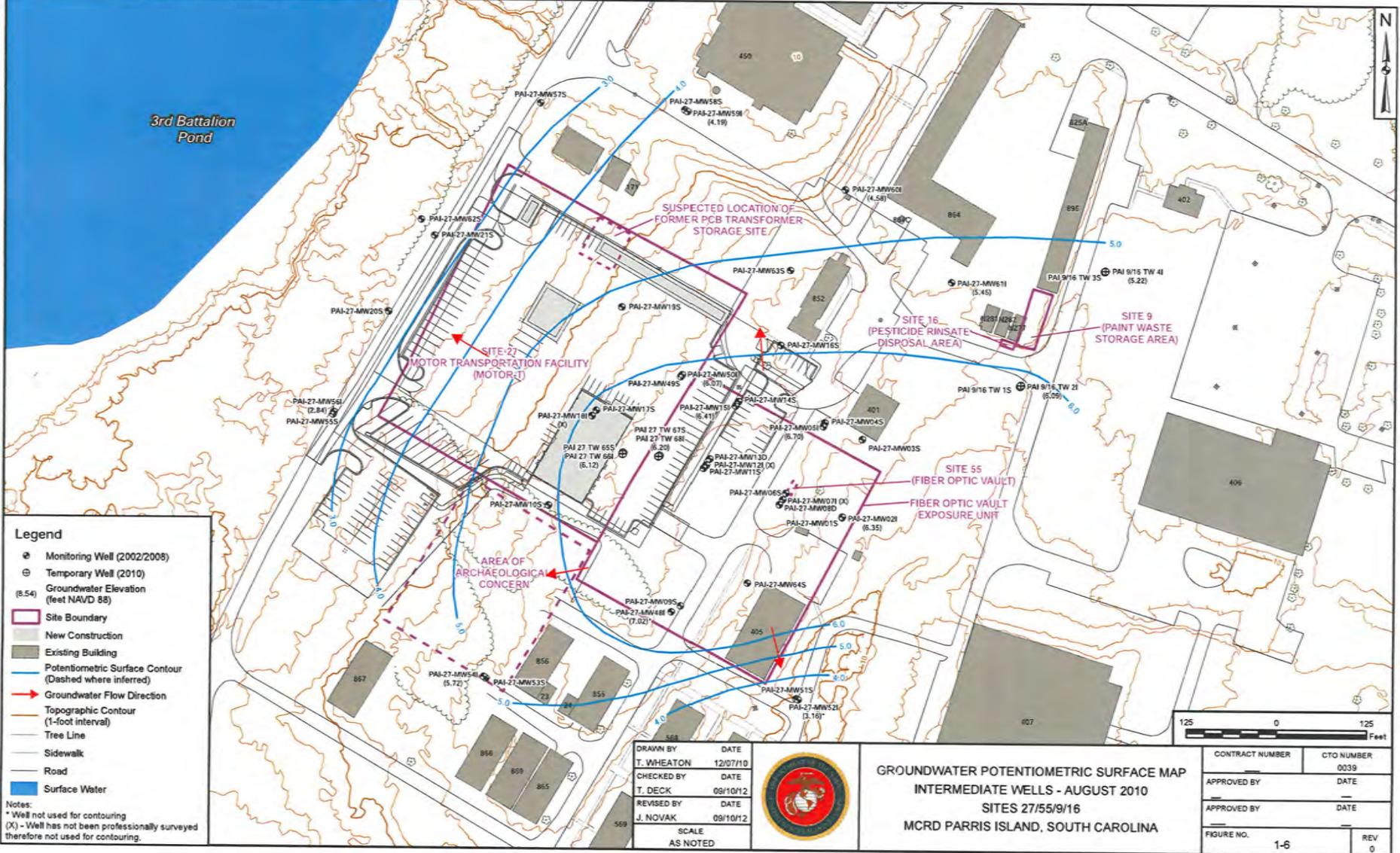
PARAMETER	UNITS	USEPA FEDERAL MCL	USEPA TAPWATER RSL
CHLOROBENZENE	UG/L	100	91

DRAWN BY	DATE
T. WHEATON	12/20/10
CHECKED BY	DATE
T. DECK	09/10/12
REVISED BY	DATE
J. NOVAK	09/10/12
SCALE	AS NOTED



CHLOROBENZENE ISOCONCENTRATIONS IN SHALLOW GROUNDWATER - 2010  
SITES 27, 55, 9 AND 16  
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	CTO NUMBER
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
1-21	0



**Legend**

- Monitoring Well (2002/2008)
- Temporary Well (2010)
- (8.54) Groundwater Elevation (feet NAVD 88)
- Site Boundary
- New Construction
- Existing Building
- Potentiometric Surface Contour (Dashed where inferred)
- Groundwater Flow Direction
- Topographic Contour (1-foot interval)
- Tree Line
- Sidewalk
- Road
- Surface Water

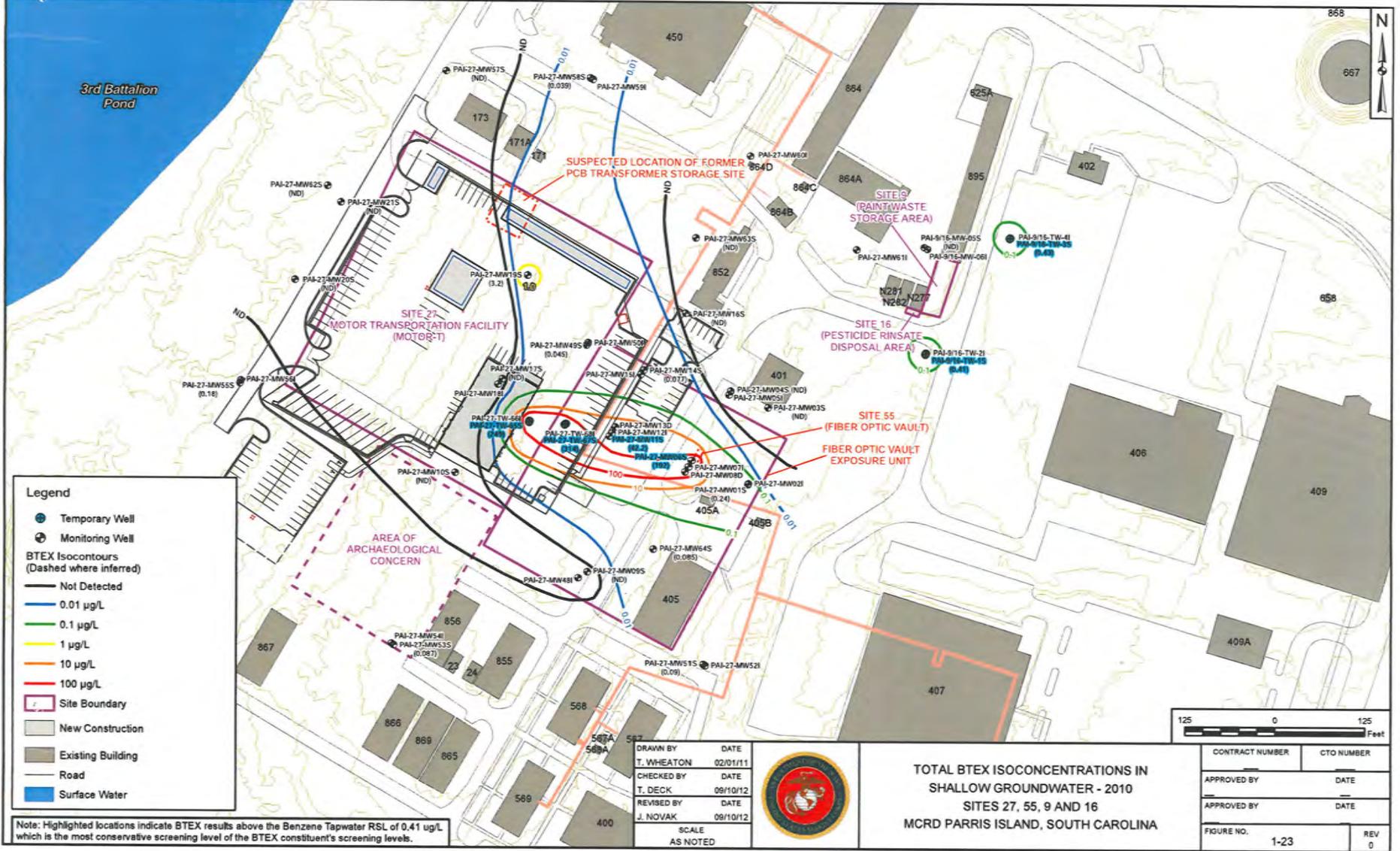
Notes:  
 \* Well not used for contouring  
 (X) - Well has not been professionally surveyed therefore not used for contouring.

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T. DECK	09/10/12
REVISED BY	DATE
J. NOVAK	09/10/12
SCALE	AS NOTED



**GROUNDWATER POTENTIOMETRIC SURFACE MAP**  
**INTERMEDIATE WELLS - AUGUST 2010**  
**SITES 27/55/9/16**  
**MCRD PARRIS ISLAND, SOUTH CAROLINA**

CONTRACT NUMBER	CTO NUMBER
	0039
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
1-6	0



**Legend**

- Temporary Well
- ⊕ Monitoring Well
- BTEX Isocontours (Dashed where inferred)
- Not Detected
- 0.01 µg/L
- 0.1 µg/L
- 1 µg/L
- 10 µg/L
- 100 µg/L
- Site Boundary
- New Construction
- Existing Building
- Road
- Surface Water

Note: Highlighted locations indicate BTEX results above the Benzene Tapwater RSL of 0.41 µg/L which is the most conservative screening level of the BTEX constituent's screening levels.

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T. DECK	09/10/12
REVISED BY	DATE
J. NOVAK	09/10/12
SCALE	AS NOTED



**TOTAL BTEX ISOCONCENTRATIONS IN SHALLOW GROUNDWATER - 2010**  
**SITES 27, 55, 9 AND 16**  
**MCRD PARRIS ISLAND, SOUTH CAROLINA**

CONTRACT NUMBER	CTO NUMBER
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
1-23	0

