N62604.AR.001885
NCBC GULFPORT
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FINAL FEASIBILITY STUDY FOR SITE 1 DISASTER RECOVERY DISPOSAL AREA NCBC GULFPORT MS

4/11/2014

TETRA TECH

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-04-D-0055

Rev. 1
04/11/14

Feasibility Study
for
Site 1 – Disaster Recovery Disposal Area

Naval Construction Battalion Center
Gulfport, Mississippi

Contract Task Order 0065

April 2014

NAVFAC
Naval Facilities Engineering Command
NAVFAC SOUTHEAST
NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH

FEASIBILITY STUDY
FOR
SITE 1 – DISASTER RECOVERY DISPOSAL AREA

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
Southeast
NAS Jacksonville
Jacksonville, Florida 32212-0030

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CONTRACT NUMBER N62467-04-D-0055
CONTRACT TASK ORDER 0065

APRIL 2014

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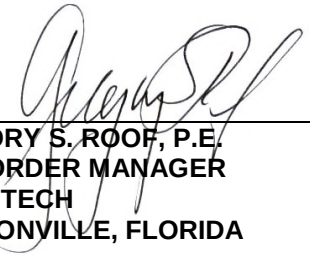

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This document, which describes the Feasibility Study for Site 1, Disaster Recovery Disposal Area, at Naval Construction Battalion Center (NCBC) Gulfport, Mississippi, was reviewed by a registered professional engineer. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document was prepared for Site 1 at NCBC Gulfport, Mississippi and should not be construed to apply to any other site.

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Michael O. Jaynes 4/11/14
Michael O. Jaynes Date
Professional Engineer
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Expires: December 31, 2014

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ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BHC	benzene hexachloride
bls	below land surface
CAA	Federal Clean Air Act, as amended
CERCLA	Comprehensive Environment Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/s	centimeter per second
COC	contaminant of concern
COPC	contaminant of potential concern
CTO	Contract Task Order
cVOC	chlorinated volatile organic compound
DPT	direct push technology
ESV	ecological screening value
FS	Feasibility Study
ft^2	square feet
GRA	general response action
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
IAW	in accordance with
LEL	lower explosive limit
LTM	long-term monitoring
LUC	land use control
LUCIP	Land Use Control Implementation Plan
µg/kg	microgram per kilogram
µg/L	microgram per liter
MDEQ	Mississippi Department of Environmental Quality
mg/kg	milligram per kilogram
MOA	Memorandum of Agreement
NA	not applicable
NCBC	Naval Construction Battalion Center
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NCF	Naval Construction Force
NPDES	National Pollutant Discharge Elimination System

ACRONYMS AND ABBREVIATIONS (Continued)

NPW	net present worth
O&M	operation and maintenance
ORNL	Oak Ridge National Laboratory
PAH	polynuclear aromatic hydrocarbon
PCE	tetrachloroethene
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
RSL	regional screening level
SARA	Superfund Amendments and Reauthorization Act
SSL	soil screening level
TBC	to be considered
TRG	target remediation goal
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
yd^3	cubic yard

EXECUTIVE SUMMARY

This Feasibility Study (FS) was prepared by Tetra Tech for Site 1, Disaster Recovery Disposal Area, located at Naval Construction Battalion Center (NCBC) Gulfport, in Gulfport, Mississippi, in accordance with Contract Task Order (CTO) 0065 under the Comprehensive Long-term Environmental Action Navy Contract Number N62467-04-D-0055. The document was prepared to fulfill the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and is consistent with the United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, 1988). This FS describes the formulation and evaluation of remedial alternatives for contaminated surface and subsurface soil, sediment, surface water, and groundwater at Site 1. The FS establishes remedial action objectives and cleanup goals; screens remedial technologies; and assembles, evaluates, and compares remedial alternatives. The FS was based on data collected during previous investigations, which culminated in the completion of the Remedial Investigation (RI) report for the site (Tetra Tech, 2013). The RI evaluated contaminant nature and extent and fate and transport and calculated the potential risks to human health and the environment associated with exposure to those contaminants.

The purpose of the FS is to gather and evaluate information sufficient to develop and evaluate remedial alternatives to mitigate potential risks to human health and the environment resulting from past Navy activities at the site. Within an FS, the results of an RI are used to develop and evaluate potential remedial alternatives that permanently and significantly reduce the risks to human health and the environment identified at the site. The alternatives should provide cost-effective methods to mitigate the identified risks and be presented in a comprehensive evaluation so that consensus can be reached between the Navy and regulators regarding the selected response action.

SITE DESCRIPTION

Site 1 is a former landfill facility of approximately 9 acres located north of 7th Street and east of Colby Avenue. The landfill was reported in operation from 1942 to 1948. This area has most recently been used as a mock disaster recovery training village and a training facility.

According to available information, Site 1 was the primary area for waste disposal on base and waste was disposed in unlined trenches and then burned and buried. Reportedly, the trenches were deeper than 8 feet, and standing water was present in the open trenches. The landfill received wastes generated at NCBC Gulfport mainly from public works shops and the supply department. Waste fuel, oil, solvents, paint, and paint thinners (reportedly in 55-gallon drums in many cases) were transported to the site, incinerated, and buried in the trenches (Envirodyne Engineers, Inc., 1985).

The waste disposal area at Site 1 was covered with soil when disposal activities ceased in 1948. Additional fill has been added over the years as parking lots and roads have been constructed over the surface. Most of the training buildings have been removed from the site. Building 109, a classroom building, is located at the northeastern corner of the site. Two vehicle storage yards are present in the southeastern quarter of the site.

Site 1 is bordered on the northern and western sides by roads beyond which are facilities of the former Pine Bayou Golf Course, on the eastern side by a motor pool, and on the southern side by 7th Street beyond which is a grassy area.

NATURE AND EXTENT OF CONTAMINATION

As determined in the RI, surface and subsurface soil, sediment, surface water, and groundwater were retained as media of concern, and the following contaminants were retained as contaminants of concern (COCs):

- Dieldrin
- Aroclor-1242

SUMMARY OF RISKS

A human health risk assessment was performed to evaluate exposure to contaminants of potential concern (COPCs) in surface and subsurface soils, groundwater, surface water, and sediment at Site 1. Estimated risks for site maintenance workers, construction/excavation workers, adult trespassers, and adolescent trespassers exposed to COPCs in site media were less than or equal to USEPA and Mississippi Department of Environmental Quality (MDEQ) risk benchmarks. Cancer risk estimates developed for the lifelong trespasser and industrial workers exposed to soils exceed the MDEQ cumulative risk benchmark. Additionally, the industrial and lifelong trespasser exposure scenarios are extremely conservative; thus, the numerical risk results for these receptors are likely overestimated.

The quantitative risk evaluation also indicated that potential adverse health effects may be associated with the hypothetical future residential use of groundwater, and the cancer risk estimate for the future resident exposed to soils exceeds the MDEQ cumulative cancer risk benchmark. The maximum detected concentrations of several volatile organic compounds and arsenic in groundwater exceed USEPA maximum contaminant levels and MDEQ target remediation goals. There is also considerable uncertainty in the risk estimates calculated for exposure to COPCs in soil and groundwater, and the numerical risk results are likely overestimated. It is important to note that the residential land use scenario is evaluated

primarily to provide information to risk managers for Site 1. The groundwater underlying and downgradient of Site 1 is not currently used as a source of drinking water, and there are no plans to develop this resource or the Site 1 area for residential purposes in the future.

Ecological risk resulting from exposure to surface soil, surface water, and sediment was also evaluated. The primary contaminant migration pathway at Site 1 is the infiltration of soil contaminants into groundwater and subsequent seepage into surface water and sediment in the ditches located east and west of the former landfill.

In summary, unacceptable ecological risks are not anticipated and no COCs were retained for Site 1. When conservative assumptions used in the ecological risk assessment are re-evaluated and factors that affect potential exposures, such as quality and size of the habitat and actual use of the site by modeled receptors, are considered, the overall level of ecological risk is considered minimal.

REMEDIAL ALTERNATIVES

The following alternatives were developed to address media of concern at Site 1:

- Alternative 1 – No action
- Alternative 2 – Focused excavation, maintaining existing soil cover, storm water drainage pipe/culvert cleanout and sediment removal, land use controls (LUCs), and groundwater monitoring
- Alternative 3 – Low permeability cap, LUCs, landfill gas monitoring, and groundwater monitoring

CRITERIA FOR EVALUATING ALTERNATIVES

The following nine criteria are used for the evaluation of remedial alternatives:

- Overall Protection of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Requirements
- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, and Volume through Treatment
- Short-term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

RECOMMENDED ALTERNATIVE

Using the evaluation criteria and the presumptive remedy approach, Alternative 2 is recommended at Site 1 to address the buried waste soil and groundwater contamination. This alternative consists of various technologies and remedial actions. Approximately 118 cubic yards of soil in the north central area of the site will require excavation. The approximately 410,000 ft^2 of existing soil cover at Site 1 is adequate and will be left in place. Approximately 137,500 ft^2 at the site has already been covered with parking areas designed to meet previous permeability requirements of a low permeability cap. Since these were installed, the NCBC Gulfport Installation Restoration Partnering Team reached consensus that the cover to prevent exposure was all that was required.

The soil cover consists of the existing site surface following the focused excavation and drainage pipe/culvert and ditch cleanout. Periodic inspections will be required to ensure that the integrity of the soil cover has not been compromised and to determine whether cover maintenance is required. Additionally, the storm water management system within Site 1 shall be inspected and maintained to limit standing water on the landfill.

LUCs in the form of institutional controls will consist of restricting access to soil and groundwater with unacceptable risk. LUCs will also be developed and implemented to prevent residential development, withdrawal of groundwater, and/or disturbance of soil at the site.

Groundwater monitoring will also be conducted to evaluate the groundwater quality over time.

1.0 INTRODUCTION

Naval Facilities Engineering Command Southeast has issued Contract Task Order (CTO) 0065 to Tetra Tech, Inc. under the Comprehensive Long-term Environmental Action Navy Contract N62467-04-D-0055 to perform a Feasibility Study (FS) for Site 1, Disaster Recovery Disposal Area, at Naval Construction Battalion Center (NCBC) Gulfport located in Gulfport, Mississippi.

This FS was prepared to fulfill the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) and Executive Order 12580 and is consistent with the United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, 1988). This report describes the formulation and evaluation of remedial alternatives for contaminated surface and subsurface soils, sediment, surface water, and groundwater at Site 1.

The FS establishes remedial action objectives (RAOs) and cleanup goals; screens remedial technologies; and assembles, evaluates, and compares remedial alternatives. The FS was based on data collected during previous investigations, which culminated in the completion of the Remedial Investigation (RI) for Site 1 (Tetra Tech, 2013). The RI evaluated contaminant nature and extent, fate and transport, and calculated the potential risks to human health and the environment that are associated with exposure to those contaminants.

Additionally, Site 1 is currently under the Navy's Installation Restoration Program that was designed to identify, assess, characterize, and abate or control contaminant migration resulting from past operations at naval installations while complying with local and federal requirements.

1.1 PRESUMPTIVE REMEDY APPROACH

Based on historical patterns of remedy selection for common categories of sites (landfills), the USEPA encourages the selection of presumptive remedies (USEPA, 1993a) to increase the consistency in remedy selection and to streamline the investigative process. During the RI for Site 1, it was determined that a presumptive remedy was applicable for the site based on the characteristics of the materials in the landfill and low concentrations of the contaminants reported in the surficial aquifer. A containment remedy incorporating a low permeability cover with a maximum vertical hydraulic conductivity of 1×10^{-5} centimeters per second (cm/s) was considered the overall site strategy most consistent with USEPA guidance (USEPA, 1993b) and *Presumptive Remedy for CERCLA Municipal Landfill Sites,* (USEPA, 1993a) amended by the *Application of the CERCLA Municipal Landfill Presumptive Remedy to*

Military Landfills, (USEPA, 1996a) as well as the Mississippi Department of Environmental Quality (MDEQ) policy requiring a final cover (containment) for this category of landfill (MDEQ, 2005).

During NCBC Gulfport Installation Restoration Partnering Team discussions, the potential proposed presumptive remedies were expanded include a cover in lieu of a low permeability cap. The basis for using a cover was that the site is located in an area with a high water table and historic waste disposal practices resulted in waste being in constant contact with groundwater. The use of a low permeability cap would provide little additional protection over a cover.

This FS was developed based on the presumptive remedy approach. The general components of the presumptive remedy include containment (landfill cover), source area groundwater control, leachate collection and treatment (if needed), landfill gas collection and treatment (if needed), groundwater monitoring, and land use controls (LUCs). The actions taken to implement containment of the Site 1 landfill will include a final cover. This action will be combined with implementation of excavation, LUCs, and long-term monitoring (LTM).

The *Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills* (USEPA, 1996a) identifies the waste characteristics of military landfills that allow the application of the presumptive remedy. The guidance states that appropriate characteristics include the following:

- *Risks are low-level except for "hotspots".* The results of sampling were generally less than Tier 1 target remediation goal (TRG) screening levels (see Sections 1.5 through 1.7).

- *Treatment of wastes is usually impractical due to the volume and heterogeneity of the waste.* The majority of the material identified at Site 1 is non-hazardous debris and household type wastes.

- *Waste types include household, commercial, and non-hazardous sludge and industrial waste solids.* The Initial Assessment Study (IAS) reports that an unknown volume of wastes from public works shops and the supply department were buried at the site.

- *Lesser quantities of hazardous wastes are present as compared to municipal wastes.* The hotspots at the site represent a very small volume of the total waste.

- *Land application units, surface impoundments, injection wells, and waste piles are **not** included.* There is no reported history, nor any visual evidence, of these at Site 1.

The guidance further states it is anticipated that military landfills will have industrial solid waste, paints (and paint thinners), pesticides, transformer oils, and other solvents in relatively low proportion to the volume of municipal wastes including construction debris, commercial/household type garbage, and yard wastes. The types of waste that would exclude a military site from presumptive remedy consideration include chemical warfare agents, munitions, and other explosives.

The guidance specifies that the presumptive remedy relate primarily to containment of landfill mass and collection and/or treatment of landfill gas. But it goes on further to say that, "In addition, measures to control landfill leachate, affected groundwater at the perimeter of the landfill and/or upgradient groundwater that is causing saturation of the landfill mass may be implemented as part of the presumptive remedy."

1.2 THE CERCLA FS PROCESS

The presumptive remedy for military landfills with municipal-landfill type wastes, which are being addressed under CERCLA as given in the USEPA directives, will be followed. Using the presumptive remedy eliminates the need for the initial identification and screening of alternatives during the FS since this is accomplished by the guidance mentioned above. Based on the historical review of completed remedial actions at similar sites by the USEPA, the presumptive remedy for landfills such as Site 1 is containment.

The development of remedial alternatives for CERCLA sites consists of developing RAOs and preliminary remediation goals (PRGs), determining areas and volumes of contamination, and then identifying applicable technologies and developing those technologies into remedial alternatives to meet the PRGs. The first step in this FS process is to develop RAOs specifying the contaminants, media of interest, and exposure pathways leading to development of the PRGs. The PRGs are developed based on chemical-specific applicable or relevant and appropriate requirements (ARARs), when available; site-specific risk-based factors; or other available information. Contaminants of concern (COCs) as identified in the RI are those contaminants with average concentrations exceeding the PRGs and background concentration levels at the site. Once the PRGs and COCs have been determined, the areas and volumes of contamination requiring remedial action are determined.

After the RAOs/PRGs are identified, general response actions (GRAs) for each contamination of potential concern (COPC) are developed. GRAs typically fall into the following categories: no action, containment, excavation, extraction, treatment, disposal, or other actions, singular or in combination, taken to achieve the RAOs for the site.

The next step in the FS process is to develop remedial action alternatives based on the presumptive remedy components for landfills and site-specific criteria. Those technologies that satisfy the site-specific criteria are then described and analyzed in detail using the CERCLA evaluation criteria (see Table 1-1) specified in the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) as follows:

TABLE 1-1

CERCLA EVALUATION CRITERIA
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI

Threshold Criteria	Overall protection of human health and the environment
	Compliance with ARARs
Balancing Criteria	Long-term effectiveness and permanence
	Reduction of toxicity, mobility, or volume of contaminants through treatment
	Short-term effectiveness
	Implementability
	Cost
Modifying Criteria	State acceptance
	Community acceptance

State acceptance is evaluated when the State reviews and comments on the FS. Then a Proposed Plan is prepared in consideration of the State's comments on the FS. Community acceptance is evaluated based on comments received on the Proposed Plan during a public comment period. This evaluation is described in a responsiveness summary and included in the Decision Document.

Upon completion of the FS, the Proposed Plan will be developed. The Proposed Plan will identify the preferred remedial alternative for Site 1. This document will be written in community-friendly language and will be made available for public comment. Following receipt of all public comments, responses to these comments will be developed in a responsiveness summary within the Decision Document. The Decision Document will document the chosen alternative for the site and will include the responsiveness summary as an appendix. Once the Decision Document is signed, the chosen remedial alternative will be implemented.

The entire FS process provides the technical information and analyses forming the basis for a proposed Remedial Action Plan (or Proposed Plan), and the subsequent Decision Document documents the identification and selection of the remedy.

1.3 SITE DESCRIPTION

NCBC Gulfport is located in the western portion of Gulfport, Mississippi, in Harrison County, approximately 2 miles north of the Gulf of Mexico. NCBC Gulfport is located approximately 1 mile west of

Highway 49 (see Figure 1-1). The area, which was acquired for Government use in April 1942, occupies approximately 1,100 acres and has an average elevation 30 feet above sea level.

The primary mission of NCBC Gulfport is to support military readiness for battalions of the Naval Construction Force (NCF) and the storage and maintenance of pre-positioned War Reserve Material Stock. The NCF mission consists of mobilization and logistics support for both homeport services and deployed units. Approximately 5,000 military and 1,600 civilian personnel are assigned to or employed at NCBC Gulfport.

Nine sites at NCBC Gulfport, including Site 1, were identified in the IAS as potential threats to human health or the environment (Naval Energy and Environmental Support Activity, 1985). Site 1, referred to as the Disaster Recovery Disposal Area, encompasses approximately 9 acres near the intersection of 7th Street and Colby Avenue. The site was operated as a landfill from 1942 until 1948. This area has most recently been used as a mock disaster recovery training village and a training facility.

Site 1 was reportedly used as the primary area for waste disposal at NCBC Gulfport from 1942 to 1948. Wastes were placed in unlined trenches at or near the groundwater table. The landfill received wastes generated at NCBC Gulfport mainly from public works shops and the supply department. Waste fuel, oil, solvents, paint, and paint thinners, reportedly in 55-gallon drums in many cases, were transported to the site, incinerated, and buried in the trenches (Envirodyne Engineers, Inc., 1985).

According to available information, waste was disposed in trenches, burned, and then buried. Reportedly, the trenches were deeper than 8 feet, and standing water was present in the open trenches. The waste disposal area at Site 1 was covered with soil when disposal activities ceased in 1948. Additional fill has been added over the years as parking lots and roads have been constructed over the surface. The site topography is relatively flat with elevations of 23 to 30 feet.

Site 1 is bordered on the northern and western sides by roads beyond which are facilities of the former Pine Bayou Golf Course, on the eastern side by a motor pool, and on the southern side by 7th Street beyond which is a grassy area.

Surface water runoff is to ditches bordering the eastern and western sides of Site 1. Water in these ditches flows to the north and then west to Canal No. 1, the primary drainage ditch for the western portion of NCBC Gulfport. As part of the Turkey Creek drainage basin, Canal No. 1 is a year round stream that exits the base at Outfall 1. Canal No. 1 continues north from NCBC Gulfport along Canal Road until it joins Turkey Creek. From there, surface water is conveyed to the east until it enters Gulfport Lake and the Back Bay of Biloxi.

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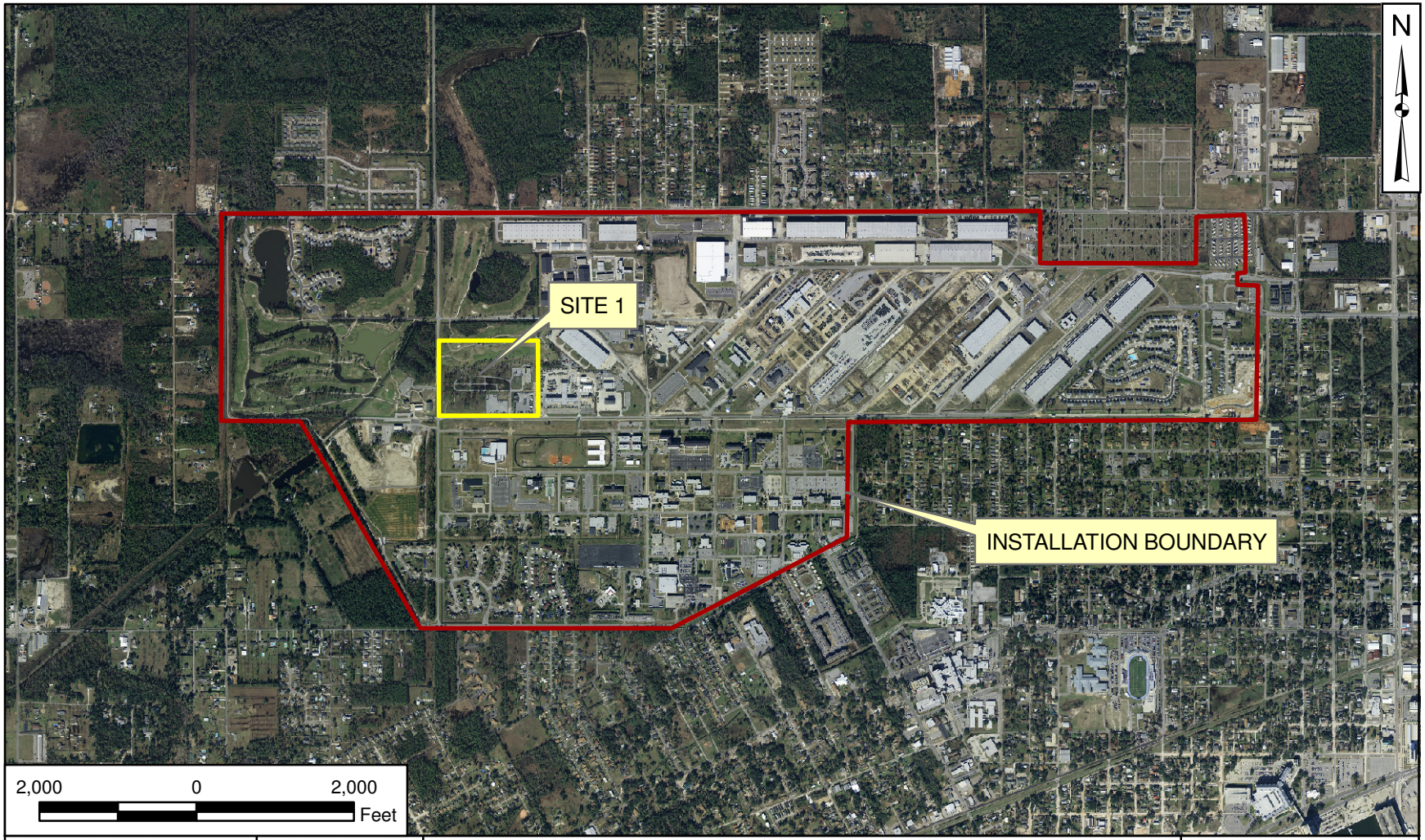

DRAWN BY K. MOORE	DATE 5/24/10	LOCATION MAP SITE 1 FEASIBILITY STUDY NCBC GULFPORT GULFPORT, MISSISSIPPI	CONTRACT NUMBER CTO 065
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COST SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 1-1 / REV 0

1.4 WASTE DISPOSAL AREA

At Site 1, the waste disposal boundary was established by evaluating the results of a magnetometer survey and an EM-31 terrain conductivity survey (see Figure 1-2). Both the EM-31 and magnetometer results indicate an irregularly shaped landfill comprised of smaller disposal cells or trenches. The landfill area defined by the geophysical survey is approximately 13.5 acres. Note that the extent of the landfill as defined by the geophysical survey includes the "Disposal Area Excluding Parking Area" shown on Figure 1-2 and the parking areas in the southeastern corner of the figure. The parking areas are approximately 4.5 acres, and the other area is approximately 9 acres.

Further depth to waste delineation and profiling was conducted at Site 1 in June 2012. Waste profile samples were collected from locations placed on a 100-foot by 100-foot grid across the site. Figure 1-3 presents the sample grid and locations as well as other site features. No landfill waste material was found in the upper 3 feet below land surface during this recent effort.

Additional characterization of the waste disposal area was performed during the soil assessment including chemical and geotechnical analyses as described in Section 1.5.

1.5 SOIL ASSESSMENT

The release of contaminants at Site 1 may have resulted from landfill operations. The detection of chlorinated volatile organic compounds (cVOCs) in subsurface soil at Site 1 supports the reported disposal of these materials at the site. Contamination detected in surface soil appears to have resulted from typical maintenance chemicals and the addition of soil used for fill from an unknown source.

Concentrations of cVOCs in surface soil were less than direct exposure screening criteria and the soil screening levels (SSLs) for the soil-to-air pathway. Tetrachloroethene (PCE) was detected in two surface soil samples at concentrations that exceeded the SSL for the soil-to-groundwater pathway. The presence of cVOCs is consistent with waste disposal practices and base operations that have included the use of solvents in degreasing.

Polynuclear aromatic hydrocarbon (PAH) concentrations exceeding screening criteria were limited to one surface soil sample location having a benzo(b)fluoranthene concentration in excess the SSL for the soil-to-groundwater pathway. The relatively low concentration of PAHs and lack of site-wide occurrence suggest the existing soil cover prevents direct exposure to landfill material. Semivolatile organic compound concentrations in the subsurface soil samples were less than detection limits.

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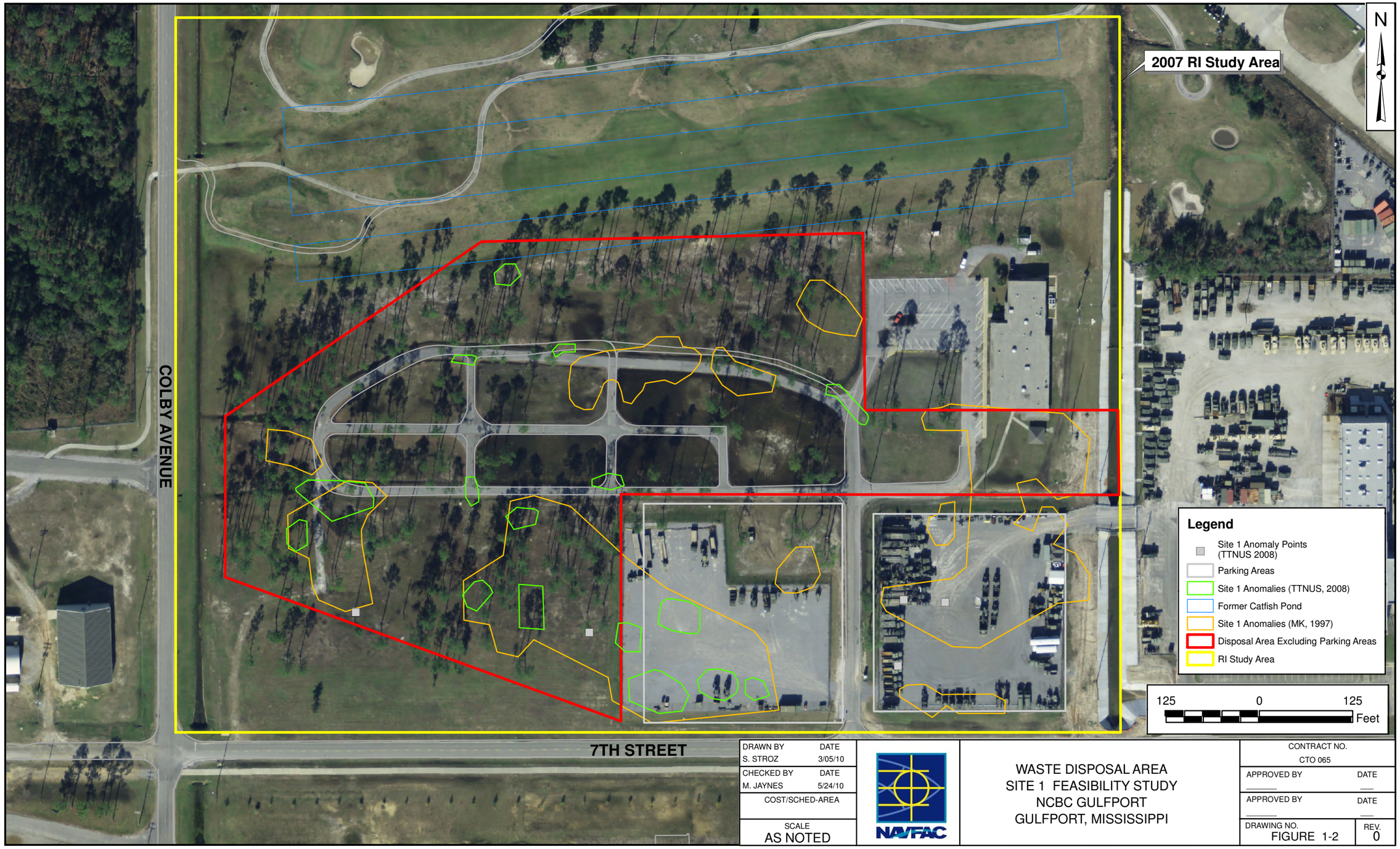

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CHECKED BY M. JAYNES	DATE 5/24/10	WASTE DISPOSAL AREA SITE 1 FEASIBILITY STUDY NCBC GULFPORT GULFPORT, MISSISSIPPI	APPROVED BY _____ DATE ___
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SCALE AS NOTED			DRAWING NO. FIGURE 1-2 / REV. 0

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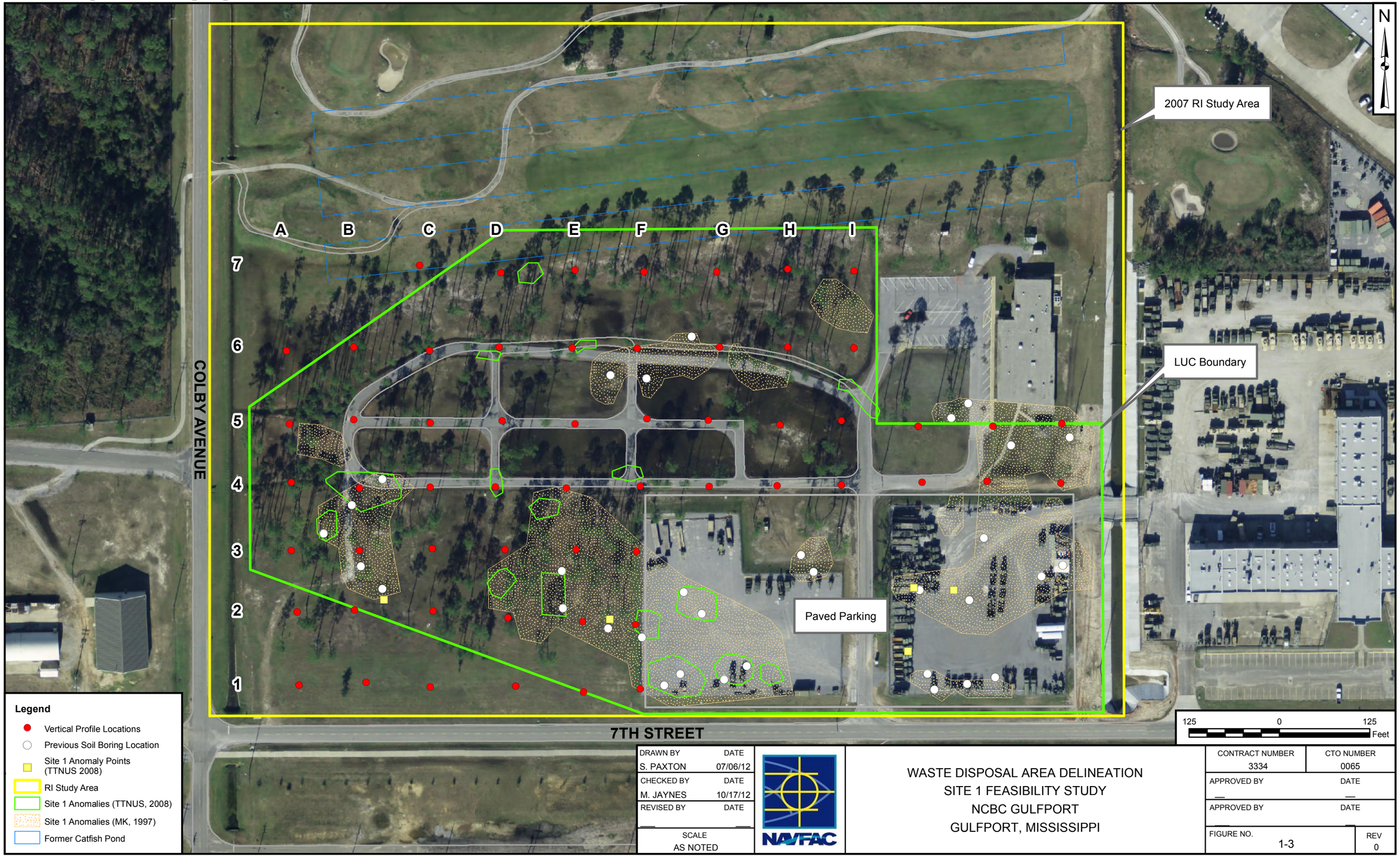

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NAVFAC

WASTE DISPOSAL AREA DELINEATION
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

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FIGURE NO. 1-3	REV 0

Dieldrin was detected at one surface soil sample location at a concentration exceeding the human health screening criteria (MDEQ Tier 1 TRG of 39.9 micrograms per kilogram [µg/kg]). Additional samples were collected in September 2012 to delineate the extent of the dieldrin in surface soil. Four samples were collected from 0 to 1 foot below land surface (bls), and there were no further exceedances of the MDEQ Tier 1 TRG. Figure 1-4 presents the analytical results for surface soil sampling at Site 1. Aroclor-1242 was detected at one subsurface soil sample location at a concentration exceeding the human health screening criteria (MDEQ Tier 1 TRG of 1,000 µg/kg). Other pesticides (aldrin, heptachlor epoxide, and benzene hexachloride [BHC] isomers) were detected in Site 1 surface and subsurface soil samples at concentrations less than direct exposure human health criteria, but exceeding SSLs for the soil-to-groundwater pathway. The pesticide concentrations were consistent with the use and/or disposal of small quantities of BHC isomers and dieldrin.

Arsenic was detected in most of the soil samples and was the only metal detected in surface soil samples collected at Site 1 with concentrations exceeding human health direct exposure criteria. The arsenic concentrations were within concentration ranges typical for Mississippi Coastal Flatwoods soil. Due to arsenic concentrations being within the accepted background range, arsenic will not be considered a COC for soil in this FS.

Concentrations of other metals detected in surface soil at Site 1 did not exceed screening criteria for direct exposures to human receptors, but did exceed SSLs for the soil-to-groundwater migration pathway and/or ecological screening values (ESVs) for ecological receptors. Copper, iron, lead, manganese, and selenium were detected in soil samples at concentrations exceeding the SSL and ESV. Antimony, cobalt, and chromium concentrations exceeded the SSL at some locations. Aluminum, vanadium, and zinc were reported at concentrations exceeding the ESV.

The results of the soil analytical program are consistent with the containment strategy of the presumptive remedy, and the direct observation of the field samples and waste profiling confirmed the waste disposal area defined by the geophysical investigation. Analytical results for surface and subsurface soil sampling at Site 1 are presented on Figures 1-4 and 1-5.

The remedial strategy for Site 1 includes the maintenance of a soil cover. A soil cover, including the existing surface, removes important exposure pathways, including direct exposure to surface soil by ecological receptors, potential leaching of contaminants from soil to groundwater, and erosion and transport of surface soil from the landfill. Direct exposure to subsurface soil will be prevented by institutional controls established to maintain the integrity of the cover.

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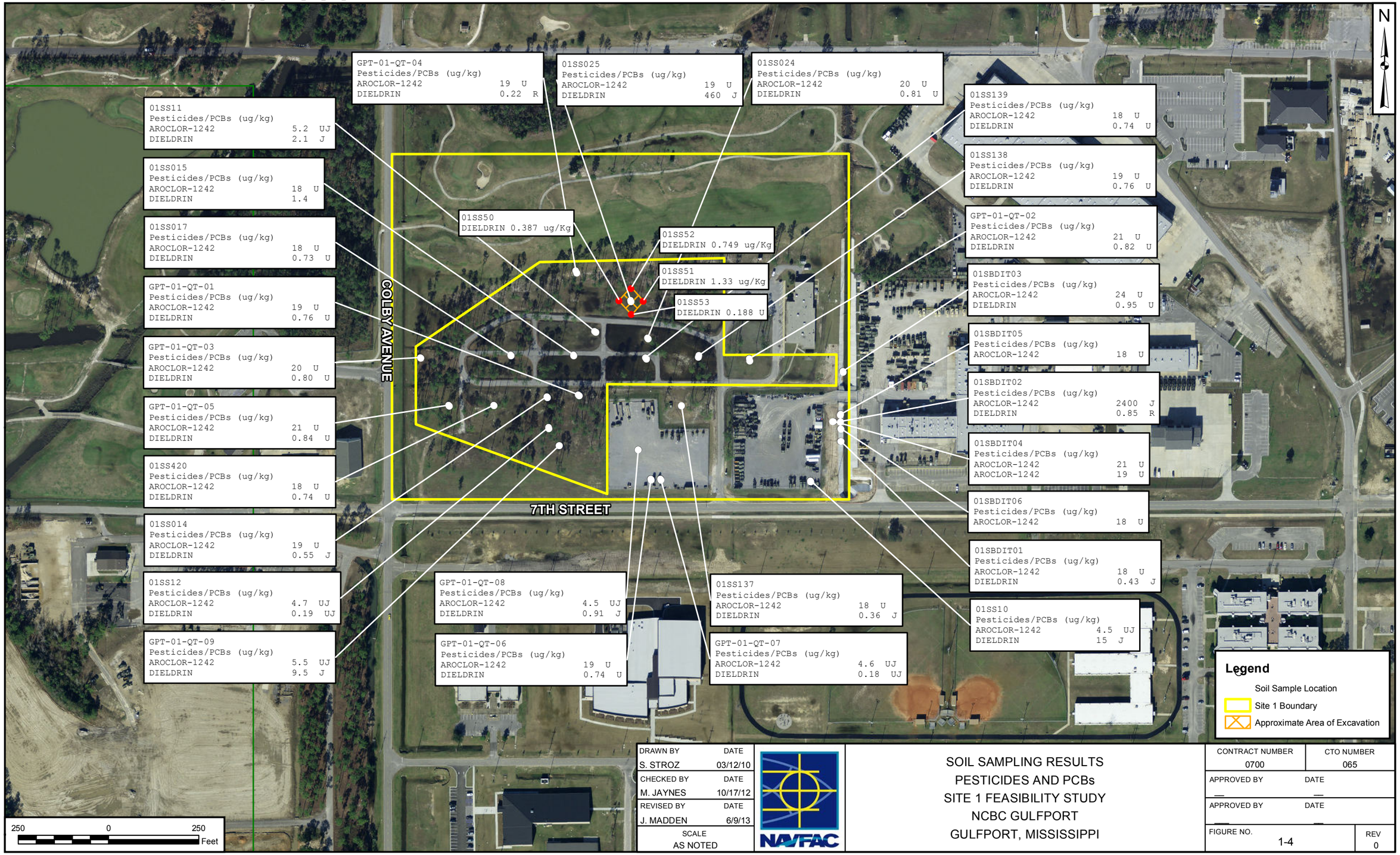

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J. MADDEN	6/9/13
SCALE	
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NAVFAC

SOIL SAMPLING RESULTS
PESTICIDES AND PCBs
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CONTRACT NUMBER	CTO NUMBER
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FIGURE NO. 1-4	REV 0

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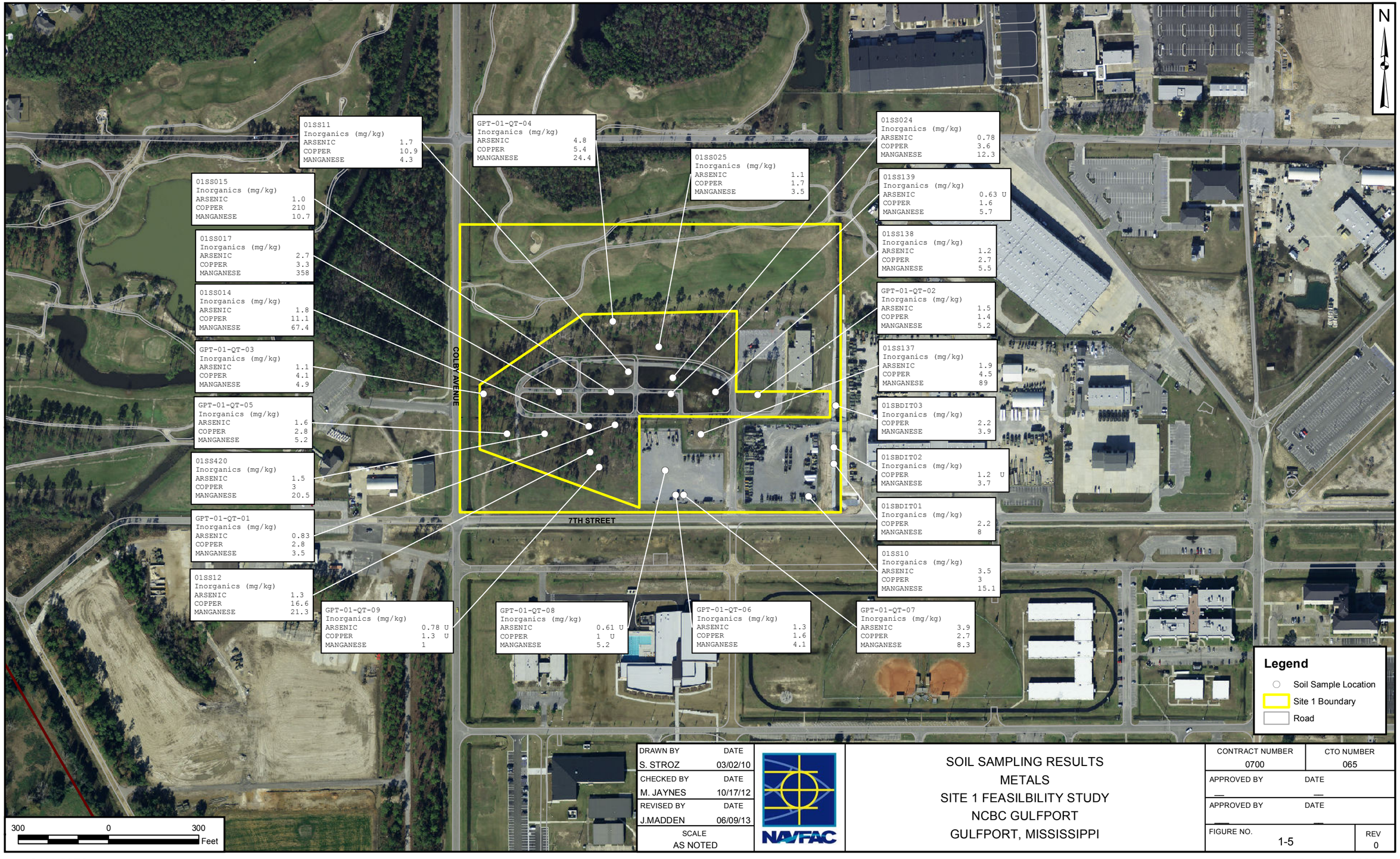

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SOIL SAMPLING RESULTS
METALS
SITE 1 FEASILBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CONTRACT NUMBER 0700	CTO NUMBER 065
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FIGURE NO. 1-5	REV 0

1.6 SURFACE WATER AND SEDIMENT ASSESSMENT

Iron, lead, and aluminum were detected in one or more surface water samples at concentrations exceeding ESVs in the ditches to the east and west, but were less than human health criteria.

Arsenic was the only metal detected in Site 1 sediment samples at concentrations exceeding both human health direct exposure criteria (TRGs and regional screening levels [RSLs]). Arsenic was detected in four of the five sediment samples. Iron was detected in each of the sediment samples at concentrations ranging from 650 milligrams per kilogram (mg/kg) to 28,100 mg/kg. The iron concentration reported for one sample exceeded the unrestricted TRG, but was less than the RSL and the restricted TRG. Lead and zinc were detected in sediment samples at concentrations exceeding the ESV, but were less than the TRG and RSL. Analytical results for surface water and sediment sampling at Site 1 are presented on Figure 1-6.

No COCs were identified for surface water or soil for this site.

1.7 GROUNDWATER ASSESSMENT

Groundwater samples collected at Site 1 were analyzed for target compound list, target analyte list, and Appendix IX analytes. Groundwater delineation samples were collected using direct push technology (DPT) and analyzed for selected volatile organic compounds (VOCs).

PCE was reported in 5 of 51 groundwater samples (29 DPT locations and 22 monitoring wells). Four of the DPT groundwater samples and one monitoring well sample had detections of PCE, and each of these detections exceeded the RSL (0.11 microgram per liter [µg/L]). Trichloroethene was reported in four of the groundwater samples at concentrations exceeding the groundwater volatilization criteria (0.053 µg/L).

Naphthalene was reported in one monitoring well at an estimated concentration of 6.7 µg/L, which exceeds the TRG and the RSL.

Arsenic was detected in two monitoring well samples at concentrations that exceed the RSL. Both of these monitoring wells are located at the northwestern corner of the site on the western side of the ditch that parallels Colby Avenue. Iron was detected in five of the monitoring well samples at concentrations exceeding the TRG and the RSL. Thallium was detected in one monitoring well sample at a concentration exceeding the TRG and the RSL.

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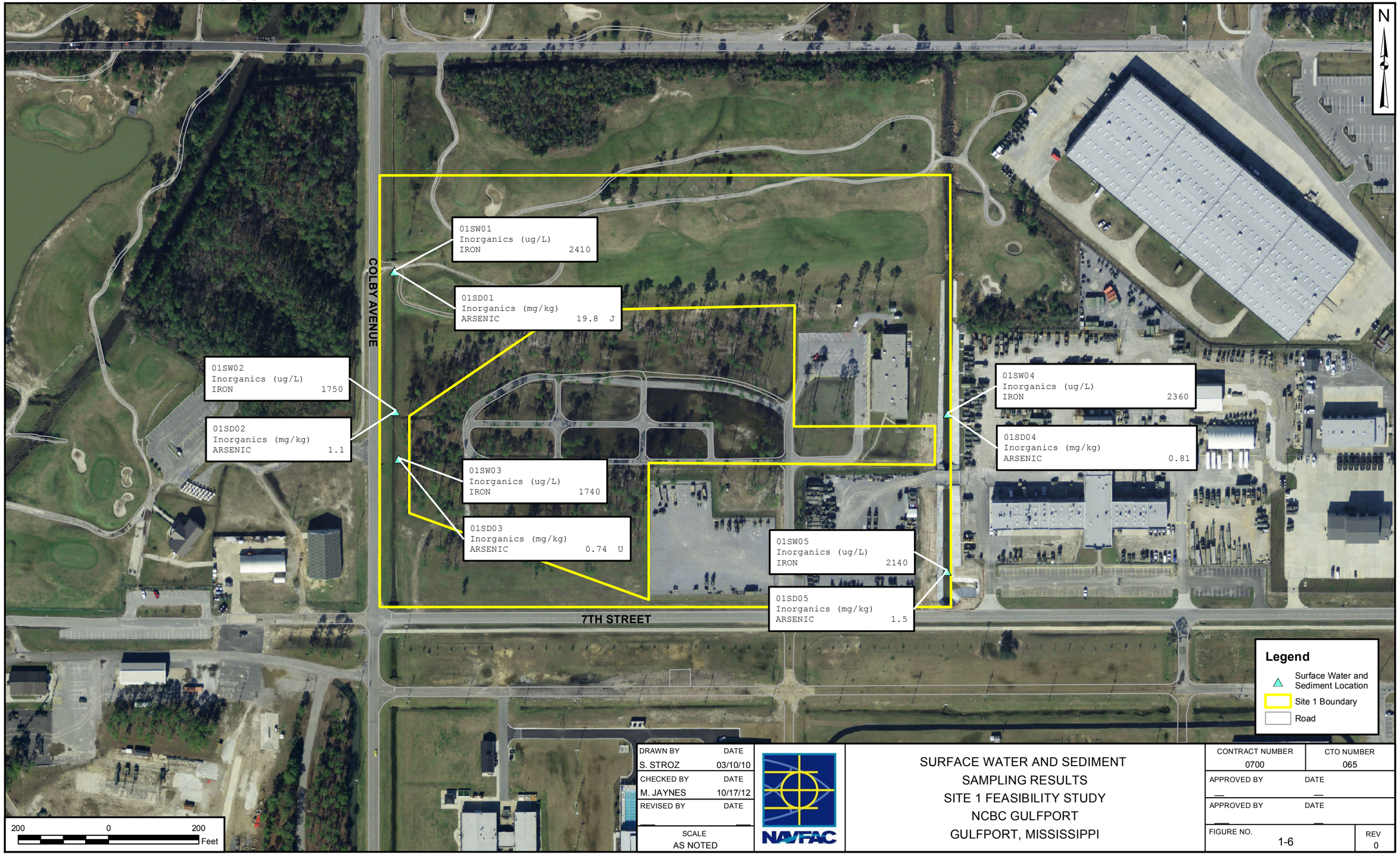

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SURFACE WATER AND SEDIMENT
SAMPLING RESULTS
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CONTRACT NUMBER	CTO NUMBER
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FIGURE NO.	REV
1-6	0

The interaction between the layers of silt and sandy clay and the contaminants at the site appears to have created a vertical barrier to migration. Although not a true aquiclude, these lower permeable layers restrict the vertical movement of contaminants. Analytical results for groundwater sampling at Site 1 are presented on Figures 1-7 and 1-8.

1.8 COPCs AND COCs

In general, a constituent was selected as a COPC and retained for further quantitative risk evaluation in the human health risk assessment (HHRA) if the maximum detection in a sampled medium exceeds a conservative screening value(s). The screening values that were used (and shown in the RI) are as follows:

Screening levels based on the following standards/criteria were used to select COPCs for soil:

- Oak Ridge National Laboratory (ORNL) RSLs for Residential Soil (ORNL, 2009).
- MDEQ Tier 1 TRGs for restricted and unrestricted land use (MDEQ, 2002).
- USEPA generic SSLs for the inhalation of volatiles and fugitive dusts calculated online at http://risk.lsd.ornl.gov/calc_start.shtml based on methodology from the USEPA's Soil Screening Guidance (USEPA, 1996b).

Screening levels based on the following criteria were used to select COPCs for sediment:

- ORNL RSLs for Residential Soil (ORNL, 2009).
- MDEQ Tier 1 TRGs for restricted and unrestricted land use (MDEQ, 2002).

Screening levels based on the following criteria were used to select COPCs for groundwater:

- ORNL RSLs for Tap water (ORNL, 2009).
- MDEQ Tier 1 TRGs for Groundwater (MDEQ, 2002).
- USEPA Maximum Contaminant Levels (USEPA, 2006).

Screening levels based on the following criteria were used to select COPCs for surface water:

- ORNL RSLs for Tap water (ORNL, 2009).
- MDEQ Tier 1 TRGs for Groundwater (MDEQ, 2002).

If the maximum concentration of a constituent exceeded any of these criteria, the chemical was selected as a COPC and carried through the quantitative risk assessment.

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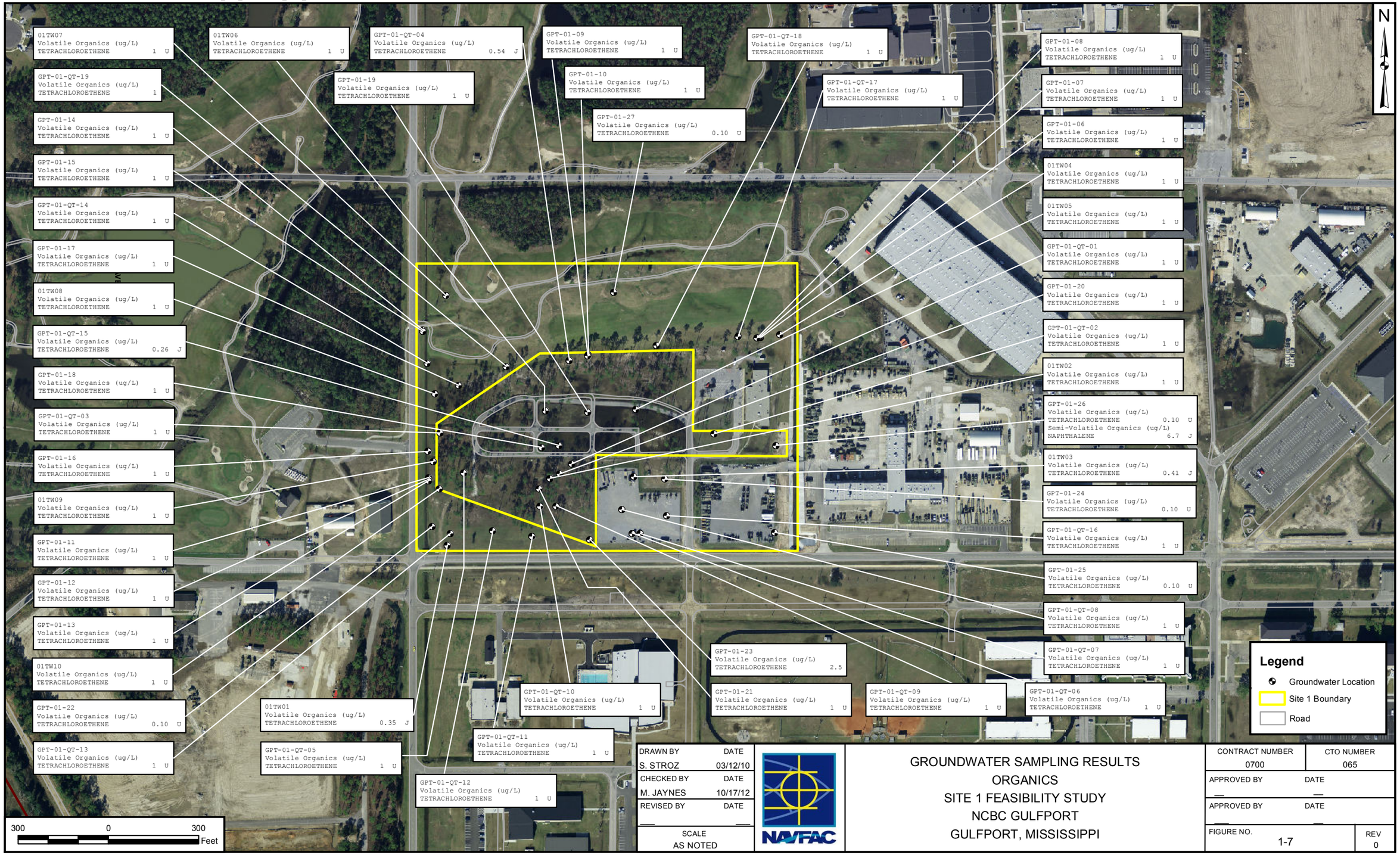

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GROUNDWATER SAMPLING RESULTS
ORGANICS
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

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FIGURE NO. 1-7	REV 0

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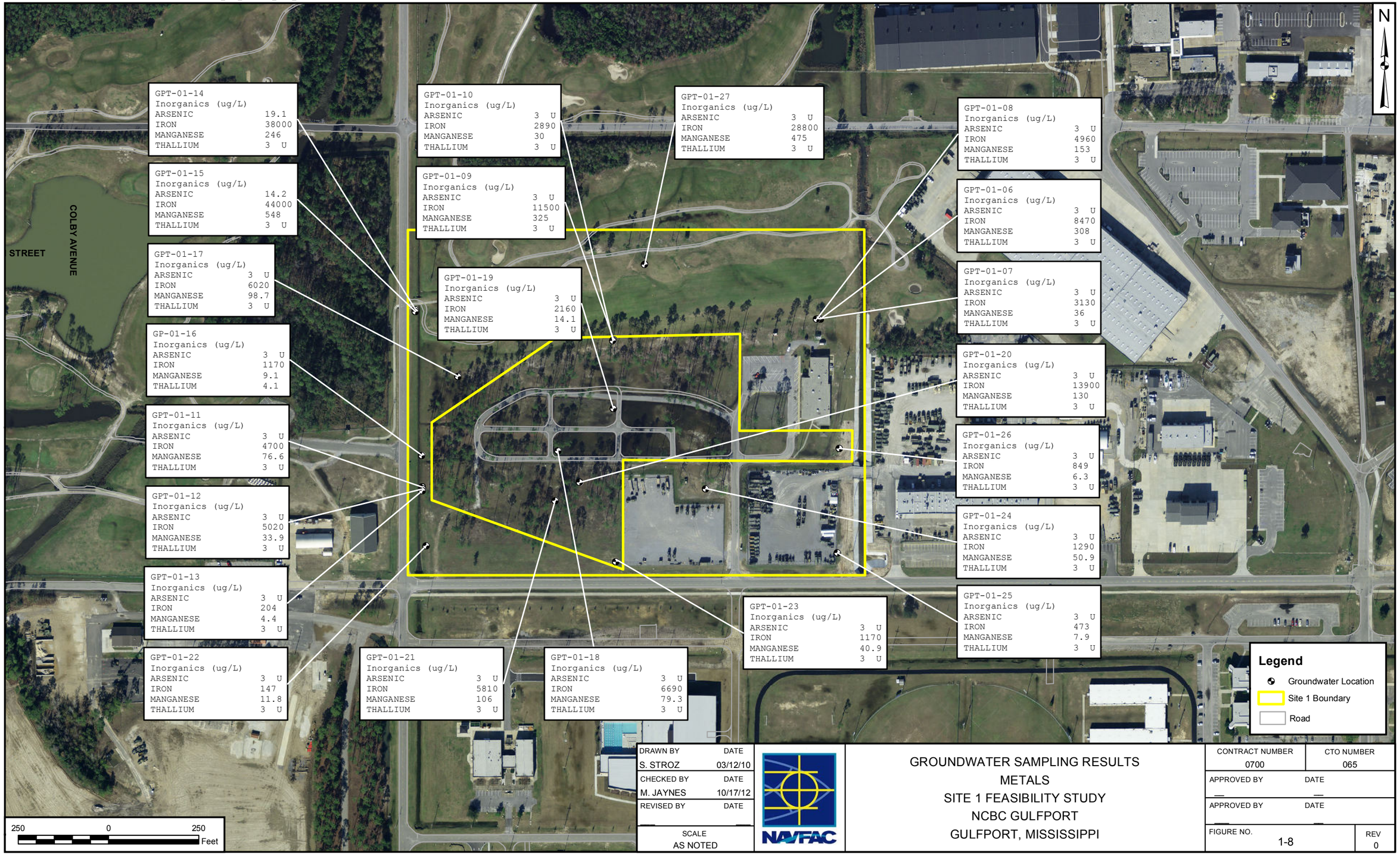

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GROUNDWATER SAMPLING RESULTS
METALS
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CONTRACT NUMBER	CTO NUMBER
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FIGURE NO.	REV
1-8	0

Soil data were also compared to ORNL SSLs for migration from soil to groundwater (ORNL, 2009). The soil-to-groundwater SSLs were not used to select COPCs for quantitative risk evaluation but to provide an evaluation of potential impact of chemicals detected in soil on groundwater.

An HHRA was performed to evaluate exposure to COPCs in subsurface and surface soil, groundwater, surface water, and sediment at Site 1. Estimated risks for construction/excavation workers and adult trespassers assumed to be exposed to COPCs in site media were less than or equal to USEPA and MDEQ risk management benchmarks. The quantitative risk evaluation indicated that risk estimates for the site maintenance worker and adolescent trespasser were only marginally greater than the MDEQ benchmark. Residential cancer risk estimates slightly exceeded the MDEQ benchmark for soils (for both adult and child residents) due to dieldrin, arsenic, and PCBs (Aroclor-1242). However, arsenic is within published background levels for soil. Sediment also exceeded the MDEQ cancer benchmark for the child resident only due to arsenic. Residential risks estimated for surface water did not exceed USEPA and MDEQ risk management benchmarks.

The quantitative risk evaluation also indicated that potential adverse health effects may be associated with the hypothetical future residential use of groundwater. The maximum detected concentration of PCE in groundwater sampled collected using DPT techniques exceeded the ORNL RSL for tap water, and the maximum concentration of arsenic in groundwater exceeded both the ORNL tap water RSL and the MDEQ groundwater TRG. Additionally, the HHRA indicated that PCE presents a risk greater than 1×10^{-6} only considering the DPT screening samples and only using the Reasonable Maximum Exposure (RME) calculations. Using the central tendency exposure scenario, PCE is not considered a cancer risk greater than 1×10^{-6} in monitoring or DPT samples. Additionally, the PCE concentration in samples from properly installed monitoring wells did not pose a 1×10^{-6} risk under either the RME or Central Tendency Exposure scenarios. Also, due to minimal detections, there is considerable uncertainty in the risk estimates calculated for exposure to COPCs in groundwater, and the numerical risk results are likely overestimated. Therefore, PCE will not be considered a COC in groundwater for the FS. The residential groundwater use scenario is evaluated to be conservative and to provide information to risk managers for Site 1. The groundwater underlying and downgradient of Site 1 is not currently used as a source of drinking water and there are no plans to develop this resource in the future.

The COPCs that showed human risks having a hazard index (HI) above 1 or risks above 10^{-6} (for cancer causing agents) were initially retained as COCs. Table 1-2 summarizes the COPCs evaluated in the risk assessments.

TABLE 1-2

COPCs IN SURFACE SOIL, SUBSURFACE SOIL, SEDIMENT, GROUNDWATER, AND SURFACE WATER
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI
PAGE 1 OF 3

CHEMICAL	MEDIA	DETECTED		UNITS	DIRECT EXPOSURE COPC	MIGRATION PATHWAY COPC	ECOLOGICAL RECEPTOR COPC	COC	REASON
		Minimum	Maximum						
Volatile Organic Compounds (VOCs)									
TETRACHLOROETHENE	SURFACE SOIL	0.22	0.28	µg/kg	No	Yes	No		
	GROUNDWATER	0.26	2.5	µg/L	Yes	Yes	NA	Yes	Cancer Risk > 10^{-6}
TRICHLOROETHENE	GROUNDWATER	0.3	1.3	µg/L	No	Yes	NA		
Semivolatile Organic Compounds (SVOCs)									
BIS(2-ETHYLHEXYL)PHTHALATE	SEDIMENT	74	450	µg/kg	No	NA	Yes		
BENZO(A)PYRENE	SEDIMENT	190	190	µg/kg	Yes	NA	No		
BENZO(B)FLUORANTHENE	SURFACE SOIL	78	78	µg/kg	No	Yes	No		
	SEDIMENT	330	330	µg/kg	Yes	NA	Yes		
CHRYSENE	SEDIMENT	400	400	µg/kg	No	NA	Yes		
FLUORANTHENE	SEDIMENT	1300	1300	µg/kg	No	NA	Yes		
PHENANTHRENE	SEDIMENT	360	360	µg/kg	No	NA	Yes		
PYRENE	SEDIMENT	930	930	µg/kg	No	NA	Yes		
NAPHTHALENE	GROUNDWATER	6.7	6.7	µg/L	Yes	No	NA		
Pesticides/Polychlorinated Biphenyls (PCBs)									
ALDRIN	SURFACE SOIL	0.16	6.3	µg/kg	No	Yes	Yes		
ALPHA-BHC	SURFACE SOIL	0.26	0.26	µg/kg	No	Yes	No		
	SUBSURFACE SOIL	4.2	4.2	µg/kg	No	Yes	NA		
BETA-BHC	SURFACE SOIL	0.16	0.36	µg/kg	No	Yes	No		
	SUBSURFACE SOIL	0.32	63	µg/kg	No	Yes	NA		
DELTA-BHC	SURFACE SOIL	0.26	0.26	µg/kg	No	Yes	No		
	SUBSURFACE SOIL	34	34	µg/kg	No	Yes	NA		
GAMMA-BHC (LINDANE)	SURFACE SOIL	0.23	0.23	µg/kg	No	No	Yes		
AROCLOR-1242	SUBSURFACE SOIL	2400	2400	µg/kg	Yes	Yes	NA	Yes	Cancer Risk > 10^{-6}
AROCLOR-1260	SURFACE SOIL	17	17	µg/kg	No	Yes	No		
ALPHA-CHLORDANE	SEDIMENT	0.85	6	µg/kg	No	NA	Yes		
GAMMA-CHLORDANE	SEDIMENT	0.52	3.5	µg/kg	No	NA	Yes		
DIELDRIN	SURFACE SOIL	0.36	460	µg/kg	Yes	Yes	Yes	Yes	Cancer Risk > 10^{-6}
	SUBSURFACE SOIL	0.43	0.43	µg/kg	No	Yes	NA		

TABLE 1-2

COPCs IN SURFACE SOIL, SUBSURFACE SOIL, SEDIMENT, GROUNDWATER, AND SURFACE WATER
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI
PAGE 2 OF 3

CHEMICAL	MEDIA	DETECTED		UNITS	DIRECT EXPOSURE COPC	MIGRATION PATHWAY COPC	ECOLOGICAL RECEPTOR COPC	COC	REASON
		Minimum	Maximum						
Pesticides/PCBs (continued)									
ENDRIN ALDEHYDE	SURFACE SOIL	0.31	2	µg/kg	No	No	Yes		
HEPTACHLOR EPOXIDE	SURFACE SOIL	0.25	1.7	µg/kg	No	Yes	Yes		
	SUBSURFACE SOIL	0.33	6.2	µg/kg	No	Yes	NA		
Inorganics									
ALUMINUM	SURFACE SOIL	1770	12300	mg/kg	Yes	No	Yes		
	SUBSURFACE SOIL	2910	9700	mg/kg	Yes	No	NA		
	GROUNDWATER	73.5	6320	µg/L	Yes	No	NA		
	SURFACE WATER	430	1690	µg/L	No	NA	Yes		
	SEDIMENT	1000	17200	mg/kg	Yes	NA	Yes		
ANTIMONY	SURFACE SOIL	1.1	3.6	mg/kg	Yes	Yes	Yes		
ARSENIC	SURFACE SOIL	0.78	4.8	mg/kg	Yes	Yes	No		Less than regional concentrations
	SUBSURFACE SOIL	1.3	2	mg/kg	Yes	Yes	NA		
	GROUNDWATER	14.2	19.1	µg/L	Yes	No	NA	Yes	Contributes to HI > 1/ Cancer Risk > 10^{-6}
	SURFACE WATER	3.4	3.4	µg/L	Yes	NA	No		
	SEDIMENT	0.81	19.8	mg/kg	Yes	NA	Yes		
BARIUM	SURFACE WATER	20.75	30.1	µg/L	No	NA	Yes		
CHROMIUM	SURFACE SOIL	2.2	11	mg/kg	No	Yes	No		
	SUBSURFACE SOIL	3	9.8	mg/kg	No	Yes	NA		
COBALT	SURFACE SOIL	6.8	6.8	mg/kg	Yes	Yes	No		
COPPER	SURFACE SOIL	1.4	210	mg/kg	No	Yes	Yes	Yes	Concentration > ESV
IRON	SURFACE SOIL	546	9050	mg/kg	Yes	Yes	Yes		
	SUBSURFACE SOIL	908	2060	mg/kg	No	Yes	NA		
	GROUNDWATER	147	44000	µg/L	Yes	No	NA	Yes	Contributes to HI > 1
	SURFACE WATER	1720	2410	µg/L	Yes	NA	Yes	Yes	Concentration > ESV
	SEDIMENT	650	28100	mg/kg	Yes	NA	Yes		
LEAD	SURFACE SOIL	3.2	70.6	mg/kg	No	Yes	Yes		
	SURFACE WATER	1.6	2	µg/L	No	NA	Yes		
	SEDIMENT	1.9	32.1	mg/kg	No	NA	Yes		
MANGANESE	SURFACE SOIL	1	358	mg/kg	Yes	Yes	Yes	Yes	Concentration > ESV
	GROUNDWATER	4.4	548	µg/L	Yes	No	NA	Yes	Contributes to HI > 1
	SEDIMENT	1.5	295	mg/kg	Yes	NA	Yes		

TABLE 1-2

COPCs IN SURFACE SOIL, SUBSURFACE SOIL, SEDIMENT, GROUNDWATER, AND SURFACE WATER
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI
PAGE 3 OF 3

CHEMICAL	MEDIA	DETECTED		UNITS	DIRECT EXPOSURE COPC	MIGRATION PATHWAY COPC	ECOLOGICAL RECEPTOR COPC	COC	REASON
		Minimum	Maximum						
Inorganics (continued)									
SELENIUM	SURFACE SOIL	0.505	1.3	mg/kg	No	Yes	Yes		
THALLIUM	GROUNDWATER	4.1	4.1	µg/L	Yes	No	NA	Yes	Contributes to HI > 1
VANADIUM	SURFACE SOIL	2.7	16	mg/kg	No	No	Yes		
ZINC	SURFACE SOIL	1.7	89	mg/kg	No	No	Yes		
	SEDIMENT	4.2	132	mg/kg	No	NA	Yes		

Notes:
NA = not applicable

After the risk calculations, further evaluations, and uncertainty analysis, the only COCs remaining are as follows:

Surface Soil – Dieldrin
Subsurface Soil – Aroclor-1242
Groundwater – None
Surface Water – None
Sediment – None

Chemicals eliminated from further evaluation at this time are assumed to present minimal risks to potential human receptors.

A constituent was also selected as a COPC and retained for further quantitative risk evaluation in the screening level ecological risk assessment if the maximum detection in a sampled medium exceeded the PRG for Ecological Endpoints (USEPA, 1987b).

The primary contaminant migration pathway at Site 1 is the infiltration of soil contaminants into groundwater and subsequent seepage into surface water and sediment in the ditches located east and west of the former landfill. Analytical data from surface soil samples collected at the site, and sediment and surface water samples collected from ditches on the eastern and western edges of the site, were evaluated in the ecological risk assessment. A Food Chain Hazard Quotient (HQ) Assessment was also performed for representative species under a conservative scenario.

VOCs and semivolatile organic compounds in surface soil do not pose risks to ecological receptors. Concentrations of metals tended to be low and pose negligible potential risks to soil invertebrates and plants.

Low levels of VOCs detected in surface water and sediment do not appear to represent a potential risk to aquatic organisms. Pesticides appear to pose negligible risks to benthic receptors. Concentrations of most metals tended to be low and pose negligible potential risks to aquatic and benthic organisms, or do not appear to be related to former activities at the landfill.

In the average concentration scenario, all food chain HQs were less than 1.0; therefore, site-related impacts to piscivorous receptors from bioaccumulative COPCs in surface water and sediment are not expected.

In summary, unacceptable ecological risks are not anticipated and no COCs were retained for Site 1. When conservative assumptions used in the ecological risk assessment are re-evaluated and factors that

affect potential exposures, such as quality and size of the habitat and actual use of the site by modeled receptors are considered, the overall level of ecological risk is considered minimal.

1.9 REPORT ORGANIZATION

This FS is organized into five sections. Section 1.0 presents the purpose, site description, and regulatory setting; Section 2.0 presents the development of the RAOs, PRGs, and areas and volumes of contamination; Section 3.0 identifies and screens the alternatives; Section 4.0 presents the detailed analysis of the alternatives; and Section 5.0 presents the comparative analysis for the remedial alternatives at Site 1.

This FS also includes the following two appendices: Appendix A – Presumptive Remedy Guidance and Determinations and Appendix B – Remedial Alternative Cost Estimates.

2.0 REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

The objectives and goals for a remedial action at Site 1 provide the basis for selecting RAOs and identifying remedial technologies to address unacceptable exposure scenarios that may be encountered with Site 1 contaminated media. The guidance for the presumptive remedy is also considered.

This section presents the development of RAOs. As part of this development, ARARs and to be considered (TBC) criteria, are identified. Next, media of concern are identified based on the COCs identified for Site 1. Preliminary action levels, or PRGs, for each medium of concern are then identified. Taking into consideration this information, RAOs are then defined.

This section also presents GRAs for Site 1 contaminated media. GRAs are categories of actions that could be implemented to satisfy or address a component of the RAOs for the site. Lastly, this section provides volume estimates for contaminated media to be addressed at Site 1.

2.1 REMEDIAL ACTION OBJECTIVES

2.1.1 Contaminants and Media of Concern

As determined in the RI (Tetra Tech, 2013), contaminants found to pose potential human health or ecological risks at Site 1 were retained as COCs in this FS. Based on the COCs and risks associated with exposure to landfill waste left in place, surface soil, subsurface soil, and groundwater were retained as media of concern at Site 1. Remedial alternatives were developed to address COCs and media of concern.

Surface soil is retained as a medium of concern due to detections of dieldrin and copper. Dieldrin is retained as a COC due to its maximum detected concentration of 460 µg/kg detected in one sample.

Subsurface soils were retained as a medium of concern due to the detection of Aroclor-1242, which was detected at a maximum concentration of 2,400 mg/kg.

The groundwater at Site 1 was encountered in the shallow subsurface, typically within 1 to 5 feet of ground surface. The surficial aquifer consists of fine-grained silty sand and is unconfined. The surficial aquifer extends to approximately 45 feet bls at Site 1 and is separated from the primary drinking water aquifer (Miocene) by a much more plastic green clayey and sandy silt layer. Water levels in monitoring wells were used to construct a potentiometric surface map.

As indicated on Figure 2-1, groundwater flow is generally to the north; however, there is a divide that is influenced by surrounding surface water bodies, mainly the canals, to the east and west of the site.

PCE was found in five samples with detections ranging from 0.26 to 2.5 µg/L. Inorganics were found as follows: arsenic was detected in 2 of 22 samples at concentrations from 14.2 to 19.1 µg/L, iron was detected in 22 samples ranging from 147 to 44,000 µg/L, and manganese was found at concentrations ranging from 4.4 to 548 µg/L. Thallium was detected in only one groundwater sample at a concentration of 4.1 µg/L. The risk evaluations determined none of the above chemicals are to be retained as COCs, Therefore, groundwater is retained as a medium of concern due to the risks posed from contaminants in soil and waste left in place leaching to groundwater only.

2.1.2 ARARs and To Be Considered (TBC) Criteria

ARARs for this FS are the federal and state environmental requirements used to define the appropriate extent of site cleanup, to identity sensitive land areas or land uses, to develop remedial alternatives, and to direct site remediation. CERCLA and the NCP require remedial actions to comply with state ARARs when they are more stringent than federal ARARs.

The NCP defines two ARAR components: 1) applicable requirements and 2) relevant and appropriate requirements. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws specifically addressing a hazardous substance, pollutant, contaminant, remedial action, or other circumstance found at a CERCLA site. Applicable state standards are only those 1) identified by the state in a timely manner, 2) consistently enforced, and 3) more stringent than federal requirements.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements under federal and state environmental and facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, or remedial action, address situations sufficiently similar to those encountered at the CERCLA site so their use is well-suited to the particular site. Only those state standards 1) identified in a timely manner and 2) more stringent than federal requirements may be relevant and appropriate.

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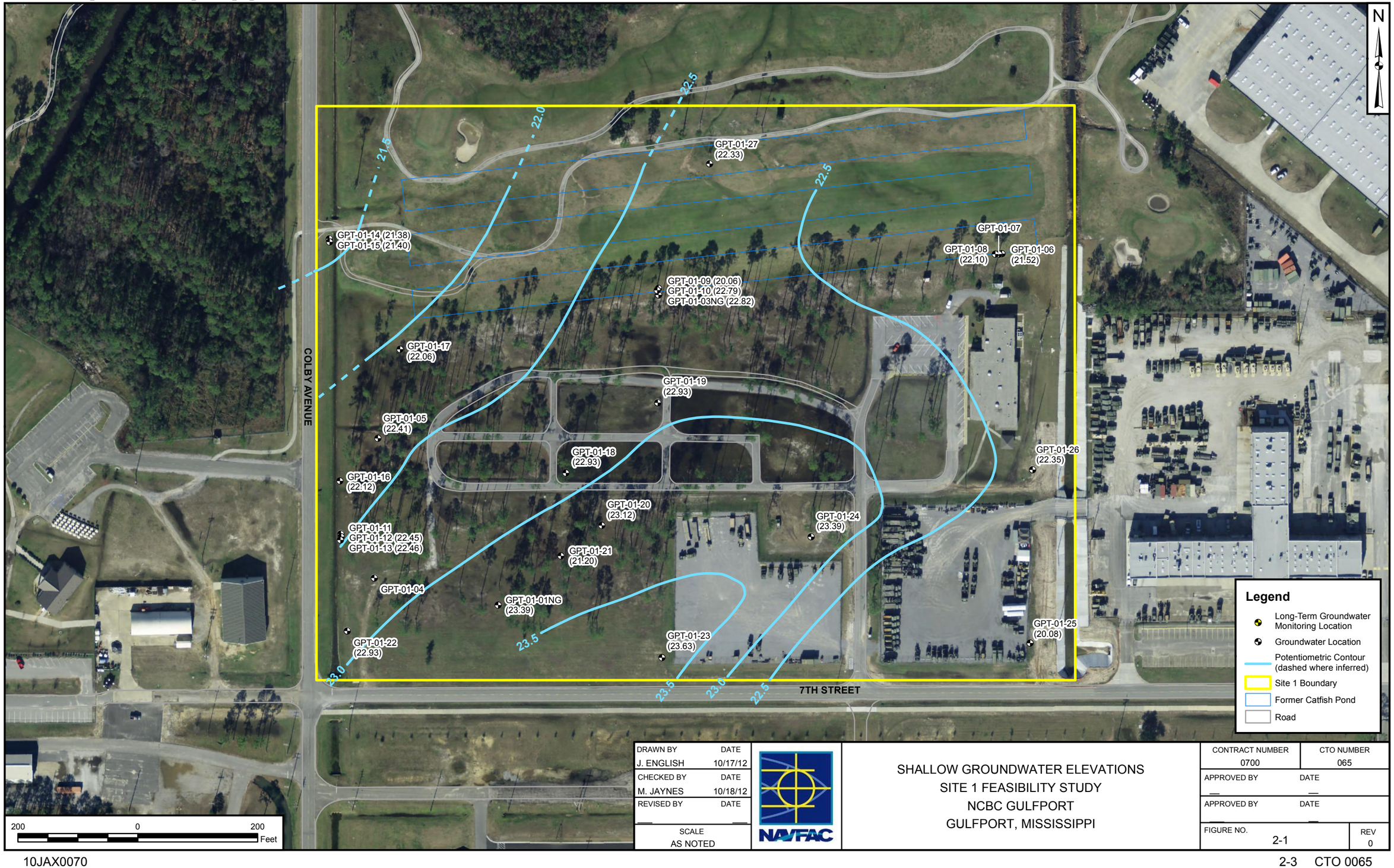

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SHALLOW GROUNDWATER ELEVATIONS
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CONTRACT NUMBER	0700
CTO NUMBER	065
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FIGURE NO.	2-1
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"Applicability" is a legal determination of jurisdiction of existing statutes and regulations, whereas "relevant and appropriate" is a site-specific determination of the appropriateness of existing statutes and regulations. Therefore, relevant and appropriate requirements allow flexibility not provided by applicable requirements in the final determination of cleanup levels. After a requirement is identified as an ARAR, the selected remedy must comply with or be waived from compliance with the ARAR, even if the ARAR is not required to assure protectiveness. Applicable requirements apply to both on- and off-site remedial actions.

TBC guidance criteria are federal and state non-promulgated advisories or guidance that are not legally binding and do not have the status of potential ARARs. However, if there are no specific ARARs for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

Under the description of ARARs set forth in the NCP and the SARA, state and federal ARARs are categorized as follows:

- Chemical-specific: Controlling the extent of site remediation with regard to specific contaminants and pollutants.

- Location-specific: Governing site features such as wetlands, floodplains, and sensitive ecosystems (including features of historical significance).

- Action-specific: Pertaining to the proposed site remedies and governing the implementation of the selected site remedy.

During the detailed analysis of remedial alternatives presented in Section 4.0, each alternative will be analyzed to determine its compliance with ARARs. Chemical-, location-, and action-specific ARARs for Site 1 are presented in Table 2-1.

2.1.3 Preliminary Remediation Goals

Based on discussions between the Navy and MDEQ, it was agreed that the State of Mississippi would be the regulatory lead agency at Site 1 and that PRGs for the project would be based on the State of Mississippi TRGs. As a result, the MDEQ TRGs will serve as the basis for remedial action. The PRGs for Site 1 are presented in Table 2-2.

TABLE 2-1

ARARs AND TBC CRITERIA
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI
PAGE 1 OF 2

NAME / CITATION	REQUIREMENT	TYPE / PREREQUISITES	CATEGORY
FEDERAL			
Hazardous Materials Transportation Act Regulations (49 CFR Parts 171-179)	Provides requirements for packaging, labeling, manifesting and transporting of hazardous materials	Applicable If any waste debris, contaminated soil or sediment is excavated and transported off-site, that material would need to be managed IAW these regulations.	Action-specific
CAA Regulations setting National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61)	Provides standards promulgated under the CAA for controlling significant sources of hazardous air pollutants	Applicable Should site activities result in release of hazardous air pollutants controls to minimize their release must be implemented IAW these requirements.	Action-specific
RCRA Regulations - Hazardous Waste Determinations by Generators of Solid Waste (40 CFR Part 261 and 40 CFR 262.11)	Provides requirements for the proper identification and characterization of hazardous waste	Applicable Should site activities generate solid wastes, determining whether those wastes are hazardous must be done IAW these requirements.	Action-specific
RCRA Regulations - Management of Hazardous Waste (40 CFR Parts 262-268)	Provides requirements for the proper management (treatment, storage and disposal) of hazardous waste	Applicable Should site activities generate hazardous waste, then such waste must be managed IAW applicable subparts of these regulations.	Action-specific
Executive Order 11988 - Floodplain Management, Section 2(a)(2)	Provides requirements for assessing alternatives to mitigate / avoid possible adverse impacts to floodplains	TBC Potential impacts of planned site activities must be assessed and alternatives implemented where possible, to avoid or minimize adverse impacts to floodplains.	NA
STATE			
TRGs Miss. Code Ann. Section 49-35-21 (2002)	Establish default screening levels and human health risk-based cleanup goals for soil and groundwater	Applicable Media-specific numerical standards as shall apply to remedial actions in the State of Mississippi will be satisfied.	Chemical -specific
Hazardous Waste Management Regulations HW-1, Parts 262-268 (MDEQ, 2005)	Provide requirements for the proper management (treatment, storage and disposal) of hazardous waste.	Applicable Should hazardous wastes be generated those substantive portions (if any) more stringent than their federal RCRA counterpart(s) must be satisfied.	Action-specific

TABLE 2-1

**ARARs AND TBC CRITERIA
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI
PAGE 2 OF 2**

Solid Waste Management Regulations, SW2 Sections IV. E.a.(1-2) (MDEQ, 2005)	Provides requirements for the post-closure care and monitoring of non-hazardous waste landfills	Relevant and Appropriate While not directly applicable to Site 3, these regulations establish otherwise relevant landfill cover maintenance and groundwater monitoring standards for similar landfills which will be met for Site 3.	Action-specific
Storm Water Management - Water Pollution Control Act, Miss. Code Ann. 49-17- 1 et. seq. (1972)	Provides requirements for controlling pollutants in storm water runoff from land disturbing activities < 5 acres	Applicable On-site activities associated with soil cap construction will comply with these requirements and applicable conditions in NCBC Gulfport's MS4 General NPDES Permit, No. MSRMS4036.	Action-specific
Air Emission Regulations for the Prevention, Abatement, and Control of Air Contaminants, Section 3, 3. (General Nuisances) (MDEQ, APC-S-1, amended December 14, 2011)	Provides requirements for controlling particulate matter and emissions during land grading and clearing activities	Applicable Reasonable measures to control fugitive dust emissions from on-site soil disturbing activities will be instituted. Only applicable to extent more stringent than federal requirement(s).	Action-specific

Notes:
CAA = Federal Clean Air Act, as amended
CFR = Code of Federal Regulations
RCRA = Federal Resource Conservation and Recovery Act, as amended
IAW = in accordance with
NPDES = National Pollutant Discharge Elimination System

TABLE 2-2

**COCs BY MEDIA WITH APPROPRIATE PRGs
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI**

MEDIA	COC	MDEQ TRG UNRESTRICTED	MDEQ TRG RESTRICTED	ESV REGION 4
Surface Soil	Dieldrin	**39.9 µg/kg**	358 µg/kg	4.9 µg/kg
Subsurface Soil	Aroclor-1242	**1,000 µg/kg**	10,000 µg/kg	-

Notes:
Bold value indicates selected PRG.
- = no criterion

Per Mississippi Code Section 49-35-21, TRGs are based on one of the following: 1) a 1×10^{-6} target incremental cancer risk level for each carcinogenic chemical, 2) an HI not to exceed 1.0 for each systemic toxicant, or 3) constituent TRG concentrations established through federal/state programs (e.g., the Safe Drinking Water Act). The State of Mississippi lists TRGs for both restricted (industrial) and unrestricted

(residential) land use. Because of the proximity of Site 1 to public access areas, unrestricted (residential) TRGs are deemed appropriate for remedial consideration.

As part of the CERCLA process, PRGs are periodically revised because of new guidance requirements and promulgated or updated ARARs. Final remediation goals will not be formally established until the approval of the Decision Document.

2.1.4 Statement of RAOs

RAOs are the medium-specific goals established to protect human health and the environment (USEPA, 1988). USEPA's documents *Presumptive Remedy for CERCLA Municipal Landfill Sites* (USEPA, 1993b) and *Applications of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills* (USEPA, 1996a) lists typical primary RAOs. Taking the referenced documents into consideration and evaluating the information from previous investigations and COCs retained, the RAOs for Site 1 consist of the following:

RAO 1: Prevent direct contact with landfill waste/disposal area contents and contaminated surface and subsurface soils, therefore eliminating unacceptable human exposure scenarios for soils.

RAO 2: Prevent direct exposure routes for human and ecological recipients to groundwater.

2.2 GENERAL RESPONSE ACTIONS

GRAs describe categories of actions that could be implemented to satisfy or address a component of the RAOs for the site. Remedial alternatives will be developed using one or more GRAs to meet the RAOs. These remedial alternatives will be capable of achieving the RAOs for each contaminated medium at the site. General GRAs may include no action, containment, excavation, extraction, disposal treatment, institutional controls, monitoring, or a combination of these.

The USEPA's presumptive remedy approach is part of their Superfund Accelerated Cleanup Model and is intended to streamline the corrective action process. The USEPA Presumptive Remedy Guidance considered applicable to this site is based on conditions normally associated with a landfill and provides a systematic approach to assessing and remediating the site. The remedy for landfills is source containment and includes the following typical components: landfill cap, source area groundwater control, leachate collection and treatment, landfill gas collection and treatment, and institutional controls (supplement to engineering controls). The presumptive remedy approach allows supplemental

technologies to be used if conditions beyond those typical for municipal landfills (e.g., contaminated groundwater migrating away from the site) are encountered.

Based on the RAOs for Site 1 and existing site conditions discovered during the investigation, the following GRAs will be considered for soil and groundwater:

- No action (USEPA requirement)
- Excavation
- Containment (includes engineering controls and covering the landfill waste/disposal area to limit exposure)
- LUCs
- Landfill gas management
- Monitoring

2.3 ESTIMATED VOLUME OF CONTAMINATED MEDIA

Based on data from the RI (Tetra Tech, 2013), the volume of soil/buried waste to be addressed is approximately 30,370 cubic yards (yd^3) within a surface area of approximately 410,000 square feet (ft^2).

3.0 TECHNOLOGY SCREENING AND REMEDIAL ALTERNATIVE DEVELOPMENT

This section identifies, screens, and evaluates the potential remedial technologies and process options for Site 1 at NCBC Gulfport. The primary objective of this portion of the FS is typically to develop an appropriate range of remedial technologies and process options that will be used for developing remedial alternatives. Given the applicability of the presumptive remedy approach to Site 1, containment should be incorporated into the remedy with appropriate modifications as necessary to address the remaining RAOs described in Section 2.1.4.

The selection of remediation technologies and process options for initial screening is based on the Guidance for Conducting RI/FSs under CERCLA (USEPA, 1988). The screening is first conducted at a preliminary level to focus on relevant remediation technologies and process options, and then the screening is conducted at a more detailed level based on the evaluation criteria. Finally, process options are selected to represent the remediation technologies that have passed the entire evaluation and screening process.

The USEPA has developed a response action or presumptive remedy for CERCLA municipal landfills that can be applied to appropriate military landfills (USEPA Directive Number 9355.0-0-67FS) (USEPA, 1996a). As discussed previously, the conditions at Site 1 meet the presumptive remedy guidelines, and the remedy components may include any of the following that are applicable:

- Landfill soil cover/cap to prevent direct exposure, erosion, and infiltration
- Excavation
- Source area groundwater control to contain plume
- Leachate collection and treatment
- Landfill gas collection and treatment
- Institutional controls to supplement engineering controls

Each of these components will be evaluated with the RAOs to determine those applicable for the site-specific conditions of the landfills. Remedial action alternatives will be established based on the applicable technology types.

3.1 PRELIMINARY SCREENING OF SOIL TECHNOLOGIES AND PROCESS OPTIONS

This section identifies and screens remediation technologies and process options at a preliminary stage based on implementation with respect to site conditions and RAOs. Table 3-1 summarizes the GRAs, and identifies the technologies and process options that were retained for screening.

TABLE 3-1

SOIL, SEDIMENT, SURFACE WATER, AND GROUNDWATER REMEDIATION TECHNOLOGIES AND PROCESS OPTIONS SITE 1 FEASIBILITY STUDY NCBC GULFPORT, MISSISSIPPI

GRA	Remediation Technology	Process Option
No Action	None	Not Applicable
Limited Action	LUCs	Legal restrictions on land use
		Maintenance of existing cover
Removal	Excavation	Removal of contaminated soil
Monitoring	Engineering controls	Sampling and Analysis (groundwater)
		Landfill gas and groundwater monitoring
Containment	Cap/cover	Native soil cover system
		Single barrier cover system
		Composite barrier cover system
Landfill Gas Control	Landfill gas collection and treatment	Landfill gas management
		Landfill gas to energy

3.2 SCREENING OF REMEDIATION TECHNOLOGIES AND PROCESS OPTIONS

3.2.1 No Action

No Action consists of maintaining the status quo at the site. As required under CERCLA regulations, the No Action alternative is carried through the FS to provide a baseline for comparison of alternatives and their effectiveness in mitigating risks posed by site contaminants.

Effectiveness

The No Action alternative would not be effective in meeting the RAOs for the site. The No Action alternative would not be effective in evaluating potential contaminant migration off site because no monitoring would be performed.

Implementability

There would be no implementability concerns since no actions would be implemented.

Cost

Because no remedial actions are conducted under this alternative, there are no costs.

Conclusion

The No Action alternative is retained for comparison to other options at Site 1.

3.2.2 Limited Action

This GRA consists of LUCs to limit or restrict site use.

LUCs

NCBC Gulfport is in the process of developing a Memorandum of Agreement (MOA) with the MDEQ to guide the LUC program. Under this program, LUCs would consist of preparing and implementing a LUC Implementation Plan (LUCIP) detailing procedures to prohibit current site users from being exposed to contaminants and deed restrictions to prevent the site from being used in the future for residential purposes. LUCs would also be used to implement long-term requirements such as inspection and maintenance of a cap/cover, monitoring, and reporting.

Effectiveness

Restricting site access and future uses of the site would prevent direct exposure for both human and ecological receptors to waste and groundwater.

Implementability

LUCs would be readily implementable. Legal requirements for property transfer would need to be met in the event of base closure. Site controls would be easy to formulate and implement. Resources are readily available for the implementation of LUCs.

Cost

Costs of LUCs would be low compared to active remedial measures.

Conclusion

LUCs are retained in combination with other process options for the development of remedial alternatives at Site 1.

3.2.3 Removal

The technology considered under this GRA is excavation.

Excavation

A variety of equipment, such as front-end loaders, backhoes, grade-alls, etc. could be used to perform the excavation. The type of equipment selected would take into consideration several factors such as the

type of material to be removed, the load-bearing capacity of the ground surrounding the removal area, the depth and areal extent of removal, the required rate of removal, and the elevation of the groundwater table.

The logistics of the excavation must take into account the available space for operating the equipment, loading and unloading of the excavated material, location of the site, etc. After excavation is completed, the void is filled and graded with clean fill material or treated soils.

Effectiveness

Excavation is a well-proven and effective method of removing contaminated material from a site. A properly designed excavation would remove soil with COCs greater than cleanup levels followed by suitable clean soil as backfill within the excavated area. Following excavation and backfilling, the overall site concentrations would not pose an unacceptable risk to human health or the environment.

Implementability

Excavation of contaminated soil at Site 1 would be implementable. Excavation equipment is readily available from multiple vendors. This technology is well proven and established in the construction/remediation industry. Prior to excavation, a utility survey would be required and utilities clearly marked so that the excavation does not impact any utility.

Cost

Cost of excavation at Site 1 on a unit volume basis would be low because of the shallow excavation depth (up to 2 feet bls) and the presence of sandy soils. Moreover, because the depth to the water table is approximately 3 to 5 feet bls, requirements for dewatering would not exist under dry weather conditions.

Conclusion

Excavation of the contaminated surface soil is retained in combination with other process options for the development of remedial alternatives at Site 1. Excavation of the buried waste is not considered cost effective and will not be retained.

3.2.4 Monitoring

Monitoring would consist of regularly collecting and analyzing groundwater samples from the site to check for potential leachate/contaminated groundwater migration. Monitoring may be considered when contaminated media are left in place without treatment.

Effectiveness

Monitoring would be an effective tool to evaluate potential migration and/or attenuation of contaminants and to determine the direction of future actions. Since there were no COCs defined for Site 1, this action is anticipated to be used to monitor future leachate development/migration issues.

Implementability

A sampling and analysis program could be readily implemented. Sampling is a routine activity that can be performed by qualified and trained personnel. Environmental consulting firms that offer sampling and laboratory services are readily available.

Cost

Capital and operation and maintenance (O&M) costs of monitoring would be low compared to other remedial measures.

Conclusion

Monitoring is retained in combination with other process options for the development of remedial alternatives at Site 1.

3.2.5 Containment

Covering would consist of providing a barrier to prevent direct exposure to contaminated soil and landfill waste/disposal area material, and minimize potential off-site migration of contaminated soil via erosion. Capping would consist of providing a barrier to prevent direct exposure to contaminated soil and landfill material, reduce percolation of precipitation through the waste, and minimize potential off-site migration of contaminated soil via erosion.

Capping is not appropriate for Site 1 due to the unlined landfill being located in a historic flood plain area. The waste was buried within the natural water table. Additionally, the bottom liner of the landfill is of similar hydraulic conductivity to the liner above the landfill material. The effort and cost associated with a low permeable cap provides little benefit over the use of the existing cover to prevent exposure to the waste. Therefore, it will not be considered.

Effectiveness

Soil covers as physical barriers can be effective in reducing risk associated with human and ecological exposure to contaminated soil and landfill/disposal area material beneath the soil cover.

Implementability

Soil covering is a common remedial alternative and would be fully implementable. Materials are readily available from several vendors, and the materials are commonly used. The existing cover was evaluated by Tetra Tech and provides a minimum 2 feet across Site 1. This is deemed adequate to protect human health and the environment. A small portion of the existing cover is contaminated with dieldrin and requires removal/repair. It is anticipated that borrow sources can be identified relatively close to the base. The main concern with implementation of a cover would be maintenance under the influence of natural (e.g., storms and burrowing animals) and human interferences (e.g., development). Proper engineering and O&M would minimize the impacts of natural interferences. Because the site is under federal control, human interferences would also be minimized.

Cost

Costs associated with soil covers are moderate to high, depending on the materials and labor involved in placement. However, Site 1 already has the required 2 feet of cover. Minor additional drainage pipe/culvert cleanout and sediment removal would be required to limit ponding of water or erosion over the landfill area. O&M costs for caps are typically low to moderate.

Conclusion

A soil cover is retained for development as an alternative. The cover system would be designed to prevent ponding and erosion. A soil cover would have a significant effect on reducing exposure to the waste disposal area. This technology meets the requirements of the presumptive remedy for landfills. Additionally, the site has a cover meeting the requirements and only requires minimal repair.

3.2.6 Landfill Gas Control

A landfill gas survey was conducted in 2008 to detect generation of landfill gases to determine if the final cover would need to include a gas collection/venting system. The evaluation included the collection and field analysis of vadose zone gas samples from five locations at Site 1. Locations were evenly spaced over the disposal area delineated during the RI.

Based on guidance from the USEPA (USEPA, 1987b), active gas collection/venting is generally required when vadose zone methane concentrations exceed either:

- 5% methane at the property line or cap edge, or
- 25% lower explosive limit (LEL) in or at onsite structures.

The methane concentrations at the five vadose zone sampling locations at Site 1 were less than the instrument detection levels for both methane concentration and LEL. Since little methane was detected from the sampling at Site 1, landfill gas-venting will be eliminated.

Effectiveness

Since no landfill gas was detected and due to the age of the landfill, significant landfill gas generation is not anticipated, and the use of a landfill gas control system is not anticipated to be necessary or effective.

Implementability

Landfill gas collection and venting would be easy to implement and the resources, materials, and services required to implement this technology are readily available. The collection and venting system would be included as part of the cover design.

Cost

Capital and O&M costs for landfill gas collection and venting would be low to moderate.

Conclusion

Landfill gas collection and venting is eliminated.

3.3 SELECTION OF REMEDIATION TECHNOLOGIES AND PROCESS OPTIONS

The following technologies and process options are retained to develop remedial alternatives:

- No Action
- LUCs
- Excavation
- Soil Cover/Capping
- Groundwater Monitoring

3.4 DEVELOPMENT OF ALTERNATIVES

Alternatives were developed based on an assembly of the technologies selected under each of the GRAs discussed in Section 2.0. Alternatives are developed to provide an appropriate range of options. Sufficient information is included to adequately evaluate and compare alternatives and to determine the most appropriate alternative. Three alternatives will be analyzed during this FS including alternatives based on USEPA's presumptive remedy guidance to remediate military landfills with municipal landfill characteristics. The following sections discuss the assembly of alternatives.

3.4.1 Alternative 1: No Action

The No Action alternative maintains the site as is. This alternative does not address site contamination and is only retained to provide a baseline for comparison to other alternatives. There would be no reduction in toxicity, mobility, or volume of wastes and site contaminants other than what might result from natural dispersion, dilution, and other attenuating factors. Existing monitoring programs and LUCs would be discontinued, and the site would be available for unrestricted use.

3.4.2 Alternative 2: Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/culvert Cleanout and Sediment Removal, LUCs, and Groundwater Monitoring

This alternative consists of various technologies and remedial actions. Approximately 118 yd^3 of soil in the north central area of the site will require excavation. Approximately 410,000 ft^2 of the site (defined area of the landfill) would require a soil cover. Based on previous investigations and the recent waste profiling, there is a minimum 2 feet of soil cover over the landfilled waste at Site 1. The approximately 410,000 ft^2 of existing soil cover at Site 1 is adequate and will be left in place. Approximately 137,500 ft^2 at the site has been capped with parking areas. To limit ponding and promote drainage, the existing drainage pipes/culverts (12-inch diameter) will be cleaned out and sediment removed as needed across the site. Final site layout would support existing conditions and restore the site to its original design.

The drainage pipe/culvert and sediment removal effort would limit ponding of water over the buried waste during normal weather conditions. However, the area is located within a historic flood plain and routinely holds water for long period after heavy rains.

COC concentration in the surface soil exceeded the risk criteria at one location in the north-central portion of Site 1. The soil at this location will be excavated and taken off site for disposal.

LUCs would be developed and implemented to restrict access to soil and groundwater with unacceptable risk. LUCs would also prevent residential development, withdrawal of groundwater, or soil excavation. Periodic inspections would be required to ensure that the integrity of the soil cover has not been compromised and to determine whether maintenance to the surface protection is required.

Groundwater monitoring would consist of groundwater sample collection and analysis (assume 12 monitoring wells on a quarterly basis for the first year, semiannually for the next two years, and annually thereafter for the costing estimate in this FS). Wells would be selected to monitor the upgradient background conditions and the conditions downgradient of the landfill.

3.4.3 Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Monitoring, and Groundwater Monitoring

This alternative consists of various technologies and remedial actions. Approximately 410,000 ft^2 of the site would be capped. The engineered low permeability cap would consist of three layers (from top to bottom): an erosion layer of topsoil, a low permeability layer, and a gas-venting layer. Prior to placing the soil cap, the existing ground surface will be graded to promote drainage. Although mentioned earlier that a gas-venting layer would be eliminated, in this scenario, passive gas vents would be used to ensure no buildup of methane occurs beneath the low permeability layer.

Overlying the infiltration layer would be a topsoil layer (MDEQ Regulation SW-2 "erosion layer"). A 6-inch layer of topsoil would be placed to provide the necessary slope to meet MDEQ requirements (MDEQ, 2005). Grading and final site layout would support existing conditions.

The low permeability layer (MDEQ Regulation SW-2 "infiltration layer") would consist of 18 inches of soil with a maximum hydraulic conductivity of 1×10^{-5} cm/s or a layer with an equivalent hydraulic conductivity installed to minimize the infiltration of rainwater into the landfill. The infiltration layer would minimize the amount of infiltration that would be exposed to the underlying waste. This action would result in minimizing infiltration through the waste and into the groundwater, which would reduce the transport of contaminants from the waste to groundwater.

Beneath the infiltration layer would be a gas-venting layer consisting of a granular material, a geocomposite, or a heavy needle-punched nonwoven geotextile, that would collect landfill gas. Below the gas-venting layer would be a 6-inch layer of common fill (or select waste) that would protect the overlying layer(s) from puncture. Landfill gas will be collected and vented.

LUCs would be developed and implemented to restrict access to soil, sediments, surface water, and groundwater with unacceptable risk. LUCs would also prevent residential development, withdrawal of groundwater, or soil excavation. Periodic inspections would be required to ensure that the integrity of the low permeability cap has not been compromised and to determine whether maintenance to the surface protection is required.

Landfill gas would be managed by preventing the accumulation of methane gas below the low permeability cap. Specific details of the venting system would be identified in the design phase. A gas-monitoring program, including vents and probes between the landfill and nearby structures, would also be developed in the design phase.

Groundwater monitoring would consist of groundwater sample collection and analysis (assume 12 monitoring wells on a quarterly basis for the first year, semiannually for the next two years, and annually thereafter for the costing estimate in this FS). Wells would be selected to monitor the upgradient background conditions and the conditions downgradient of the landfill.

4.0 ASSEMBLY AND DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

In this section, the remedial technologies retained from the technology screening process conducted in Section 3.0 are assembled into multiple remedial alternatives. The following sections contain descriptions of the alternatives developed in Section 3.0 and provide a detailed analysis of these alternatives in accordance with the CERCLA evaluation criteria.

4.1 INTRODUCTION

This section presents an evaluation of each remedial alternative with respect to the criteria of the NCP of 40 CFR Part 300, as revised in 1990. The criteria as required by the NCP and the relative importance of these criteria are described in the following subsections.

4.1.1 Evaluation Criteria

In accordance with the NCP (40 CFR 300.430), the following nine criteria are used for the evaluation of remedial alternatives:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs
- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, and Volume through Treatment
- Short-term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

4.1.1.1 Overall Protection of Human Health and the Environment

Alternatives must be assessed for adequate protection of human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances or contaminants present at the site. For this purpose, alternatives should eliminate, reduce, or control exposure to levels of contaminants exceeding remediation goals. Overall protection draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

4.1.1.2 Compliance with ARARs

Alternatives must be assessed to determine whether they comply with ARARs under federal environmental laws and state environmental or facility siting laws. CERCLA Section 121(d) specifies in part that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site or a waiver must be obtained (see also 40 CFR 300.430(f)(1)(ii)(B)). ARARs include only federal and state environmental or facility siting laws/regulations and do not include occupational safety or worker protection requirements. In addition, per 40 CFR 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (TBC guidance).

4.1.1.3 Long-term Effectiveness and Permanence

Alternatives must be assessed for the long-term effectiveness and permanence offered, along with the degree of certainty that the alternative will prove successful. Factors that shall be considered as appropriate include the following:

- Magnitude of Residual Risk – Residual risk is posed by untreated waste or treatment residuals at the conclusion of remedial activities. The characteristics of residuals should be considered to the degree that they remain hazardous taking into account their volume, toxicity, mobility, and propensity to bioaccumulate.

- Adequacy and Reliability of Controls – Controls such as containment systems and LUCs that are necessary to manage treatment residuals and untreated waste must be shown to be reliable. In particular, the following should be addressed: the uncertainties associated with land disposal for providing long-term protection from residuals; the potential need to replace technical components of an alternative such as a cap, slurry wall, or treatment system; and the potential exposure pathways and risks posed should the remedial action need replacement.

4.1.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The degree to which the alternative employs recycling or treatment that reduces the toxicity, mobility, or volume shall be assessed including how treatment is used to address the principal threats posed by the site. Factors that shall be considered, as appropriate, include the following:

- The treatment or recycling processes the alternative employs and the materials that they will treat.

- The amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated, or recycled.

- The degree of expected reduction in toxicity, mobility, or volume of waste due to treatment or recycling and the specification of which reductions are occurring.

- The degree to which the treatment is irreversible.

- The type and quantity of residuals that will remain following treatment considering the persistence, toxicity, mobility, and propensity for bioaccumulation of hazardous substances and their constituents.

- The degree to which treatment reduces the inherent hazards posed by principal threats at the site.

4.1.1.5 Short-term Effectiveness

The short-term impacts of the alternative shall be assessed considering the following:

- Short-term risks that might be posed to the community during implementation.
- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures.

- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigation measures during implementation.

- Time until protection is achieved.

4.1.1.6 Implementability

The ease or difficulty of implementing the alternatives shall be assessed by considering the following types of factors, as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy.

- Administrative feasibility, including activities needed to coordinate with other offices and agencies, and the ability and time required to obtain any necessary approvals and permits from other agencies.

- Availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists and provisions to ensure necessary additional resources; the availability of services and materials; and the availability of prospective technologies.

4.1.1.7 Cost

Capital costs shall include both direct and indirect costs. Annual O&M costs shall be provided. A net present worth (NPW) of the capital and O&M costs shall also be provided. Typically, the cost estimate accuracy range is plus 50 percent to minus 30 percent.

4.1.1.8 State Acceptance

The state's concerns that must be assessed include the following:

- The state's position and key concerns related to the preferred alternative and other alternatives.
- State comments on ARARs or the proposed use of waivers.

These concerns cannot be evaluated until the state has reviewed and commented on this FS. These concerns will be discussed, to the extent possible, in the Proposed Plan to be issued for public comment.

4.1.1.9 Community Acceptance

This assessment consists of responses of the community to the Proposed Plan. This assessment includes determining which components of the alternative interested persons in the community support, have reservations about, or oppose. This assessment can be done after comments on the Proposed Plan are received from the public.

4.1.2 Relative Importance of Criteria

Among the nine criteria, the threshold criteria to be considered include the following:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs (excluding those that may be waived)

The threshold criteria must be satisfied for an alternative to be eligible for selection.

Among the remaining criteria, the following five criteria are considered the primary balancing criteria:

- Long-term Effectiveness and Permanence
- Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment
- Short-term Effectiveness
- Implementability
- Cost

The balancing criteria are used to weigh the relative merits of alternatives.

The remaining two of the nine criteria, State Acceptance and Community Acceptance, are considered to be modifying criteria that must be considered during remedy selection. These last two criteria can be evaluated after the FS has been reviewed by MDEQ and the Proposed Plan has been discussed in a public meeting. Therefore, this document addresses only seven of the nine criteria.

4.1.3 Remedy Selection

The selection of a remedy is a two-step process. The first step consists of identification of a preferred alternative and presentation of the alternative in a Proposed Plan to the community for review and comment. The preferred alternative must meet the following criteria:

- Protection of human health and the environment.
- Compliance with ARARs unless a waiver is justified.
- Cost effectiveness in protecting human health and the environment and in complying with ARARs.
- Utilization of permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

The second step consists of the review of the public comments and the determination, in consultation with MDEQ, as to whether or not the preferred alternative continues to be the most appropriate remedial action for the site.

4.2 ASSEMBLY OF REMEDIAL ALTERNATIVES

Based on the technology screening presented in Section 3.0, the following three remedial alternatives were developed:

- Alternative 1: No Action
- Alternative 2: Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/culvert Cleanout and Sediment Removal, LUCs, and LTM Groundwater Monitoring
- Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Monitoring, and Groundwater Monitoring

Alternative 1 was developed and analyzed to serve as a baseline for other alternatives, as required by CERCLA and the NCP. Alternatives 2 and 3 were formulated and analyzed to evaluate the soil cover/cap alternatives. Descriptions and detailed analyses of these alternatives are presented in the following sections.

4.3 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

4.3.1 Alternative 1: No Action

4.3.1.1 Description

The No Action alternative maintains the site as is. This alternative does not address site contamination and is only retained to provide a baseline for comparison to other alternatives. There would be no reduction in toxicity, mobility, or volume of waste. Existing monitoring programs and institutional controls would be discontinued, and the site would be available for unrestricted use.

4.3.1.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative 1 would not provide protection of human health and the environment. Under the current land use scenario (industrial/military), the potential for human contact with waste would remain. This alternative would not be protective of potential future residents who might consume or be exposed to Site 1 groundwater in the future.

Compliance with ARARs

Alternative 1 would not comply with chemical-specific ARARs because no action would be taken to reduce contaminant concentrations. There are no location-specific ARARs identified for Site 1. Action-specific ARARs or TBCs are not applicable because no action would be taken.

Long-term Effectiveness and Permanence

Alternative 1 would have no long-term effectiveness and permanence because waste would remain on site. Since there would be no institutional controls to control land use, the potential would exist for human

exposure to waste. Because there would be no monitoring, potential contaminant migration would not be detected.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 would not reduce toxicity, mobility, or volume of waste through treatment because no treatment would occur. Some reduction of VOC or metal toxicity and volume might occur through natural dispersion, dilution, or other attenuation process in the very long term, but no monitoring would be performed to verify this condition.

Short-term Effectiveness

Because no action would occur, implementation of Alternative 1 would not pose any risks to on-site workers or result in short-term adverse impact to the local community and the environment. Alternative 1 would never achieve the RAOs and, although the PRGs might eventually be achieved through natural attenuation in the very long term, monitoring would not be in place to verify this condition.

Implementability

Because no action would occur, Alternative 1 would be readily implementable. The technical feasibility criteria, including constructability, operability, and reliability, are not applicable. Implementability of administrative measures is not applicable because no such measures would be taken.

Cost

There would be no costs associated with the No Action alternative.

4.3.2 Alternative 2: Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/culvert Cleanout and Sediment Removal, LUCs, and Groundwater Monitoring

4.3.2.1 Description

Alternative 2 consists of the following components: 1) focused excavation and off-site disposal of contaminated soil, 2) waste containment (via existing soil cover), 3) LUCs, and 4) groundwater monitoring.

Component 1: Focused Excavation

Utility clearance would be conducted in the proposed areas of excavation, at a minimum for water, communication, and electrical lines. Following the utility clearance, the excavation would occur across an area of 1,600 ft^2 to a depth of 2 feet, for a total soil volume of approximately 118 yd^3 of soil. Figure 4-1

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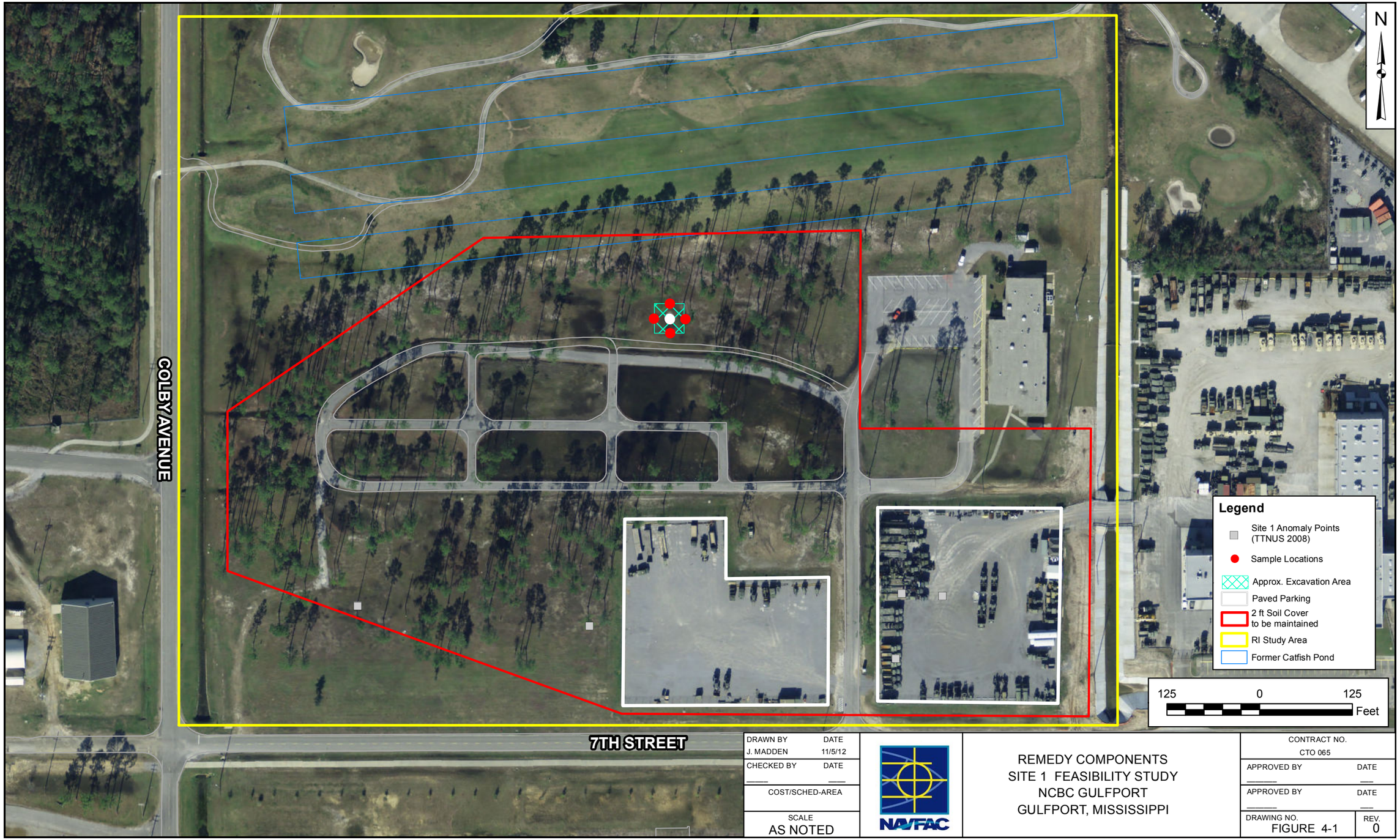

DRAWN BY J. MADDEN	DATE 11/5/12	REMEDY COMPONENTS SITE 1 FEASIBILITY STUDY NCBC GULFPORT GULFPORT, MISSISSIPPI	CONTRACT NO. CTO 065
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presents the location and areal extent of the proposed soil excavation. Dust control measures and appropriate health and safety measures would be implemented during the excavation. Samples of soil from the side walls and bottom of the excavated area would be collected for confirmatory analysis of dieldrin. The excavated soil would be disposed of off-site at a RCRA Subtitle C facility.

Approximately 118 yd^3 of excavated void would be filled with clean backfill as defined in the design and covered with top soil similar to the existing land surface for purposes of the soil cover described in Component 2.

Component 2: Waste Containment

Under this alternative, the waste disposal area will be contained by the existing soil cover. Figure 4-1 illustrates the areal extent where the soil cover would be in place. The area of this cover is approximately 410,000 ft^2. Based on previous investigations and the recent waste profiling, the existing soil at the site is a minimum of 2 to 3 feet thick and is adequate to be used as a soil cover. Approximately 137,500 ft^2 at the site has been capped with parking areas. To prevent ponding and promote drainage, the existing 12-inch diameter drainage pipes/culverts will be cleaned out and sediment removed as needed across the site. The drainage pipe/culvert cleanout and sediment removal effort would limit ponding of water over the buried waste during normal weather conditions. Final site layout would support existing conditions and restore the area to its original design and intent.

Component 3: LUCs

LUCs would be developed to prevent the site from being used in the future for any intrusive activity and to ensure integrity of the soil cover. Engineering controls at the site may include signage and fencing. LUC performance objectives and restrictions would be as follows:

- Prohibit residential and agricultural (specifically growing crops for human consumption) use unless prior written approval is obtained from the Navy and MDEQ. Prohibited residential uses shall include, but are not limited to, any form of housing, child-care facilities, preschools, elementary schools, secondary schools, playgrounds, convalescent, or nursing care facilities.

- Prohibit the excavation of soils from the site unless prior written approval is obtained from the Navy and MDEQ.

- Prohibit extraction of groundwater from the site unless prior written approval is obtained from the Navy and MDEQ.

- Maintain the integrity of the soil cover and any existing or future monitoring or remediation system(s) unless prior written approval is obtained from the Navy and MDEQ.

Annual site inspections would be conducted to confirm compliance with LUC objectives. Prior to any property conveyance, the MDEQ would be notified.

The LUCs would be implemented through a LUCIP, which would be prepared in accordance with the Decision Document and MOA. The LUCs would be maintained for as long as they are required to prevent unacceptable exposure to contaminated soil and groundwater and/or to preserve the integrity of the selected remedy.

The LUCIP would also include procedures for regular inspections of the soil cover and maintenance and repair of the cover as required. LUCs would be developed in accordance with the *Principles and Procedures for Specifying, Monitoring, and Enforcement of Land Use Controls and Other Post-ROD Actions* (Department of Defense, 2003). Implementation of this alternative would, therefore, require a survey of the site, annual visual inspections, and five-year reviews and report preparation.

Component 4: Groundwater Monitoring

Based on the results of the RI, the groundwater is not contaminated at concentrations presenting unacceptable risk levels. The groundwater is in frequent contact with the buried waste and shall be monitored to ensure no future health risk occurs. .

Monitoring would consist of collecting groundwater samples from 12 proposed monitoring wells and analyzing them for select constituents. The locations of the 12 proposed monitoring wells are shown on Figure 4-2. For the purpose of costing in this FS, sampling frequency would be quarterly for the first year, semiannually for the next 2 years, and annually thereafter. Consistent with landfill protocols, the monitoring is anticipated to occur for no more than 30 years.

4.3.2.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative 2 would be protective of human health and the environment. The focused soil excavation would remove the lone remaining “hot spot” area of contamination. The soil cover over the site would ensure that the most likely future potential site users would be protected from exposure to unacceptable levels of contaminants. The use of LUCs would prevent potential residential and commercial/industrial receptors from being exposed to unacceptable levels of contaminants in the soil and groundwater that would remain under the covered areas. The site would be suitable for revegetation. The RAOs would be met.

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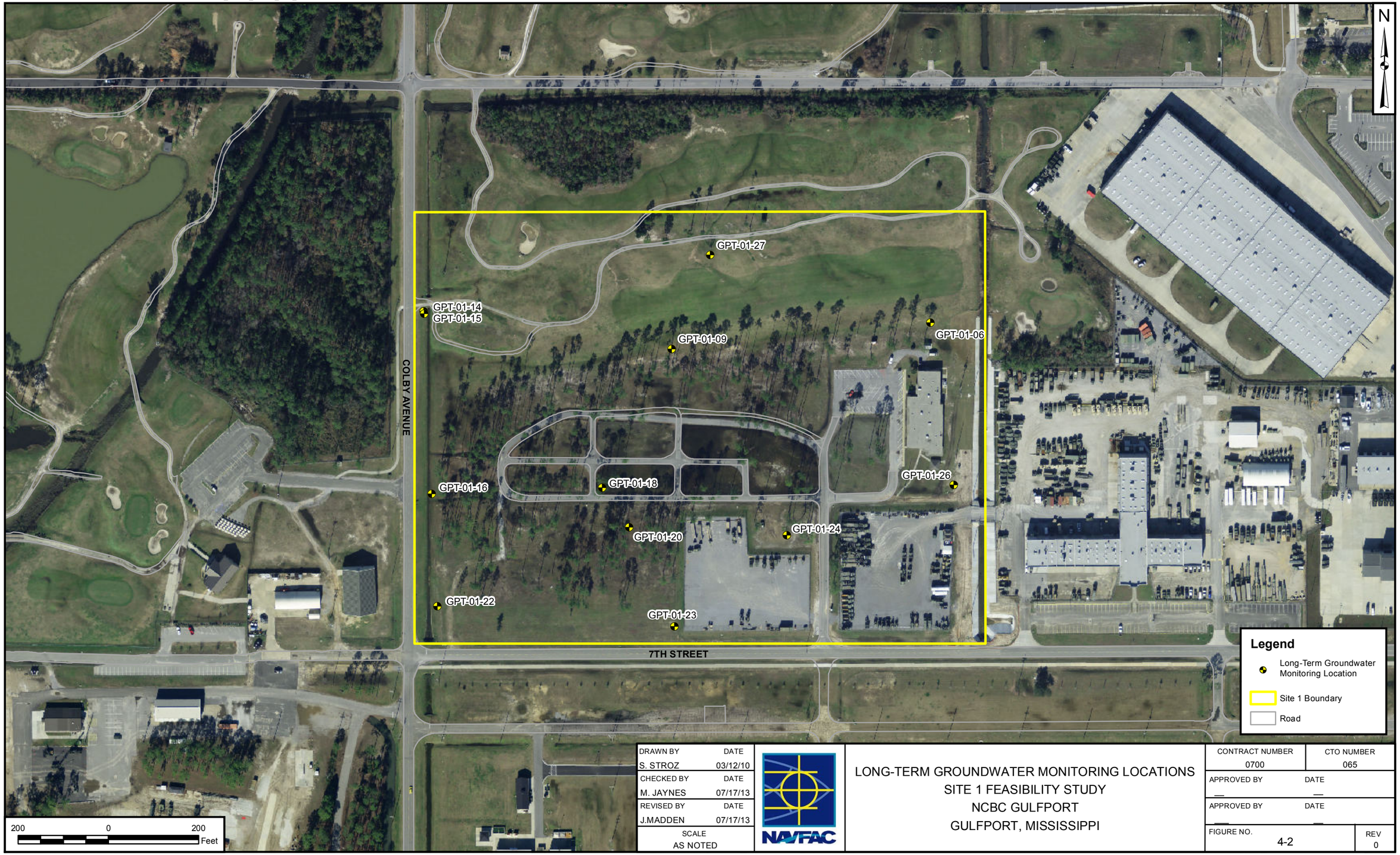

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LONG-TERM GROUNDWATER MONITORING LOCATIONS
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT
GULFPORT, MISSISSIPPI

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Compliance with ARARs

Alternative 2 would comply with chemical-specific ARARs because exposure to soil with COC concentrations exceeding TRGs would be eliminated by the focused excavation, the soil cover, and LUCs. It would also comply with the location-specific and action-specific ARARs.

Long-term Effectiveness and Permanence

Alternative 2 would be effective in the long term because the soil cover would provide a barrier that would prevent recreational and ecological receptors from unacceptable exposure to COCs in soil.

Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 2 would not reduce the toxicity, mobility, or volume through treatment.

Short-term Effectiveness

Alternative 2 would be effective in the short term. Dust suppression and control measures would be implemented to minimize the emission of contaminated soil particulates during on-site remedial activities such as the excavation. Erosion control measures would minimize the potential migration of soil into the adjacent ditches. Workers performing work during excavation and collecting samples from monitoring wells will be adequately protected if suitable health and safety procedures are followed. The period for implementation of this alternative is estimated to be approximately 3 months, after which it would be protective assuming LUCs have been implemented.

Implementability

Alternative 2 is implementable. Earthmoving equipment considered under this alternative is typical in the construction industry and readily available from several local sources. Establishment of LUCs would require negotiation and agreement on the specifics of the procedures between the Navy and MDEQ.

Cost

Estimated costs for Alternative 2 are as follows:

- Capital: $251,000
- Average Yearly O&M: $47,000
- 30-Year NPW: $910,000

The above figures have been rounded to the nearest $1,000 to reflect the preliminary nature of the estimates. A more detailed breakdown of these cost estimates is provided in Appendix B.

4.3.3 Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Monitoring, and Groundwater Monitoring

4.3.3.1 Description

Alternative 3 consists of the following components: 1) waste containment (via soil cap), 2) LUCs, 3) landfill gas management and monitoring, and 4) groundwater monitoring.

Component 1: Waste Containment

Under this alternative, the landfill/disposal area will be contained by a soil cap system. Figure 4-1 illustrates the areal extent where the soil cap would be installed. The area to be covered is approximately 410,000 ft^2. Existing monitoring wells within the boundary of the proposed soil cap would be abandoned. The area to be disturbed would also be cleared, existing site conditions are such that minimal clearing would be expected (other than pine trees). The existing ground surface would be re-graded to provide a slope to allow for drainage and reuse of the site.

A soil cap would then be installed to minimize the infiltration of rainwater into the landfill/disposal area. The soil cap would consist of the following layers:

- Erosion layer of topsoil – 6-inch layer of topsoil placed to provide the necessary slope to meet MDEQ requirements.
- Low permeability layer – 18 inches of soil with a maximum hydraulic conductivity of 1×10^{-5} cm/s or a layer with an equivalent hydraulic conductivity installed to minimize the infiltration of rainwater into the landfill.
- Gas-venting layer – granular material, a geocomposite, or a heavy needle-punched nonwoven geotextile that would collect landfill gas.
- Common fill – 6-inch layer below the gas-venting layer.

The site will be graded to promote drainage in accordance with the following regulatory requirements:

- The final cover gradient on landfills shall be a minimum of 4 percent and a maximum of 25 percent.
- A native grass seed or other shallow-rooted vegetation suitable to minimize soil erosion must be planted and maintained.

Component 2: LUCs

Similar to Alternative 2, LUCs would be developed to prevent the site from being used in the future for any intrusive activity and to ensure integrity of the soil cover. Engineering controls at the site may include signage and fencing. LUC performance objectives and restrictions would be as follows:

- Prohibit residential and agricultural (specifically growing crops for human consumption) use unless prior written approval is obtained from the Navy and MDEQ. Prohibited residential uses shall include, but are not limited to, any form of housing, child-care facilities, preschools, elementary schools, secondary schools, playgrounds, convalescent, or nursing care facilities.
- Prohibit the excavation of soils from the site unless prior written approval is obtained from the Navy and MDEQ.
- Prohibit extraction of groundwater from the site unless prior written approval is obtained from the Navy and MDEQ.
- Maintain the integrity of the soil cover and any existing or future monitoring or remediation system(s) unless prior written approval is obtained from the Navy and MDEQ.

Annual site inspections would be conducted to confirm compliance with LUC objectives. Prior to any property conveyance, the MDEQ would be notified.

The LUCs would be implemented through a LUCIP, which would be prepared in accordance with the Decision Document and MOA. The LUCs would be maintained for as long as they are required to prevent unacceptable exposure to contaminated soil and groundwater and/or to preserve the integrity of the selected remedy.

The LUCIP would also include procedures for regular inspections of the soil cover and maintenance and repair of the cover as required. LUCs would be developed in accordance with the *Principles and Procedures for Specifying, Monitoring, and Enforcement of Land Use Controls and Other Post-ROD Actions* (Department of Defense, 2003). Implementation of this alternative would, therefore, require a survey of the site, annual visual inspections, and five-year reviews and report preparation.

Component 3: Landfill Gas Management and Monitoring

Methane accumulation below the cap would be controlled via passive vents. Monitoring of the methane concentration in the landfill gas in perimeter soil gas monitoring wells will be performed semiannually as part of the landfill soil cap O&M program. Landfill gas would be controlled by preventing the accumulation of methane gas below the cap. Specific details would be identified in the design phase. The methane concentration in the gas will be routinely sampled and analyzed. Methane would be measured at landfill vents and from probes located between the landfill and nearby structures.

Component 4: Groundwater Monitoring

Based on the results of the RI, groundwater is not contaminated at concentrations presenting a greater than 1×10^{-6} risk. LTM groundwater monitoring will be used to ensure that the contamination is not leaching from the buried waste and migrating away from the site.

Monitoring would consist of collecting groundwater samples from 12 proposed monitoring wells and analyzing them for select constituents. The locations of the 12 proposed monitoring wells are shown on Figure 4-2. Sampling frequency would be quarterly for the first year, semiannually for the next 2 years, and annually thereafter.

4.3.3.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative 3 would be protective of human health and the environment. A soil cap over the area of contamination would ensure that the most likely future potential site users would be protected from exposure to unacceptable levels of contaminants. The use of LUCs would prevent potential residential and commercial/industrial receptors from being exposed to unacceptable levels of contaminants in the soil and groundwater that would remain under the capped areas. The site would be suitable for revegetation. Additionally, the groundwater would be monitored to ensure the waste is not leaching at unacceptable levels. The RAOs would be met.

Compliance with ARARs

Alternative 3 would comply with chemical-specific ARARs, because exposure to soil with COC concentrations greater than TRGs would be prevented by the soil cap and LUCs. Additionally, it would meet the location-specific and action-specific ARARs.

Long-term Effectiveness and Permanence

Alternative 3 would be effective in the long term because the soil cap would provide a barrier that would prevent recreational and ecological receptors from unacceptable exposure to COCs in soil.

Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 3 would not reduce the toxicity, mobility, or volume through treatment.

Short-term Effectiveness

Alternative 3 would be effective in the short term. Dust suppression and control measures would be implemented to minimize the emission of contaminated soil particulates during on-site remedial activities such as initial re-grading of the site. Erosion control measures would minimize the potential migration of soil into the adjacent ditches. Workers performing work during construction and collecting samples from monitoring wells will be adequately protected if suitable health and safety procedures are followed. The period for implementation of this alternative is estimated to be approximately 1 year, after which it would be protective assuming LUCs have been implemented.

Implementability

Alternative 3 is implementable. Excavation and earthmoving equipment considered under this alternative is typical in the construction industry and readily available from several local sources. Off-site borrow locations for clean soil can be identified. Establishment of LUCs would require negotiation and agreement on the specifics of the procedures between the Navy and MDEQ.

Cost

Estimated costs for Alternative 2 are as follows:

- Capital: $4,352,000
- Average Yearly O&M: $49,000
- 30-Year NPW: $5,064,000

The above figures have been rounded to the nearest $1,000 to reflect the preliminary nature of the estimates. A more detailed breakdown of these cost estimates is provided in Appendix B.

Uncertainty

The use of a cap and alternation of the local topography would trigger the need for a storm water study to ensure no unacceptable flow. This could also cause the need for a much larger construction project to prevent these conditions. The cost included here does not account for the study or additional storm water construction.

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

This section compares the analyses presented for each of the remedial alternatives in Section 4.0 of this FS. The criteria for comparison are identical to those used for the detailed analysis of individual alternatives.

The following remedial alternatives are being compared in this section:

- Alternative 1: No Action
- Alternative 2 Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/Culvert Cleanout and Sediment Removal, LUCs, and Groundwater Monitoring
- Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Management, and Groundwater Monitoring

5.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 would not be protective. Alternatives 2 and 3 would be protective.

5.2 COMPLIANCE WITH ARARS

Alternative 1 would not comply with chemical-specific or location-specific ARARs. Action-specific ARARs do not apply to Alternative 1. Alternatives 2 and 3 would comply with chemical-, location-, and action-specific ARARs.

5.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 would not be effective in the long-term and offers no permanent solution. Alternatives 2 and 3 offer long-term effectiveness and permanence although it depends on verification that LUCs are properly maintained and enforced to ensure long-term effectiveness.

5.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternatives 1, 2, and 3 do not employ any treatment and, therefore, there would be no reduction of toxicity, mobility, or volume of soil or groundwater through treatment. However, natural attenuation of the chlorinated solvents in the Site 1 groundwater is expected.

5.5 SHORT-TERM EFFECTIVENESS

Alternative 1 has no relevant issues to address. Alternatives 2 and 3 would be effective in the short-term in terms of risks to workers, the community, and the environment. Short-term risks would be properly mitigated by application of engineering controls and adherence to Occupational Safety and Health Administration requirements. Alternative 1 would not achieve the RAOs. The approximate periods for implementation and attainment of RAOs would be 1 year for Alternatives 2 and 3.

5.6 IMPLEMENTABILITY

Alternative 1 would be readily implementable because there is no action to implement. Alternatives 2 and 3 would be relatively easy to implement, but would require maintenance of LUCs as well as maintenance of the soil cover/cap and groundwater monitoring.

5.7 COST

The capital costs, average yearly O&M costs, and NPW costs of the alternatives are as follows. Costs have been rounded to the nearest $1,000 to reflect the preliminary nature of the estimates. Detailed cost estimates are provided in Appendix B.

Alternative	Capital ($)	30-Year NPW of O&M ($)	30-Year NPW ($)
1	0	0	0
2	$251,000	$47,000	$910,000
3	$4,352,000	$49,000	$5,064,000

5.8 SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 5-1 summarizes the comparative analysis of the remedial alternatives.

TABLE 5-1

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI
PAGE 1 OF 2

Criterion	Alternative 1: No Action	Alternative 2: Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/Culvert Cleanout and Sediment Removal, LUCs, and Groundwater Monitoring	Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Monitoring, and Groundwater Monitoring
Overall protective of human health and the environment	The No Action alternative provides a baseline against other alternatives. This alternative would involve no treatment, engineering measures, or institutional actions. If implemented, this action would not be protective of human health or the environment.	Soil excavation would eliminate lone "hot spot". Soil cover would eliminate potential exposure to buried waste and remaining COCs in soil and prevent migration of contaminants via erosion. Storm water pipe cleanout and sediment removal would promote drainage and limit ponding at the site. LUCs would prevent exposure to contaminants in the groundwater.	Capping of landfill would eliminate potential exposure to COCs in soil. Capping of the landfill will prevent migration of contaminants via erosion and prevent percolation of rain from leaching contaminants from landfill material to groundwater. LUCs would prevent exposure to contaminants in the groundwater.
Compliance with ARARs	The No Action alternative does not trigger any ARARs. It does not comply with federal and state ARARs that require cleanup of contaminated sites.	Would meet the threshold criteria for compliance with ARARs.	Would meet the threshold criteria for compliance with ARARs.
Long-term effectiveness and permanence	This alternative would not be effective in the long-term.	This alternative should be effective for the long-term in protecting human health and the environment by eliminating contaminant exposure pathways. LUCs would provide for routine inspection, maintenance, and monitoring.	This alternative should be effective for the long-term in protecting human health and the environment by eliminating contaminant exposure pathways. LUCs would provide for routine inspection, maintenance, and monitoring.
Reductions of toxicity, mobility, or volume through treatment	This alternative would not reduce toxicity, mobility, or volume of contaminated media through treatment.	This alternative would not reduce toxicity, mobility, or volume of contaminated media through treatment.	This alternative would not reduce toxicity, mobility, or volume of contaminated media through treatment.
Short-term effectiveness	This alternative would not entail any remedial activities that would affect the community, workers, or the environment during implementation.	Risk to workers would be limited to those normally associated with excavation and groundwater monitoring activities. This risk would be mitigated through the development and implementation of a project-specific Health and Safety Plan.	Risk to workers would be limited to those normally associated with construction and groundwater and landfill gas monitoring activities. This risk would be mitigated through the development and implementation of a project-specific Health and Safety Plan.

TABLE 5-1

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
SITE 1 FEASIBILITY STUDY
NCBC GULFPORT, MISSISSIPPI
PAGE 2 OF 2

Criterion	Alternative 1: No Action	Alternative 2: Focused Excavation Maintaining Existing Soil Cover, Strom Water Drainage Pipe/Culvert Cleanout and Sediment Removal, LUCs, and Groundwater Monitoring	Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Monitoring, and Groundwater Monitoring
Implementability	This alternative could be readily implemented because it would not involve remediation activities.	The technologies needed for this alternative would be readily available, easily implemented, and reliable.	The technologies needed for this alternative would be readily available, easily implemented, and reliable.
Cost	There would be no cost with this alternative.	Capital Cost: $251,000 NPW of O&M Cost: $47,000 NPW: $910,000	Capital Cost: $4,352,000 NPW of O&M Cost: $49,000 NPW: $5,064,000

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APPENDIX A

PRESUMPTIVE REMEDY GUIDANCE AND DETERMINATIONS

United States Environmental Protection Agency
Office of Solid Waste and Emergency Response
Directive: 9355.0-47FS
EPA 540-F-93-047
PB 93-963345
September1993

EPA

Presumptive Remedies: Policy and Procedures

Office of Emergency and Remedial Response
Hazardous Site Control Division 5203G

Quick Reference Fact Sheet

Since Superfund's inception in 1980, the remedial and removal programs have found that certain categories of sites have similar characteristics, such as types of contaminants present, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, Superfund is undertaking an initiative to develop presumptive remedies to accelerate future cleanups at these sites. The presumptive remedy approach is one tool of acceleration within the **Superfund Accelerated Cleanup Model (SACM).**

The objective of the presumptive remedies initiative is to use the program's past experience to streamline site investigations and speed up selection of cleanup actions. Overtime presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of sites. Presumptive remedies are expected to be used at all appropriate sites except under unusual site-specific circumstances. EPA plans to develop a series of directives on presumptive remedies for various types of sites.

This directive serves as an overall guide to the presumptive remedies initiative and its effect on site cleanup. Through a question and answer format, it explains, in general terms, ways in which presumptive remedies will streamline or change the remedial and removal processes from the conventional processes and how certain Superfund policies will be affected by the initiative. This directive also unites the series of directives, due to come out over the next year, on presumptive remedies for specific site types (e.g., Volatile Organic Compounds (VOCs), wood treaters, ground water). This general directive, together with the site type-specific directives, will provide readers with a comprehensive knowledge of the procedural as well as policy considerations of the presumptive remedies initiative. The directive is designed for use by staff involved in managing site cleanups (e.g., Remedial Project Managers (RPMs), On-Scene Coordinators (OSCs), Site Assessment Managers (SAMs)). Site managers in other programs, such as RCRA Corrective Action, the Underground Storage Tank program, State Project Managers, or private sector parties, may also use this directive, as appropriate.

Provided below are several common questions and answers regarding general issues associated with presumptive remedies.

Q1. What Are Presumptive Remedies and How Should They Be Used?

A. Presumptive Remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. EPA has evaluated technologies that have been consistently selected at past sites using the remedy selection criteria set out in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); reviewed currently available performance data on the application of these technologies; and has determined that a particular remedy, or set of remedies, is **presumptively** the most appropriate for addressing specific types of sites.

Presumptive remedies are expected to be used at all appropriate sites. The approaches described in each presumptive remedies directive are designed to accommodate a wide range of site-specific circumstances. In some cases, multiple technologies are included (e.g., VOCs); in others, various

components of the presumptive remedy are optional, depending on site situation (e.g., municipal landfills). Further, these directives recognize that at some sites, there may be unusual circumstances (such as complex contaminant mixtures, soil conditions, or extraordinary State and community concerns) that may require the site manager to look beyond the presumptive remedies for additional (perhaps more innovative) technologies or remedial approaches.

These tools will help site managers to focus data collection efforts during site investigations (e.g., remedial investigations, removal site evaluation) and significantly reduce the technology evaluation phase (e.g., Engineering Evaluation/Cost Analysis (EE/CA) and/or Feasibility Studies (FS)) for certain categories of sites. The specific impacts on the various stages of the remedy selection process are highlighted in questions 7 and 8 of this guidance. It is advised that presumptive remedies be used with the assistance of the expert teams[1] for the various categories of sites.

Q2. Why Should Presumptive Remedies Be Used?

Presumptive remedies are expected to have several benefits. Limiting the number of technologies considered should promote focused data collection, resulting in streamlined site assessments and accelerated remedy selection decisions which achieve time and cost savings. Additional time savings could be realized during the remedial design since early knowledge of the remedy may allow technology-specific data to be collected upfront during the remedial investigation. Presumptive remedies will also produce the added benefit of promoting consistency in remedy selection, and improving the predictability of the remedy selection process for communities and potentially responsible parties (PRPs).

Presumptive remedies may be used as part of a wide variety of response actions. These actions include non-time-critical removal and early remedial actions, actions at sites with different leads (e.g., Fund-lead, State-lead, PRP-lead), actions addressing one or more contaminated media, actions with several operable unitss, and actions involving treatment trains.

Q3. Can Presumptive Remedies be Implemented Within the Existing NCP Process?

Yes. The presumptive remedy approach is consistent with all of the requirements of the NCP, and in particular the site management principle of streamlining (see section 300.430(a)(1)(ii)(C)). The presumptive remedy approach simply consolidates what have become the common, expected results of site-specific decision making at Superfund sites over the past decade. The various presumptive remedies directives and supporting documentation (e.g., "Feasibility Study Analysis for CERCLA Sites with Volatile Organic Compounds in Soils") provide the basis for an administrative record which justifies consideration of a very limited number of cleanup options. These materials summarize the findings of EPA's research and analysis, and the reasons that were found for generally considering certain technologies more or less appropriate.

The availability of presumptive remedies does not preclude a Region from expanding the FS (either on its own initiative or at the suggestion of outside parties) to consider other technologies under unusual site-specific circumstances. The site type directives will define the kind of circumstances (e.g., soil conditions, heterogeneous and complicated contamination mixtures, field tests demonstrating significant advantages of alternate or innovative technologies, etc.) that may make presumptive remedies less clearly suited for particular sites. Most of these directives also provide references to additional technologies if the presumptive remedies are found not to apply at a particular site.

Q4. How Did the Presumptive Remedies Initiative Evolve?

A. The general concept of presumptive remedies was first proposed in 1990 during the Superfund 90-Day Study and subsequently in 1991 during the 30-Day Study as a method of accelerating the remedial process. These management studies were efforts to generate options for accelerating the overall Superfund clean-up process. The presumptive remedies initiative is also consistent with, and supports, a larger program initiative known as the Superfund Accelerated Cleanup

[1] It is envisioned that for most categories of sites, teams of experts (technical, legal, policy, etc.) who have developed the presumptive remedies guidance and Regional site managers conducting field demonstrations, will be available to assist site managers in implementing presumptive remedies on a site-specific basis.

Table 1
Current Presumptive Remedies and Contacts

Site Type/Schedule	Presumptive Remedy(ies)	Anticipated Products	EPA Contact
General Policy and Procedures (9/93)	NA	*Presumptive Remedies: Policy and Procedures*	Shahid Mahmud Headquarters, HSCD (703) 603-8789
Volatile Organic Compounds (VOCs) in Soils (9/93)	Soil Vapor Extraction, Thermal Desorption, Incineration	*Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with VOCs in Soils*	Shahid Mahmud Headquarters, HSCD (703) 603-8789
Wood Treaters (6/94)	For Organics - Incineration, Bioremediation, Dechlorination For Inorganics - Immobilization	*Presumptive Remedy: Wood Treating Sites* *Technology Selection Guide for Wood Treater Sites (5/93)*	Lisa Boynton Headquarters, ERD (703) 603-9052 Harry Allen Emergency Response Division (908) 321-6747
Municipal Landfills (9/93)	Containment (could include capping, leachate collection and treatment, LF gas treatment, institutional controls, etc.)	*Presumptive Remedy for CERCLA Municipal Landfill Sites*	Andrea McLaughlin Headquarters, HSCD (703) 603-8793
Contaminated Ground Water (1/94)	Pump and Treat (Will specify preferred treatment technologies & describe overall approach)	*TBD*	Ken Lovelace Headquarters, HSCD (703) 603-8787
Region 7 Pilots - PCB Sites, Coal Gas Sites, Grain Storage Sites (6/94)	TBD	*TBD*	Diana Engeman Region 7 (913) 551-7746

KEY:
TBD - To Be Determined
NA - Not Applicable

Model (SACM). SACM incorporates theexperience gained from past Superfund actions into an integrated approach to site cleanup aimed at getting response action decisions made and implemented more quidkly. The presumptive remedies initiative is one mechanism for accomplishing the broad sreamlining goal set fort by SACM. The presemptive remedies initiative was also identifies as one of the Adminsitrative Improvements to Superfund in June of 1993.

Q5. What Other Presumptive Remedy Initiatives are Underway or Planned?

A. There are a variety of presumptive remedy activities currently planned or underway. Table 1 lists the site types with the anticipated schedule of associated presumptive remedy products that are currently underway along with the Headquarters and Regional contacts. There are four site types for which presumptive remedies are being developed in EPA Headquarters: VOCs, wood treaters, municipal landfills, and contaminated ground-water sites. Concurrently, Region 7 is preparing presumptive remedy guidances for PCB, coal gasification, and grain storage sites.

Q6. How Will Presumptive Remedies Affect the Remedy Secection Process?

A. Presumptive remedies are anticipated to affect se3veral phases of the ccurrent remedy selection process. A diagram depicting the generic impacts on the overall process is provded in Table 2.

Data collection during the initial site assessment(Preliminary Assessment/Site Inspection (PA/SI)

Table 2
Generic Effect of Presumptive Remedies

	Phases of Cleanup Process	Effect on Cleanup Process
SITE ASSESSMENT	PA/SI or Removal Site Evaluation	X
	Scoping • Collect and analyze existing data	○
	• Identify initial project/OUs and remedial action objectives	■
	• Identify range of likely alternatives	■
	• Identify potential ARARs	○
	• Identify initial DQOs	○
	• Prepare project plans	■
	Remedial Investigation • Conduct field investigation	X(1)
	• Define nature and extent of contamination	○(1)
	• Identify ARARs	○
	• Conduct baseline risk assessment	○(1)
FEASIBILITY STUDY OR EE/CA	Remedy Selection • Identify potential treatment technologies and containment/disposal requirements	●
	• Screen technologies	●
	• Assemble technologies into alternatives	●
	• Screen alternatives as necessary to reduce number subject to detailed analysis	●
	• Further refine alternatives as necessary	■
	• Analyze alternatives against the nine criteria and each other	■
	Proposed Plan	■
	Record of Decision	■
	Remedial Design	■

○ = not impacted ■ = Streamlined
X = Focused ● = Eliminated
(1) Streamlined for Municipal Landfills

or Removal Site Evaluation) can be used to help define the specific site typw and to determine whether presumptive remedies may be potentially applicable.

Assuming the site warrants further attention (i.e., it is listed on the National Priorities List (NPL) or determined by the Regional Decision Team (RDT) to be an NPL-caliber site or to merit a removal action), further confirmation of the site type should take place as either an RI/FS or EE/CA is scoped to determine whether the site is a potential candidate for presumptive remedies. For a detailed discussion of how to make this determination, refer to the appropriate site type-specific directive. If it is determined that a site falls into a certain category, the presumptive remedies associated with that site type should be included in the list of likely remedial alternatives (e.g., no action, presumptive remedies, etc.) For the site. Other aspects of scoping that may be affected by presumptive remedies are the designation of appropriate operable units (OUS) and identification of data needed to support the evaluation and selection of a presumptive remedy.

Presumptive remedies are expected to help focus data collection efforts. Specifically, initial data collection would focus on confirming the site type. If the site is of the typw for which presumptive remedies have been developed, the streamlined steps for site characterization outlined in the site type-specific directive for the particular site type should be followed. These steps outline data collection to determine the extent of contamination and to support selection of the presumptive remedy and Remedial Design (RD).

Presumptive remedies will streamline the FS and the alternatives analysis in the EE/CA more than any other phase of the remedy selection process. In most cases, after a site is confirmed as being a type for which presumptive remedies exist, a focused FS or EE/CA which eliminates the technology identification and screening step would be prepared. The study would limit its consideration to the no action alternative and the presumptive remedy technologies. This is possible because EPA has conducted an analysis of potentially available technologies for most of the presumptive remedies site categories and has determined that certain technologies are routinely and appropriately screened out either on the basis of effectiveness, implementability, or excessive cost (NCP Section 300.430 (e)(3) and (7)), or have not been selected under the nine criteria analysis identified in NCP Section 300.430 (e) (9). This detailed analysis will serve to substitute for the development and screening of alternatives phases of the FS (and will allow the

remaining alternatives to be limited to variations of the presumptive remedy). The site-specific directive and supporting documentation (e.g., "Feasibility Study Analysis for CERCLA Municipal Landfill Sites") along with this directive then can be placed in the administrative record for the site to support the elimination of the screening step identified in section 300.430 (e) (1) of the NCP. Further supporting materials can be provided by Headquarters (e.g., FS reports included in the analysis, technical reports), as needed. The specific presumptive remedy directives address the process of eliminating the alternatives development and screening step of the RI/FS or EE/CA in further detail. The directives also provide generic discussion of a partial nine criteria analysis (excluding state ARARs and community and state acceptance) and may help streamline the detailed analysis of alternatives within the FS and EE/CA reports. However, the user is cautioned that the criteria are discussed on a general basis and the nine criteria analysis should be supplemented to reflect the site-specific conditions.

The Proposed Plan (PP) and subsequent ROD would be similarly streamlined by focusing only on the presumptive remedy(ies). The remedial design (RD) may be streamlined since some RD data will likely have been collected previously during the site assessment and RI.

Q?. How Will Presumptive Remedies Affect the Removal Process?

A. Non-time critical removal actions are anticipated to be used more often to accomplish early actions at Superfund sites under SACM. The presumptive remedies approach will focus the data collection during the removal site evaluation and reduce the number of technologies identified and analyzed in the EE/CA. Presumptive remedies are not expected to have an impact on emergency and time-critical actions under the removal program.

Q8. What are the Implications of Presumptive Remedies for Innovative Technologies?

The NCP in section 300.430 (a) (1) (iii) (E) states that "EPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance and implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies." The use of the presumptive remedies may tend to reduce the frequency of the full evaluation of innovative technologies. However, as indicated previously, the presumptive remedies provide a tool for streamlining the remedy selection process. They do not preclude the consideration of innovative technologies should the technologies be demonstrated to be as effective or superior to the presumptive remedies. Innovative technologies may be evaluated and recommended in addition to the presumptive remedies where these criteria are met.

EPA encourages review of the latest Innovative Technologies Semi-Annual Reports or Engineering Bulletins for the up-to-date information on the potential effectiveness and applicability of various innovative technologies. Site managers are strongly encouraged to involve the site-type expert team (see Question 13) to determine whether unusual circumstances exist to consider a non-presumptive remedy based on site-specific conditions and/or community, state, and PRP concerns, or the availability of a potentially promising innovative technology.

Q9. How Will Presumptive Remedies Affect Risk Assessments?

A. Generally, the role of baseline risk assessments under the presumptive remedy approach would be unaffected with Municipal Landfill sites being a notable exception. It is anticipated that risk assessments would still be needed on a site-specific basis to assist site managers in determining the need for a response action. EPA managers have indicated the value of the risk assessment in communicating with states, PRPs, and local communities about the nature and extent of health and environmental threats. Therefore, it is recommended that the current risk assessment process be continued on an individual site basis except for Municipal Landfills. The site manager should refer to the EPA Directive entitled "Presumptive Remedy for CERCLA Municipal Landfill Sites," Directive No. 9355.0-49FS to identify streamlining opportunities at Municipal Landfill sites.

Guidance on developing risk-based preliminary remediation goals (PRGs) would be unaffected under this initiative. These goals are needed for individual sites especially in the absence of ARARs to assist in determining which remedial options

will result in medium-specific chemical concentrations that are protective of human health. For example, there may be several candidate presumptive remedies identified in the site-type directives. But it is the extent and degree of contamination across a given site that will determine whether a technology, which is predicted to reduce a chemical's concentration to some specified level, will be adequate by itself to produce protective concentrations following remedial action. For some sites or site locations, because of the magnitude of contamination or co-occurrence of contaminants, it may be necessary to assemble several technologies into a treatment train to adequately reduce levels of all chemicals of concern in a medium to protective levels. In other cases, it may be necessary to evaluate the use of institutional and/or engineering controls on an area following remediation to ensure protection during subsequent land use. In other words, it is not reasonable to assume that because a specific technology resulted in "protection" at one site, it will result in protective levels at all sites. A determination that the selected remedy will result in protection of human health and the environment must be made for each site. Both ARARs and risk-based PRGs are important tools in this exercise.

Generally, presumptive remedy directives will specify those technologies that have been determined to achieve levels protective of human health and the environment under a variety of site conditions. However, because all sites differ to some extent, especially in their relation to surrounding communities and sensitive ecosystems, a determination must still be made on a site-specific basis as to how a given remedy design is expected to achieve "protectiveness" during remedy construction and following remedial action. Overall protection of human health and the environment is one of two threshold considerations (the other being compliance with ARARs) that must be met in order for an alternative to be eligible for selection as the remedy for a given site.

Q10. What if Outside Parties such as PRPs or the Community Want Other Alternatives Considered?

A. The identification of a presumptive remedy does not relieve EPA of the obligation to propose the remedy for public comment, or to respond to comments suggesting that other alternatives should have been considered. In some cases, the information in the site-type directive and supporting documentation may be sufficient to address such comments; in others, additional analysis may be required to assess the relative merits of an alternative technology proposed by a commenter.

To reduce the risk of delay due to the need to respond to such comments, it is generally desirable to publicize the planned use of presumptive remedies early on, and give States, communities, PRPs, and others an early opportunity to express any concerns they may have about focusing the FS or EE/CA in this way. The agency may then decide whether to include additional alternatives in the FS or EE/CA so that those concerns can be addressed before the remedy is proposed.

In general, it is expected that the directive and supporting documents will provide substantial justification for preferring the presumptive remedy over alternative technologies. Therefore, the submission of comments advocating other approaches does not necessarily require broadening of the FS or EE/CA, or conducting additional analysis after the plan has been proposed. Whether additional documentation is required will depend upon how substantial or persuasive the comments are (e.g., whether a comment identifies unusual site circumstances that seriously call into question the applicability of the presumptive remedy). The Region will have to assess this by evaluating each comment on its own merits.

It should be noted that even if the FS is broadened to consider alternatives other than the presumptive remedy, much of the benefit of the presumptive remedy approach can still be achieved. In such cases, it is not necessary to address the full array of possible technologies, rather only the presumptive remedy and the specific alternative(s) that genuinely warrant detailed study. Therefore, the FS can still be narrowed and data gathering can still be focused.

Q11. How do State ARARs Affect the Use of Presumptive Remedies?

A. Any remedy, including presumptive remedies, must be selected in accordance with Section 121(d)(2)(A)(ii) of the Comprehensive Environmental Response, Compensation and Liability Act

(CERCLA), which specifies that selected remedial actions comply with promulgated standards under Federal and more stringent State environmental laws (i.e., State ARARs). At this time it is difficult to predict situations where presumptive remedies will not comply with State ARARs, and such issues must necessarily be addressed on a site-specific basis. However, as the presumptive remedies have been widely selected, they are likely to be capable of meeting State ARARs.

Q12. What Are the Implications of Presumptive Remedies on Community, PRP, and State Relations?

A. It will generally be desirable to notify the community, State, and PRP(s) as early in the clean-up process as possible that presumptive remedies are being considered for the site. This notification can take the form of a fact sheet, a notice in the newspaper, and/or a public meeting in which the site manager (with assistance from the expert team, as desired) explains the rationale for taking such actions and distributes the appropriate directives of the site type in question. Additionally, the site manager should explain the potential benefits associated with the use of presumptive remedies such as time and cost savings, and consistency. Early discussions about the rationale for presumptive remedies should help instill confidence in both the technologies and remedy selection processes.

Q13. How Will EPA Communicate Progress on Current Presumptive Remedies, Newly Developed Presumptive Remedies, and Future Issues Related to Presumptive Remedies?

A. Information about presumptive remedies will be communicated in several ways. First, it is anticipated that an orientation will be provided to communicate the key elements of presumptive remedies to Regional site managers as appropriate. This may be followed by periodic meetings with expert teams, if necessary, to scope out the applications of presumptive remedies on a site-specific basis. The expert team may also be used to convey any new developments on technology or policies and procedures for general or specific applications. A quarterly conference call is also anticipated between site managers and the expert teams to allow for the exchange of ideas and to identify and resolve technical issues. Technology selection directives, SACM Bulletins, and Q&A directives will be published periodically to disseminate information on presumptive remedies and related issues as they arise. Finally, the presumptive remedies directives on the various site categories will be updated every several years to reflect new technology development and up-to-date performance data, as appropriate.

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United States Environmental Protection Agency
Office of Solid Waste and Emergency Response
Directive No. 9355.0-49FS
EPA 540-F-93-035
PB 93-963339
September 1993

Presumptive Remedy for CERCLA Municipal Landfill Sites

Office of Emergency and Remedial Response
Hazardous Site Control Division 5203G

Quick Reference Fact Sheet

Since Superfund's inception in 1980, the remedial and removal programs have found that certain categories of sites have similar characteristics, such as types of contaminants present, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, the Superfund program is undertaking an initiative to develop presumptive remedies to accelerate future cleanups at these types of sites. The presumptive remedy approach is one tool of acceleration within the **Superfund Accelerated Cleanup Model (SACM).**

Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. The objective of the presumptive remedies initiative is to use the program's past experience to streamline site investigation and speed up selection of cleanup actions. Over time presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of sites. Presumptive remedies are expected to be used at all appropriate sites except under unusual site-specific circumstances.

This directive establishes **containment** as the presumptive remedy for CERCLA municipal landfills. The framework for the presumptive remedy for these sites is presented in a streamlining manual entitled *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites,* February 1991 (OSWER Directive 9355. 3-11). This directive highlights and emphasizes the importance of certain streamlining principles related to the scoping (planning) stages of the remedial investigation/feasibility study (RI/FS) that were identified in the manual. The directive also provides clarification of and additional guidance in the following areas: (1) the level of detail appropriate for risk assessment of source areas at municipal landfills and (2) the characterization of hot spots.

BACKGROUND

Superfund has conducted pilot projects at four municipal landfill sites[1] on the National Priorities List (NPL) to evaluate the effectiveness of the manual *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (hereafter referred to as "the manual") as a streamlining tool and as the framework for the municipal landfill presumptive remedy. Consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (or NCP), EPA's expectation was that containment technologies generally would be appropriate for municipal landfill waste because the volume and heterogeneity of the waste generally make treatment impracticable. The results of the pilots support this expectation and demonstrate that the manual is an effective tool for streamlining the RI/FS process for municipal landfills.

Since the manual's development, the expectation to contain wastes at municipal landfills has evolved into a presumptive remedy for these sites.[2] Implementation of the streamlining principles outlined in the manual at the four pilot sites helped to highlight issues requiring further clarification, such as the degree to which risk assessments can be streamlined for source areas and the characterization and remediation of hot spots. The pilots also demonstrated the value of focusing streamlining efforts at the scoping stage, recognizing that the biggest savings in time and money can be realized if streamlining is incorporated at the beginning of the RI/FS process. Accordingly, this directive addresses those issues identified during the pilots and highlights streamlining opportunities to be considered during the scoping component of the RI/FS.

[1] Municipal landfill sites typically contain a combination of principally municipal and to a lesser extent hazardous wastes.

[2] See EPA Publication 9203.1-02I, SACM Bulletins, *Presumptive Remedies for Municipal Landfill Sites,* April 1992, Vol. 1, No. 1, and February 1993, Vol. 2, No. 1, and SACM Bulletin *Presumptive Remedies,* August 1992, Vol. 1, No. 3.

Finally, while the primary focus of the municipal landfill manual is on streamlining the RI/FS, Superfund's goal under SACM is to accelerate the entire clean-up process. Other guidance issued under the municipal landfill presumptive remedy initiative identifies design data that may be collected during the RI/FS to streamline the overall response process for these sites (see Publication No. 9355.3-18FS, *Presumptive Remedies:* CERCLA *Landfill Caps Data Collection Guide,* to be published in October 1993).

CONTAINMENT AS A PRESUMPTIVE REMEDY

Section 300.430(a)(iii)(B) of the NCP contains the expectation that engineering controls, such as containment, will be used for waste that poses a relatively low long-term threat where treatment is impracticable. The preamble to the NCP identifies municipal landfills as a type of site where treatment of the waste may be impracticable because of the size and heterogeneity of the contents (55 FR 8704). Waste in CERCLA landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste. Because treatment usually is impracticable, EPA generally considers containment to be the appropriate response action, or the "presumptive remedy," for the source areas of municipal landfill sites.

The presumptive remedy for CERCLA municipal landfill sites relates primarily to containment of the landfill mass and collection and/or treatment of landfill gas. In addition, measures to control landfill leachate, affected ground water at the perimeter of the landfill, and/or upgradient ground-water that is causing saturation of the landfill mass may be implemented as part of the presumptive remedy.

The presumptive remedy does not address exposure pathways outside the source area (landfill), nor does it include the long-term ground-water response action. Additional RI/FS activities, including a risk assessment, will need to be performed, as appropriate, to address those exposure pathways outside the source area. It is expected that RI/FS activities addressing exposure pathways outside the source generally will reconducted concurrently with the streamlined RI/FS for the landfill source presumptive remedy. A response action for exposure pathways outside the source (if any) may be selected together with the presumptive remedy (thereby developing a comprehensive site response), or as an operable unit separate from the presumptive remedy.

Highlight 1 identifies the components of the presumptive remedy. Response actions selected for individual sites will include only those components that are necessary, based on site-specific conditions.

Highlight 1: Components of the Presumptive Remedy: Source Containment

- Landfill cap;
- Source area ground-water control to contain plume;
- Leachate collection and treatment;
- Landfill gas collection and treatment; and/or
- Institutional controls to supplement engineering controls.

The EPA (or State) site manager will make the initial decision of whether a particular municipal landfill site is suitable for the presumptive remedy or whether a more comprehensive RI/FS is required. Generally, this determination will depend on whether the site is suitable for a streamlined risk evaluation, as described on page 4. The community, state, and potentially responsible parties (PRPs) should be notified that a presumptive remedy is being considered for the site before work on the RI/FS work plan is initiated. The notification may take the form of a fact sheet, a notoice in a local newspaper, and/or a public meeting.

Use of the presumptive remedy eliminates the need for the initial identification and screening of alternatives during the feasibility study (FS). Section 300.430(e)(1) of the NCP states that, "... the lead agency shall include art alternatives screening step, when needed, (emphasis added) to select a reasonable number of alternatives for detailed analysis."

EPA conducted an analysis of potentially available technologies for municipal landfills and found that certain technologies are routinely and appropriately screened out on the basis of effectiveness, feasibility, or cost (NCP Section 300.430(e)(7)). (See Appendix A to this directive and "Feasibility Study Analysis for CERCLA Municipal Landfills," September 1993 available at EPA Headquarters and Regional Offices.) Based on this analysis, the universe of alternatives that will be analyzed in detail may be limited to the components of the containment remedy identified in Highlight 1, unless site-specific conditions dictate otherwise or alternatives are considered that were not addressed in the FS analysis. The FS analysis document, together with this directive, must be included in the administrative record for each municipal landfill presumptive remedy site to support elimination of the initial identification and screening of site-specific alternatives. Further detailed and comprehensive

supporting materials (e.g., FS reports included in analysis, technical reports) can be provided by Headquarters, as needed.

While the universe of alternatives to address the landfill source will be limited to those components identified in Highlight 1, potential alternatives that may exist for each component or combinations of components may be evaluated in the detailed analysis. For example, one component of the presumptive remedy is source area ground-water control. If appropriate, this component may be accomplished in a number of ways, including pump and treat, slurry walls, etc. These potential alternatives may then be combined with other components of the presumptive remedy to develop a range of containment alternatives suitable for site-specific conditions. Response alternatives must then be evaluated in detail against the nine criteria identified in Section 300.430(e)(g) of the NCP. The detailed analysis will identify site-specific ARARs and develop costs on the basis of the particular size and volume of the landfill.

EARLY ACTION AT MUNICIPAL LANDFILLS

EPA has identifies the presumptive remedy site categories as good candidates for early action under SACM. At municipal landfills, the upfront knowledge that the source area will be contained may facilitate such early actions as installation of a landfill cap or a ground-water containment system. Depending on the circumstances, early actions may be accomplished using either removal authority (e.g., non-time-critical removal actions) or remedial authority. In some cases, it may be appropriate for an Engineering Evaluation/Cost Analysis to replace part or all of the RI/FS if the source control component will be a non-time-critical removal action. Some factors may affect whether a specific response action would be better accomplished as a removal or remedial action including the size of the action, the associated state cost share, and/or the scope of O&M. A discussion of these factors is contained in *Early Action and Long-term Action Under SACM - Interim Guidance,* Publication No. 9203.1-05I, December 1992.

SCOPING A STREAMLINED RI/FS UNDER THE PRESUMPTIVE REMEDY FRAMEWORK

The goal of an RI/FS is to provide the information necessary to: (1) adequately characterize the site; (2) define site dynamics; (3) define risks; and (4) develop the response action. As discussed in the following sections, the process for achieving each of these goals can be streamlined for CERCLA municipal landfill sites because of the upfront presumption that landfill contents will be contained. The strategy for streamlining each of these areas should be developed early (i.e., during the scoping phase of the RI/FS).

1. Characterizing the Site

The use of existing data is especially important in conducting a streamlined RI/FS for municipal landfills. Characterization of a landfill's contents is not necessary or appropriate for selecting a response action for these sites except in limited cases; rather, existing data are used to determine whether the containment presumption is appropriate. Subsequent sampling efforts should focus on characterizing areas where contaminant migration is suspected, such as leachate discharge areas or areas where surface water runoff has caused erosion. It is important to note that the decision to characterize hot spots should also be based on existing information, such as reliable anecdotal information, documentation, and/or physical evidence (see page 6).

In those limited cases where no information is available for a site, it may not be advisable to initiate use of the presumptive remedy until some data are collected. For example, if there is extensive migration of contaminants from a site located in an area with several sources, it will be necessary to have some information about the landfill source in order to make an association between on-site and off-site contamination.

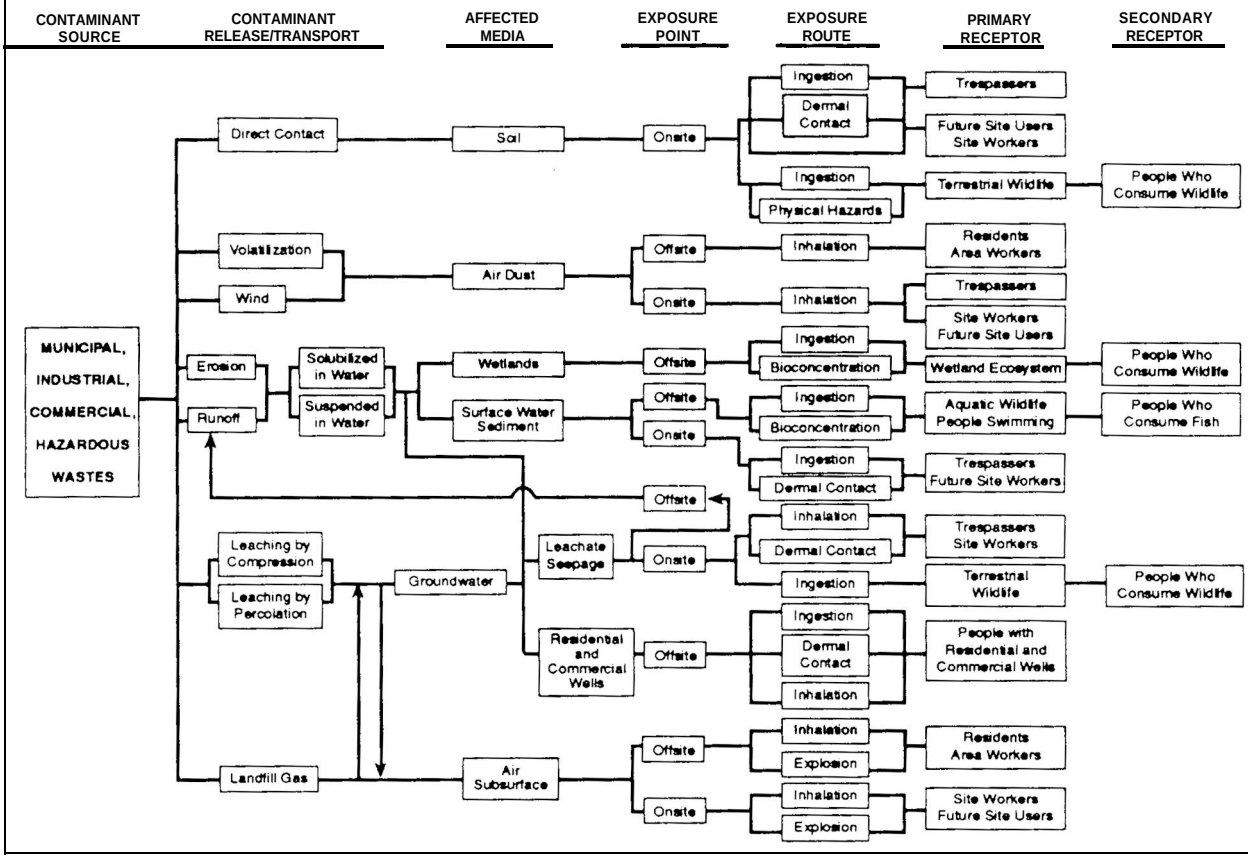
Sources of information of particular interest during scoping include records of previous ownership, state files, closure plans, etc., which may help to determine types and sources of hazardous materials present. In addition, a site visit is appropriate for several reasons, including the verification of existing data, the identification of existing site remediation systems, and to visually characterize wastes (e.g., leachate seeps). Specific information to be collected is provided in Sections 2.1 through 2.4 of the municipal landfill manual.

2. Defining Site Dynamics

The collected data are used to develop a conceptual site model, which is the key component of a streamlined RI/FS. The conceptual site model is an effective tool for defining the site dynamics, streamlining the risk evaluation, and developing the response action. Highlight 2 presents a generic conceptual site model for municipal landfill. The model is developed before any RI field activities are conducted, and its purpose is to aid in understanding and describing the site and to present hypotheses regarding:

- The suspected sources and types of contaminants present;
- Contaminant release and transport mechanisms;

Highlight 2: Generic Conceptual Site Model



- Rate of contaminant release and transport (where possible);
- Affected media;
- Known and potential routes of migration; and
- Known and potential human and environmental receptors.

After the data are evaluated and a site visit is completed, the contaminant release and transport mechanisms relevant to the site should be determined. The key element in developing the conceptual site model is to identify those aspects of the model that require more information to make a decision about response measures. Because containment of the landfill's contents is the presumed response action, the conceptual site model will be of most use in identifying areas beyond the landfill source itself that will require further study, thereby focusing site characterization away from the source area and on areas of potential contaminant migration (e.g., ground water or contaminated sediments).

3. Defining Risks

The municipal landfill manual states that a streamlined or limited baseline risk assessment will be sufficient to initiate response action on the most obvious problems at a municipal landfill (e.g., ground water, leachate, landfill contents, and landfill gas). One method for establishing risk using a streamlined approach is to compare contaminant concentration levels (if available) to standards that are potential chemical-specific applicable or relevant and appropriate requirements (ARARs) for the action. The manual states that where established standards for one or more contaminants in a given medium are clearly exceeded, remedial action generally is warranted.[3]

It is important to note, however, that based on site-specific conditions, an active response is not required if ground-water contaminant concentrations exceed chemical-specific standards but the site risk is within the Agency's acceptable risk range (10^{-4} to 10^{-6}). For example, if it is determined that the release of

[3] See also OSWER Directive 9355.0-30, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, April 22, 1991, which states that if MCLs or non-zero MCLGs are exceeded, [a response] action generally is warranted.

contaminants from a particular landfill is declining, and concentrations of one or more ground-water contaminants are at or barely exceed chemical-specific standards, the Agency may decide not to implement an active response. Such a decision might be based on the understanding that the landfill is no longer acting as a source of ground-water contamination, and that the landfill does not present an unacceptable risk from any other exposure pathway.

A site generally will not be eligible for a streamlined risk evaluation if ground-water contaminant concentrations do not clearly exceed chemical-specific standards or the Agency's accepted level of risk, or other conditions do not exist that provide a clear justification for action (e.g., direct contact with landfill contents resulting from unstable slopes). Under these circumstances, a quantitative risk assessment that addresses all exposure pathways will be necessary to determine whether action is needed.

Ultimately, it is necessary to demonstrate that the final remedy addresses all pathways and contaminants of concern, not just those that triggered the remedial action. As described in the following sections, the conceptual site model is an effective tool for identifying those pathways and illustrating that they have been addressed by the containment remedy.

Streamlined Risk Evaluation Of The Landfill Source

Experience from the presumptive remedy pilots supports the usefulness of a streamlined risk evaluation to initiate an early response action under certain circumstances. As a matter of policy, for the source area of municipal landfills, a quantitative risk assessment that considers all chemicals, their potential additive effects, etc., is not necessary to establish a basis for action if ground-water data are available to demonstrate that contaminants clearly exceed established standards or if other conditions exist that provide a clear justification for action.

A quantitative risk assessment also is not necessary to evaluate whether the containment remedy addresses all pathways and contaminants of concern associated with the source. Rather, all potential exposure pathways can be identified using the conceptual site model and compared to the pathways addressed by the containment presumptive remedy. Highlight 3 illustrates that the containment remedy addresses all exposure pathways associated with the source at municipal landfill sites.

Finally, a quantitative risk assessment is not required to determine clean-up levels because the type of cap will be determined by closure ARARs, and ground water that is extracted as a component of the presumptive remedy will be required to meet discharge limits, or other standards for its disposal. Calculation of clean-up levels for ground-water contamination that has migrated away from the source will not be accomplished under the presumptive remedy, since such contamination will require a conventional investigation and a risk assessment.

Highlight 3: Source Contaminant Exposure Pathways Addressed by Presumptive Remedy

1. Direct contact with soil and/or debris prevented by landfill cap;
2. Exposure to contaminated ground water within the landfill area prevented by ground-water control;
3. Exposure to contaminated leachate prevented by leachate collection and treatment; and
4. Exposure to landfill gas addressed by gas collection and treatment, as appropriate.

Streamlining the risk assessment of the source area eliminates the need for sampling and analysis to support the calculation of current or potential future risk associated with direct contact. It is important to note that because the continued effectiveness of the containment remedy depends on the integrity of the containment system, it is likely that institutional controls will be necessary to restrict future activities at a CERCLA municipal landfill after construction of the cap and associated systems. EPA has thus determined that it is not appropriate or necessary to estimate the risk associated with future residential use of the landfill source, as such use would be incompatible with the need to maintain the integrity of the containment system. (Long-term waste management areas, such as municipal landfills, may be appropriate, however, for recreational or other limited uses on a site-specific basis.) The availability and efficacy of institutional controls should be evaluated in the FS. Decision documents should include measures such as institutional controls to ensure the continued integrity of such containment systems whenever possible.

Areas of Contaminant Migration

Almost every municipal landfill site has some characteristic that may require additional study, such as leachate discharge to a wetland or significant surface water run-off caused by drainage problems. These migration pathways, as well as ground-water contamination that has migrated away from the source, generally will require characterization and a more comprehensive risk assessment to determine whether action is warranted beyond the source area and, if so, the type of action that is appropriate.

While future residential use of the landfill source area itself is not considered appropriate, the land adjacent to

landfills is frequently used for residential purposes. Therefore, based on site-specific circumstances, it may be appropriate to consider future residential use for ground water and other exposure pathways when assessing risk from areas of **contaminant migration.**

4. Developing the Response Action

As a first step in developing containment alternatives, response action objectives should be developed on the basis of the pathways identified for action in the conceptual site model. Typically, the primary response action objectives for municipal landfill sites include:

Presumptive Remedy

- Preventing direct contact with landfill contents;
- Minimizing infiltration and resulting contaminant leaching to ground water;
- Controlling surface water runoff and erosion;
- Collecting and treating contaminated ground water and leachate to contain the contaminant plume and prevent further migration from source area; and
- Controlling and treating landfill gas.

Non-Presumptive Remedy

- Remediating ground water;
- Remediating contaminated surface water and sediments; and
- Remediating contaminated wetland areas.

As discussed in Section 3, "Defining Risks," the containment presumptive remedy accomplishes all but the last three of these objectives by addressing all pathways associated with the source. Therefore, the focus of the RI/FS can be shifted to characterizing the media addressed in the last three objectives (contaminated ground water, surface water and sediments, and wetland areas) and on collecting data to support design of the containment remedy.

Treatment of Hot Spots

The decision to characterize and/or treat hot spots is a site-specific judgement that should be based on the consideration of a standard set of factors. Highlight 4 lists questions that should be answered before making the decision to characterize and/or treat hot spots. The overriding question is whether the combination of the waste's physical and chemical characteristics and volume is such that the integrity of the new containment system will be threatened if the waste is left in place. This question should be answered on the basis of what is known about a site (e.g., from operating records or other reliable information). An answer in the affirmative to all of the questions listed in Highlight 4 would indicate that it is likely that the integrity of the containment system would be threatened, or that excavation and treatment of hot spots would be practicable, and that a significant reduction in risk at the site would occur as a result of treating hot spots. EPA expects that few CERCLA municipal landfills will fall into this category; rather, based on the Agency's experience, the majority of sites are expected to be suitable for containment only, based on the heterogeneity of the waste, the lack of reliable information concerning disposal history, and the problems associated with excavating through refuse.

The volume of industrial and/or hazardous waste co-disposed with municipal waste at CERCLA municipal landfills varies from site to site, as does the amount of information available concerning disposal history. It is impossible to fully characterize, excavate, and/or treat the source area of municipal landfills, so uncertainty about the landfill contents is expected. Uncertainty by itself does not call into question the containment approach. However, containment remedies must be designed to take into account the possibility that hot spots are present in addition to those that have been identified and characterized. The presumptive remedy must be relied upon to contain landfill contents and prevent migration of comtaminants. This is accomplished by a combination of measures, such as a landfill cap combined with a leachate collection system. Monitoring will further ensure the continued effectiveness of the remedy.

The following examples illustrate site-specific decision making and show how these factors affect the decision whether to characterize and/or treat hot spots.

Examples of Site-Specific Decision Making Concerning Hot Spot Characterization/ Treatment

Site A

There is anecdotal information that approximately 200 drums of hazardous waste were disposed of at this 70-acre former municipal landfill, but their location and contents are unknown. The remedy includes a landfill cap and ground-water and landfill gas treatment.

A search for and characterization of hot spots is not supported at Site A based on the questions listed in

Highlight 4: Characterization of Hot Spots

If all of the following questions can be answered in the affirmative, it is likely that characterization and/or treatment of hot spots is warranted:

1. Does evidence exist to indicate the presence and approximate location of waste?
2. Is the hot spot known to be principal threat waste?*
3. Is the waste in a discrete, accessible part of the landfill?
4. Is the hot spot known to be large enough that its remediation will reduce the threat posed by the overall site but small enough that it is reasonable to consider removal (e.g., 100,000 cubic yards or less)?

*See *A Guide to Principal Threat and Low Level Threat Wastes,* November 1991, Superfund Publication No. 9380.3-06FS.

Highlight 4: (1) no reliable information exists to indicate the location of the waste; (2) the determination of whether the waste is principal threat waste cannot be made since the physical/chemical characteristics of the wastes are unknown; (3) since the location of the waste is unknown, the determination of whether the waste is in a discrete accessible location cannot be made; (4) in this ease, the presence of 200 drums in a 70-acre landfill is not considered to significantly affect the threat posed by the overall site. Rather, the containment system will include measures to ensure its continued effectiveness (e.g., monitoring and/or leachate collection) given the uncertainty associated with the landfill contents and suspected drums.

Site B

Approximately 35,000 drums, many containing hazardous wastes, were disposed of in two drum disposal units at this privately owned 80-acre inactive landfill, which was licensed to receive general refuse. The site is divided into two operable units. The remedy for Operable Unit 1 (OU 1) is incineration of drummed wastes in the two drum disposal units. The remedy for OU 2 consists of treatment of contaminated ground water and leachate and containment of treatment residuals (from OU 1) and remaining landfill contents, including passive gas collection and flaring.

Treatment of landfill contents is supported at Site B because all of the questions in Highlight 4 can be answered in the affirmative: (1) existing evidence from previous investigations and sampling conducted by the state (prior to the RI) indicated the presence and approximate location of wastes; (2) the wastes were considered principal threat wastes because they were liquids and (based on sampling) were believed to contain contaminants of concern; (3) the waste is located in discrete accessible parts of the landfill; and (4) the waste volume is large enough that its remediation will significantly reduce the threat posed by the overall site.

CLOSURE REQUIREMENTS

Subtitle D

In the absence of Federal Subtitle D closure regulations, State Subtitle D closure requirements generally have governed CERCLA response actions at municipal landfills as applicable or relevant and appropriate requirements (ARARs). New Federal Subtitle D closure and post-closure care regulations will be in effect on October 9, 1993 (56 FR 50978 and 40 CFR 258).[4] State closure requirements that are ARARs and that are more stringent than the Federal requirements must be attained or waived.

The new Federal regulations contain requirements related to construction and maintenance of the final cover, and leachate collection, ground-water monitoring, and gas monitoring systems. The final cover regulations will be applicable requirements for landfills that received household waste after October 9,1991. EPA expects that the final cover requirements will be applicable to few, if any, CERCLA municipal landfills, since the receipt of household wastes ceased at most CERCLA landfills before October 1991. Rather, the substantive requirements of the new Subtitle D regulations generally will be considered relevant and appropriate requirements for CERCLA response actions that occur after the effective date.

Subtitle C

RCRA Subtitle C closure requirements may be applicable or relevant and appropriate in certain circumstances. RCRA Subtitle C is applicable if the landfill received waste that is a listed or characteristic waste under RCRA, and:

1. The waste was disposed of after November 19,1980 (effective date of RCRA), or

[4] An extension of the effective date has been proposed but not finalized at this time.

2. The new response action constitutes disposal under RCRA (i.e., disposal back into the original landfill).[5]

The decision about whether a Subtitle C closure requirement is relevant and appropriate is based on a variety of factors, including the nature of the waste and its hazardous properties, the date on which it was disposed, and the nature of the requirement itself. For more information on RCRA Subtitle C closure requirements, see *RCRA ARARs:Focus on Closure Requirements,* Directive No. 9234.2-04FS, October 1989.

[5]Note that disposal of only small quantity hazardous waste and household hazardous waste does not make Subtitle C applicable.

APPENDIX A
TECHNICAL BASIS FOR PRESUMPTIVE REMEDIES

This Appendix summarizes the analysis that EPA conducted of feasibility study (FS) and Record of Decision (ROD) data from CERCLA municipal landfill sites which led to the establishment of containment as the presumptive remedy for these sites. The objective of the study was to identify those technologies that are consistently included in the remedies selected, those that are consistently screened out, and to identify the basis for their elimination. Results of this analysis support the decision to eliminate the initial technology identification and screening steps on a site-specific basis for this site type. The technical review found that certain technologies are appropriately screened out based on effectiveness, implementability, or excessive costs.

The methodology for this analysis entailed reviewing the technology identification and screening components of the remedy selection process for a representative sample of municipal landfill sites. The number of times each technology was either screened out or selected in each remedy was compiled. A detailed discussion of the methodology used is provided below.

METHODOLOGY

Identification of Sites for Feasibility Study Analysis

Of the 230 municipal landfill sites on the NPL, 149 sites have had a remedy selected for at least one operable unit. Of the 149 sites, 30 were selected for this study on a random basis, or slightly greater than 20 percent. The sites range in size from 8.5 acres to over 200 acres and are located primarily in Regions 1,2,3, and 5. This geographical distribution approximates the distribution of municipal landfills on the NPL.

Technology Secrrning and Remedial Alternative Analysis

The FS analysis involved a review of the technology identification and screening phase, including any pre-screening steps, followed by a review of the detailed analysis and comparative analysis phases. Information derived from each review was documented on site-specific data collection forms, which are available for evaluation as part of the Administrative Record for this presumptive remedy directive. The review focused on the landfill source contamination only; ground-water technologies and alternatives were not included in the analysis.

For the screening phase, the full range of technologies considered was listed on the data collection forms, along with the key reasons given for eliminating technologies from further consideration. These reasons were categorized according to the screening criteria: cost, effectiveness, or implementability. The frequency with which specific reasons were given for eliminating a technology from further consideration was then tallied and compiled into a screening phase summary table.

For the detailed analysis and comparative analysis, information on the relative performance of each technology/alternative with respect to the seven NCP criteria was documented on the site-specific data collection forms. The advantages and disadvantages associated with each clean-up option were highlighted. In some cases, a technology was combined with one or more technologies into one or more alternatives. The disadvantages of a technology/alternative were then compiled into a detailed analysis/comparative analysis summary table, under the assumption that these disadvantages contributed to non-selection. All summary tables are available for review as part of the Administrative Record.

APPENDIX A
TECHNICAL BASIS FOR PRESUMPTIVE REMEDIES (continued)

RESULTS

The information from the technology screening and remedial alternative analyses is provided in Table 1. It demonstrates that containment (the presumptive remedy), was chosen as a component of the selected remedy at all thirty of the sites analyzed. No other technologies or treatments were consistently selected as a remedy or retained for consideration in a remedial alternative. However, at eight of the thirty sites, there were circumstances where technologies were included in the selected remedy to address a site-specific concern, such as principal threat wastes. These technologies are included in the column entitled "Tech. Not Primary Component of Alternative"[1] in Table 1 and include incineration at two sites, waste removal and off-site disposal at two sites, soil vapor extraction at two sites, and bioreclamation at one site.

Leachate collection and gas collection systems were also tracked as part of the detailed analysis and comparison of remedial alternatives. These types of systems generally were not considered as remediation technologies during the screening phases. At fifteen sites, leachate collection was selected as part of the overall containment remedy. At seventeen sites, gas collection systems were selected as part of the overall containment remedy.

This analysis supports the decision to eliminate the initial technology identification and screening step for municipal landfill sites. On a site-specific basis, consideration of remediation technologies may be retained as needed.

[1] This column title is used for record-keeping purposes only and is not meant to imply that these treatment technologies are not considered important components of the selected remedies.

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3			# RODs Tech. Selected	# RODs Tech. Not Selected		#RODS WHERE CRITERION CONTRIBUTED TO NON-SELECTION							
					Cost	Effectiveness	Implement			Protect.	ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns[4]	Community Concerns[4]
Multi-layer Cap	28	25	3	0	2	2	0	18	7	1	0	0	1	3	5	3	---	---
Clay Cap	16	8	8	0	1	8	0	4	4	2	2	1	2	1	0	1	---	---
Asphalt Cap	17	0	17	0	2	14	5	0	0	0	0	0	0	0	0	0	---	---
Concrete Cap	17	0	17	0	3	14	5	0	0	0	0	0	0	0	0	0	---	---
Soil Cover	16	7	5	4	0	5	1	5	2	1	0	0	0	0	0	0	---	---
Synthetic Cap	13	3	10	0	0	10	1	2	1	1	1	1	1	1	1	1	---	---
Chemical Seal	5	0	5	0	0	4	0	0	0	0	0	0	0	0	0	0	---	---
Slurry Wall	22	5	14	3	2	8	6	2	3	3	2	2	1	2	0	2	---	---
Grout Curtain	18	0	18	0	3	15	9	0	0	0	0	0	0	0	0	0	---	---
Sheet Piling	17	1	16	0	0	13	5	0	1	0	0	0	0	0	0	0	---	---
Grout Injection	8	0	8	0	0	8	2	0	0	0	0	0	0	0	0	0	---	---
Block Displacement	5	0	5	0	0	3	3	0	0	0	0	0	0	0	0	0	---	---
Bottom Sealing	5	0	5	0	0	3	4	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3: Cost	Effectiveness	Implement	# RODs Tech. Selected	# RODs Tech. Not Selected	Protect	#RODS WHERE CRITERION CONTRIBUTED TO NON-SELECTION: ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns[4]	Community Concerns[4]
Vibrating Beam	5	0	5	0	0	3	3	0	0	0	0	0	0	0	0	0	---	---
Liners	2	0	2	0	0	1	2	0	0	0	0	0	0	0	0	0	---	---
Offsite Nonhazardous Landfill	3	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	---	---
Offsite RCRA Landfill	17	0	13	4	8	3	12	0	0	0	0	0	0	0	0	0	---	---
Offsite Landfill (unspecified)	9	1	8	0	5	3	5	1	0	0	0	0	0	0	0	0	---	---
Onsite Nonhazardous Landfill	2	0	2	0	1	1	1	0	0	0	0	0	0	0	0	0	---	---
Onsite RCRA Landfill	14	1	11	2	3	2	10	0	1	0	0	0	0	0	0	1	---	---
Onsite Landfill (unspecified)	7	0	6	1	3	3	6	0	0	0	0	0	0	0	0	0	---	---
Bioremediation (unspecified)	13	0	13	0	0	13	1	0	0	0	0	0	0	0	0	0	---	---
Bioremediation Ex-situ	10	0	10	0	0	7	7	0	0	0	0	0	0	0	0	0	---	---
Bioremediation In-situ	15	1	14	0	1	13	7	1	0	0	0	0	0	0	0	0	---	---
Dechlorinization/ APEG	6	0	5	1	1	4	2	0	0	0	0	0	0	0	0	0	---	---
Oxidation/ Reduction	12	0	12	0	1	8	5	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3: Cost	Effectiveness	Implement	# RODs Tech. Selected	# RODs Tech. Not Selected	Protect.	#RODs WHERE CRITERION CONTRIBUTED TO NON-SELECTION: ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns[4]	Community Concerns[4]
Neutralization	4	0	3	1	0	2	1	0	0	0	0	0	0	0	0	0	---	---
Thermal Destruction (unspecified)	6	0	6	0	0	3	4	0	0	0	0	0	0	0	0	0	---	---
Offsite Incineration (unspecified)	19	2	14	3	9	5	10	1	1	0	0	0	0	1	1	0	---	---
Onsite Incineration (unspecified)	12	0	8	3	5	5	6	0	1	0	0	0	0	1	1	1	---	---
Fluidized Bed	9	0	9	0	5	6	4	0	0	0	0	0	0	0	0	0	---	---
Infrared	8	0	7	1	6	3	3	0	0	0	0	0	0	0	0	0	---	---
Pyrolysis	5	2	3	1	2	2	1	0	1	0	1	0	0	1	1	1	---	---
Multiple Hearth	4	0	4	0	2	2	1	0	0	0	0	0	0	0	0	0	---	---
Rotary Kiln	10	0	9	1	6	5	4	0	0	0	0	0	0	0	0	0	---	---
Vitrification	21	0	21	0	8	15	11	0	0	0	0	0	0	0	0	0	---	---
Low Temperature Thermal Desorp/ Stripping	13	1	11	1	2	9	3	0	1	0	0	0	0	0	1	0	---	---
In-situ Steam Stripping	5	0	5	0	1	4	2	0	0	0	0	0	0	0	0	0	---	---
Soil Flushing	16	2	14	0	2	9	10	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out [3]: Cost	Effectiveness	Implement	# RODs Tech. Selected	# RODs Tech. Not Selected: Protect	#RODs WHERE CRITERION CONTRIBUTED TO NON-SELECTION: ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns [4]	Community Concerns [4]
Soil Washing	12	2	9	1	1	8	6	0	0	0	0	0	0	0	0	0	---	---
Soil Vapor Extraction (SVE)	14	1	11	2	2	9	5	1	0	0	0	0	0	0	0	0	---	---
Fixation	7	1	5	1	0	4	2	2	0	0	0	0	0	0	0	0	---	---
Stabilization/ Solidification	20	0	19	2	1	13	6	0	0	0	0	0	0	0	0	0	---	---
Aeration	7	0	7	0	0	5	3	0	0	0	0	0	0	0	0	0	---	---

[1] The study was conducted on 30 RODs and their corresponding FSs.

[2] This does not include the no-action or institutional control only alternatives. No RODs selected either of these as remedies.

[3] FSs and RODs may contain more than one criterion for screening or non-selection of technology. Also, some FSs did not fully explain the criteria for screening out a technology. Thus, the totals for screening and non-selection criteria are not equal to the number of FSs and RODs considered.

[4] Information on State and community concerns was not included in this analysis because FSs do not contain this information and RODs generally only reference supporting documentation (i.e., State concurrence letter and responsiveness summary).

United States Environmental Protection Agency | Office of Solid Waste and Emergency Response | Directive No.9355.0-67FS
EPA/540/F-96/020
PB96-963314
December 1996

EPA

Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills

Federal Facilities Restoration and Reuse Office
Mail Code 5101

Quick Reference Fact Sheet

Presumptive remedies are preferred technologies for common categories of sites based on historical patterns of remedy selection and the U.S. Environmental Protection Agency's (EPA's) scientific and engineering evaluation of performance data on technology implementation. By streamlining site investigation and accelerating the remedy selection process, presumptive remedies are expected to ensure the consistent selection of remedial actions and reduce the cost and time required to clean up similar sites. Presumptive remedies are expected to be used at all appropriate sites. Site-specific circumstances dictate whether a presumptive remedy is appropriate at a given site.

EPA established source containment as the presumptive remedy for municipal landfill sites regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) in September of 1993 (see the directive *Presumptive Remedy for CERCLA Municipal Landfill Sites*). The municipal landfill presumptive remedy should also be applied to all appropriate military landfills. This directive highlights a step-by-step approach to determining when a specific military landfill is an appropriate site for application of the containment presumptive remedy. It identifies the characteristics of municipal landfills that are relevant to the applicability of the presumptive remedy, addresses characteristics specific to military landfills, outlines an approach to determining whether the presumptive remedy applies to a given military landfill, and discusses administrative record documentation requirements.

PURPOSE

This directive provides guidance on applying the containment presumptive remedy to military landfills. Specifically, this guidance:

- Describes the relevant characteristics of municipal landfills for applicability of the presumptive remedy;
- Presents the characteristics specific to military installations that affect application of the presumptive remedy;
- Provides a decision framework to determine applicability of the presumptive remedy to military landfills; and
- Provides relevant contacts/specialists in military wastes, case histories, administrative record documentation requirements, and references.

BACKGROUND

Municipal landfills are those facilities in which a combination of household, commercial and, to a lesser extent, industrial wastes have been co-disposed. The presumptive remedy for municipal landfills – source containment – is described in detail in the directive *Presumptive Remedy for CERCLA Municipal Landfill Sites*. Highlight 1 outlines the components of the containment presumptive remedy. Highlight 2 lists the characteristics of municipal landfills that are compatible with the presumptive remedy of containment.

Highlight 1

Components of the Containment Presumptive Remedy

- Landfill cap
- Source area groundwater control to contain plume
- Leachate collection and treatment
- Landfill gas collection and treatment
- Institutional controls to supplement engineering controls

Highlight 2

Appropriate Municipal Landfill Characteristics for Applicability of the Presumptive Remedy

- Risks are low-level, except for "hot spots"
- Treatment of wastes is usually impractical due to the volume and heterogeneity of waste
- Waste types include household, commercial, nonhazardous sludge, and industrial solid wastes
- Lesser quantities of hazardous wastes are present as compared to municipal wastes
- Land application units, surface impoundments, injection wells, and waste piles are not included

The presumptive remedy process involves streamlining of the remedial investigation/feasibility study (RI/FS) or, for non-time-critical removals, an Engineering Evaluation/Cost Analysis (EE/CA) by:

- Relying on existing data to the extent possible rather than characterizing landfill contents (limited or no landfill source investigation unless there is information indicating a need to investigate hot spots);
- Conducting a streamlined risk assessment; and
- Developing a focused feasibility study that analyzes only alternatives consisting of appropriate components of the presumptive remedy and, as required by the National Contingency Plan, the no action alternative.

Several directives, including *Presumptive Remedy for CERCLA Municipal Landfill Sites, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*, and *Streamlining the RI/FS for CERCLA Municipal Landfill Sites,* provide a complete discussion of these streamlining principles.

USE OF THIS GUIDANCE

EPA anticipates that the containment presumptive remedy will be applicable to a significant number of landfills found at military facilities. Although waste types may differ between municipal and military landfills, these differences do not preclude use of source containment as the primary remedy at appropriate military landfills.

Additionally, EPA continues to seek greater consistency among cleanup programs, especially in the process of selecting response actions for sites regulated under CERCLA and corrective measures for facilities regulated under the Resource Conservation and Recovery Act (RCRA). In general, even though the Agency's presumptive remedy guidances were developed for CERCLA sites, they should also be used at RCRA Corrective Action sites to focus RCRA Facility Investigations, simplify evaluation of remedial alternatives in the Corrective Measures Study, and influence remedy selection in the Statement of Basis. For more information, refer to the *RCRA Corrective Action Plan*, the proposed *Subpart S regulations,* and the *RCRA Corrective Action Advance Notice of Proposed Rulemaking.*

CHARACTERISTICS OF MILITARY LANDFILLS

The size of the landfill and the presence, proportion, distribution, and nature of wastes are fundamental to the application of the containment presumptive remedy to military landfills.

An examination of 31 Records of Decisions (RODs) that document the remedial decisions for 51 landfills at military installations revealed that no action was chosen for 10 landfills and remedial actions were chosen at 41 landfills (see Appendix). Of these 41 landfills, containment was selected at 23 (56 percent). For the remaining 18 landfills where other remedies were selected, institutional controls only were selected at three landfills, excavation and on-site consolidation were selected at four landfills, and excavation and off-site disposal were selected for 11 landfills.

The military landfills examined in the 51 RODs mentioned above ranged in size from 100 square feet to 150 acres and contained a wide variety of waste types. Of the 41 landfills for which remedial actions were chosen, 14 (34 percent) were one acre or less in size; containment was not selected for any of these landfills. Containment was chosen at 23 (85 percent) of the 27 landfills that were greater than one acre in size. This information suggests that the size of the landfill area is an important factor in determining the use of source containment at military landfills.

The wastes most frequently deposited at these military landfills were municipal-type wastes: household, commercial (e.g., hospital wastes, grease, construction debris), and industrial (e.g., process wastes, solvents, paints) wastes. Containment was the remedy selected at the majority of these sites. Military-specific wastes (e.g., munitions) were found at only 5 of the 51 landfills (10 percent).

Highlight 3 lists typical municipal and military wastes, including:

(1) Wastes that are common to both municipal landfills and military landfills;

(2) Wastes that are usually specific to military bases but that do not necessarily pose higher risks than other industrial wastes commonly found in municipal landfills (i.e., low-hazard military-specific wastes), depending on the volume and heterogeneity of the wastes; and

(3) High-hazard military wastes that, because of their unique characteristics, would require special consideration (i.e., high-hazard military-specific wastes).

The proportion and distribution of hazardous wastes in a landfill are important considerations. Generally, municipal landfills produce low-level threats with occasional hot spots. Similarly, most military landfills present only low-level threats with pockets of some high-hazard waste. However, some military facilities (e.g., weapons fabrication or testing, shipbuilding, major aircraft or equipment repair depots) have a high level of industrial activity compared to overall site activities. In these cases, there may be a higher proportion and wider distribution of industrial (i.e., potentially hazardous) wastes present than at other less industrialized facilities.

PRACTICAL CONSIDERATIONS

Sensitive Environments

Site-specific conditions may limit the use of the containment presumptive remedy at military landfills. For example, the presence of high water tables, wetlands and other sensitive environments, and the possible destruction or alteration of existing habitats as a result of a particular remedial action could all be important factors in the selection of the remedy.

Land Use

Reasonably anticipated future land use is also an important consideration at all sites. However, at military bases undergoing base closure procedures, where expeditiously converting property to civilian use is one of the primary goals, land use may receive heightened attention. Thus, at bases that are closing, it is particularly important for reuse planning to proceed concurrently with environmental investigation and restoration activities. The local reuse group is responsible for developing the preferred reuse alternatives. The Base Realignment and Closure Team should work closely with the reuse group to integrate reuse planning into the cleanup process, where practicable (see the *Land Use in CERCLA Remedy Selection* directive).

Highlight 3
Examples of Municipal-Type and Military-Specific Wastes

Municipal-Type Wastes

Municipal landfills contain predominantly nonhazardous materials. However, industrial solid waste and even some household refuse (e.g., pesticides, paints, and solvents) can possess hazardous components. Further, hazardous wastes are found in most municipal landfills as a result of past disposal practices.

Predominant Constituents

Household refuse, garbage, and debris
Commercial refuse, garbage, and debris
Construction debris
Yard wastes

Found In Low Proportion

Asbestos
Batteries
Hospital wastes
Industrial solid waste(s)
Paints and paint thinner
Pesticides
Transformer oils
Other solvents

Military-Specific Wastes

The majority of military landfills contain primarily nonhazardous wastes. The materials listed in this column are rarely predominant constituents of military landfills.

Low-Hazard Military-Specific Wastes

These types of wastes are specific to military bases but generally are no more hazardous than some wastes found in municipal landfills.

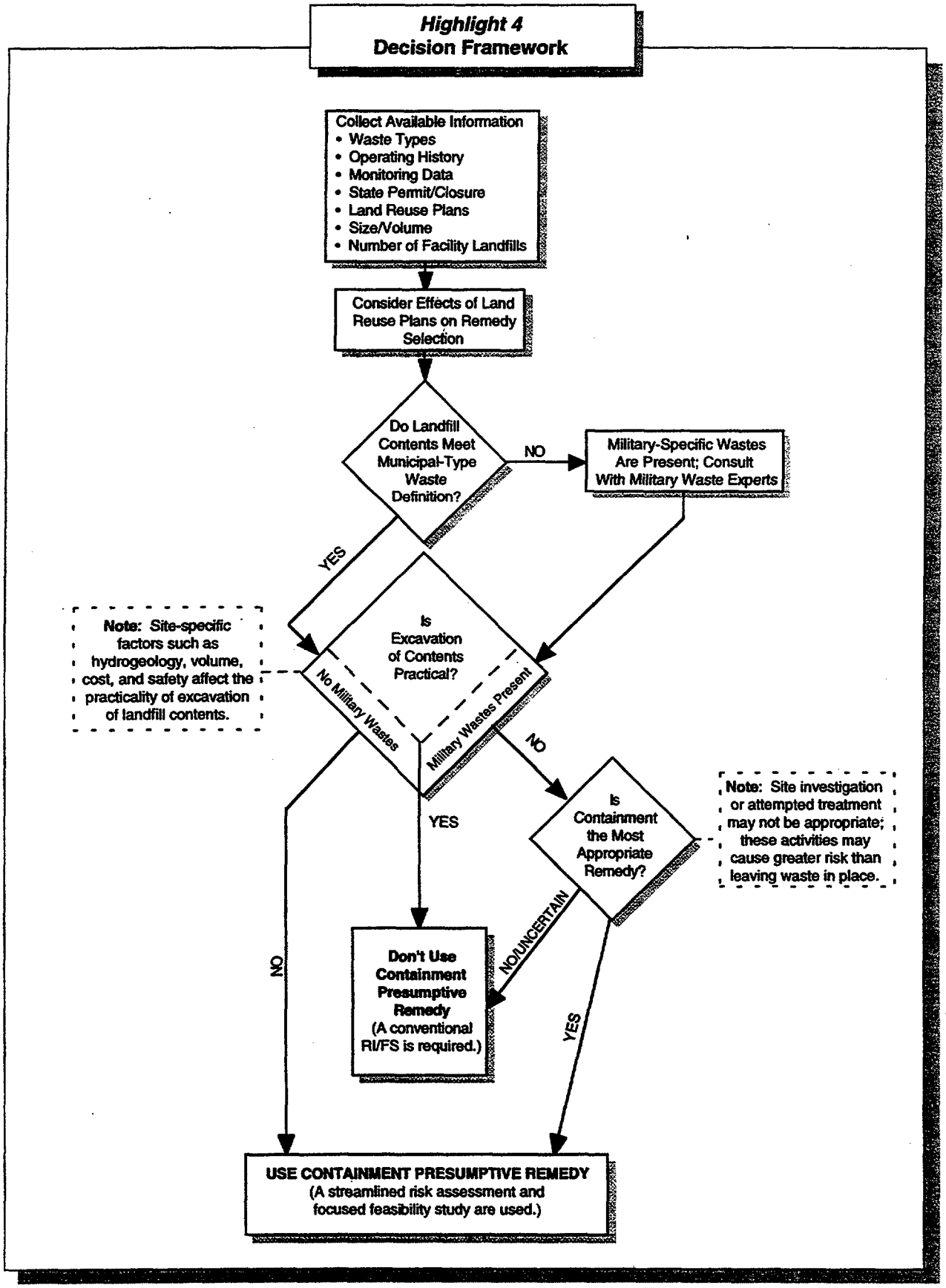
Low-level radioactive wastes
Decontamination kits
Munitions hardware

High-Hazard Military-Specific Wastes

These wastes are extremely hazardous and may possess unique safety, risk, and toxicity characteristics. Special consideration and expertise are required to address these wastes.

Military Munitions

Chemical warfare agents
(e.g., mustard gas, tear agents)
Chemical warfare agent training kits
Artillery, small arms, bombs
Other military chemicals
(e.g., demolition charges, pyrotechnics, propellants)
Smoke grenades


Highlight 4
Decision Framework
Collect Available Information
• Waste Types
• Operating History
• Monitoring Data
• State Permit/Closure
• Land Reuse Plans
• Size/Volume
• Number of Facility Landfills
Consider Effects of Land Reuse Plans on Remedy Selection
Do Landfill Contents Meet Municipal-Type Waste Definition?
NO
Military-Specific Wastes Are Present; Consult With Military Waste Experts
YES
Note: Site-specific factors such as hydrogeology, volume, cost, and safety affect the practicality of excavation of landfill contents.
Is Excavation of Contents Practical?
No Military Wastes
Military Wastes Present
NO
YES
Is Containment the Most Appropriate Remedy?
Note: Site investigation or attempted treatment may not be appropriate; these activities may cause greater risk than leaving waste in place.
NO/UNCERTAIN
YES
NO
Don't Use Containment Presumptive Remedy
(A conventional RI/FS is required.)
USE CONTAINMENT PRESUMPTIVE REMEDY
(A streamlined risk assessment and focused feasibility study are used.)

DECISION FRAMEWORK TO EVALUATE APPLICABILITY OF THE PRESUMPTIVE REMEDY TO MILITARY LANDFILLS

This Section and Highlight 4 describe the steps involved in determining whether the containment presumptive remedy applies to a specific military landfill.

1. What Information Should Be Collected? Determine the sources, types, and volumes of landfill wastes using historical records, state files, closure plans, available sampling data, etc. This information should be sufficient to determine whether source containment is the appropriate remedy for the landfill. If adequate data do not exist, it may be necessary to collect additional sampling or monitoring data. The installation point of contact (environmental coordinator, base civil engineer, or public works office) should be contacted to obtain records of disposal practices. Current and former employees are also good sources of information.

2. How May Land Reuse Plans Affect Remedy Selection? For smaller landfills (generally less than two acres), land reuse plans may influence the decision on the practicality of excavation and consolidation or treatment of landfill contents. Excavation is a remedial alternative that is fundamentally incompatible with the presumptive remedy of source containment.

3. Do Landfill Contents Meet Municipal Landfill-Type Waste Definition? To determine whether a specific military landfill is appropriate for application of the containment presumptive remedy, compare the characteristics of the wastes to the information in Highlights 2 and 3.

4. Are Military-Specific Wastes Present? Military wastes, especially high-hazard military wastes, may possess unique safety, risk, and toxicity characteristics. Highlight 3 presents examples of these types of materials. If historical records or sampling data indicate that these wastes may have been disposed at the site, special consideration should be given to their handling and remediation. Caution is warranted because site investigation or attempted treatment of these contaminants may pose safety issues for site workers and the community. Some high-hazard military-specific wastes could be considered to present low-level risk, depending on the location, volume, and concentration of these materials relative to environmental receptors. Consult specialists in military wastes (see Highlight 5) when determining whether military-specific wastes at a site fall into either the low-hazard or the high-hazard military-specific waste category found in Highlight 3.

Highlight 5

Specialists in Military Wastes

The installation point of contact will notify the major military command's specialists in military wastes (Explosive Ordnance Disposal Team) for assistance with regard to safety and disposal issues related to any type of military items.

Army chemical warfare agents specialists:

- Project Manager, Non-Stockpile Chemical Materiel, Aberdeen Proving Ground, Maryland 21010-5401, (410) 671-1083.

Navy ordnance related items specialists:

- The Navy Ordnance Environmental Support Office, Naval Surface Warfare Center, Indian Head, Maryland 20460-5035, (301) 743-4534/ 4906/4450.

Navy low-level radioactive wastes specialists:

- The Naval Sea Systems Command Detachment, Radiological Affairs Support Office, Yorktown, Virginia 23691-0260, (804) 887-4692.

Air Force ordnance specialists:

- The Air Force Civil Engineering Support Agency, Contingency Support Division, Tyndall AFB, Florida 32403-5319, (904) 283-6410.

Responsibilities for response are clearly spelled out in the regulation *Interservice Responsibilities For Explosive Ordnance Disposal.*

5. Is Excavation of Contents Practical? The volume of landfill contents, types of wastes, hydrogeology, and safety must be considered when assessing the practicality of excavation and consolidation or treatment of wastes. Consideration of excavation must balance the long-term benefits of lower operation and maintenance costs and unrestricted land use with the initial high capital construction costs and potential risks associated with excavation. Although no set excavation volume limit exists, landfills with a content of more than 100,000 cubic yards (approximately two acres, 30 feet deep) would normally not be considered for excavation. If military wastes are present, especially high-hazard military wastes such as ordnance, safety considerations may be very important in determining the practicality of excavation.

If excavation of the landfill contents is being considered as an alternative, the presumptive remedy should not be used. Therefore, a standard RI/FS would be required to adequately analyze and select the appropriate remedial actions.

6. Can the Presumptive Remedy Be Used? The site manager will make the initial decision of whether a particular military landfill site is suitable for the presumptive remedy or whether a more comprehensive RI/FS is required. This determination must be made before the RI/FS is initiated. This decision will depend on whether the site is a potential candidate for excavation, and if not, whether the nature of contamination is such that a streamlined risk evaluation can be conducted.* A site generally is eligible for a streamlined risk evaluation if groundwater contaminant concentrations clearly exceed chemical-specific standards or the Agency's level of risk or if other conditions exist that provide a justification for action (e.g., direct contact with landfill contents due to unstable slopes). If these conditions do not exist, a quantitative risk assessment that addresses all exposure pathways will be necessary to determine whether action is needed. Before work on the RI/FS workplan is initiated, the community and state should be notified that a presumptive remedy is being considered for the site. It is important for all stakeholders to understand completely how the presumptive remedy process varies from the usual clean-up process, and the benefits of using the presumptive remedy process.

TREATING "HOT SPOTS"

The presumptive remedy also allows for the treatment of hot spots containing military-specific (or other) waste. While the analysis, *Feasibility Study Analysis for CERCLA Municipal Landfill Sites,* that justified the selection of source containment as the presumptive remedy for municipal landfill sites did not specifically take into account high-hazard military wastes, the high-hazard materials present in some military landfills may be compared to the hazardous wastes at municipal landfills and could potentially be treated as hot spots. For further information and case studies on treatment of hot spots, see the *Presumptive Remedy for CERCLA Municipal Landfill Sites* directive.

CASE HISTORIES

The case histories below illustrate how use of the municipal landfill presumptive remedy at military landfills follows the decision framework in Highlight 4.

* See *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, which states that if MCLs or non-zero MCLGs are exceeded [a response] action generally is warranted.

The decision to use the presumptive remedy can be made for one landfill or as a part of a site-wide strategy (as in the Loring Air Force Base example below), depending on factors such as the nature of the wastes, size of the landfill, land reuse potential, and public acceptance.

The following case histories present examples of where the containment presumptive remedy was or was not applied, based on site-specific conditions.

Disposal of Municipal-Type Wastes

The **Naval Reactor Facility (NRF)** site in Idaho Falls, Idaho, was established in 1949 as a testing site for the nuclear propulsion program. The three landfill units at the site received solid wastes similar to municipal landfills. These wastes included petroleum and paint products, construction debris, and cafeteria wastes. Historical records do not indicate that any radioactive wastes were disposed of in these landfill units. The selected remedy for the landfills at the site included the installation of a 24-inch native soil cover designed to incorporate erosion control measures to reduce the effects from rain and wind. The remedy also provided for maintenance of the landfill covers, including subsidence correction and erosion control. Monitoring of the landfills will include sampling of soil gas to assess the effectiveness of the cover and sampling of the groundwater to ensure that the remedy remains protective. Institutional controls will also be implemented to prevent direct exposure to the landfill. The NRF site is an example of where the streamlining principles of the presumptive remedy process, including a streamlined risk assessment and a focused feasibility study, were successfully employed.

Co-Disposal of High-Hazard Wastes

At the **Massachusetts Military Reservation**, in Cape Cod, Massachusetts, anecdotal information indicated that munitions had been disposed of at an unidentified location in a landfill that primarily contained municipal-type waste. Ground penetrating radar was utilized to determine if there were any discrete disposal areas containing potential hot spots at this site and found none. Because the munitions waste was not in a known discrete and accessible area, it could not be treated as a hot spot. Consequently, without excavating or treating the munitions waste as a hot spot, the authorities decided to cap the landfill. In this case, the streamlining principles of the presumptive remedy process were applied. For example, site investigation was limited and treatment options were not considered.

Land Reuse Considerations

At **Loring Air Force Base**, a closing base in Limestone, Maine, base landfills 2 and 3 (9 and 17 acres, respectively) consisted primarily of municipal and flightline wastes. The selected remedy for these landfills included a multi-layer cap, passive venting system, and institutional controls. The RODs for the landfills, signed in September 1994, required placing a RCRA Subtitle C cap on the landfills. To construct the RCRA cap, the designers estimated that 400,000 to 600,000 cyds of material would have to be placed on the landfills prior to construction of the cap to ensure proper drainage and slopes.

At Loring, the streamlining principles of the containment remedy, a focused feasibility study, and a streamlined risk assessment were applied for landfills 2 and 3. Additionally, the RODs signed for these landfills specified that excavated material from other parts of the base would be used at the landfills to meet subgrade design specifications. To date, more than 500,000 cyds of contaminated soils have been excavated and used as subgrade for the landfills (after demonstrating compliance with RCRA Land Disposal Restrictions). In addition to cost savings realized by providing subgrade, other benefits have been realized, such as limiting the number of parcels requiring deed restrictions and minimizing locations requiring operation and maintenance. At this base, the landfill consolidation efforts resulted in an estimated total cost savings of $12–20 million while incorporating future land use considerations into the decision process.

The Brunswick Naval Air Station in Brunswick, Maine, contained several landfill sites. One of the first RODs signed, for Sites 1 and 3, called for construction of a 12-acre RCRA Subtitle C cap and a slurry wall, as well as for groundwater extraction and treatment. Subsequently, during the remedy selection process for Site 8, the public objected to containment as the proposed remedy for this relatively small (0.6 acre) site on the grounds that should the base eventually close, containment would create several useless parcels of land. After public comment, the Navy reconsidered, proposing instead to excavate Site 8 and consolidate the removed materials (which consisted of construction debris and soil contaminated with nonhazardous levels of polycyclic aromatic hydrocarbons) as part of the necessary subgrade fill for the landfill cap to be constructed at Sites 1 and 3. In this case, land reuse considerations preempted the selection of a containment remedy.

PRESUMPTIVE REMEDY ADMINISTRATIVE RECORD DOCUMENTATION REQUIREMENTS

As stated earlier, it must be determined whether the military landfill in question contains military-specific wastes, as described in Highlight 3. This should be followed by a determination of whether anything about these wastes would make the engineering controls specified in the presumptive remedy for municipal landfills less suitable at that site. These determinations must be documented in the administrative record, which supports the final decision. This information, in turn, will assist the public in understanding the evaluation of the site as a candidate for use of the presumptive remedy and the advantage it provides. For further reference, the administrative record requirements for all Superfund sites including military landfills are explained in the *Final Guidance on Administrative Records for Selecting CERCLA Response Actions.*

The administrative record must contain the following generic and site-specific information, which documents the selection or non-selection of the containment presumptive remedy.

Generic Information

A. **Generic Documents.** These documents should be placed in the docket for each federal facility site where the containment presumptive remedy is selected. Each EPA Regional Office has copies of the following presumptive remedy documents:

- *Presumptive Remedy: Policy and Procedures*
- *Presumptive Remedy for CERCLA Municipal Landfill Sites*
- *Application of the Municipal Landfill Presumptive Remedy to Military Landfills*
- *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*

B. **Notice Regarding Backup File.** The docket should include a notice specifying the location of and times when public access is available to the generic file of backup materials used in developing the *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*. This file contains background materials such as technical references and portions of the feasibility studies used in the generic study. Each EPA Regional Office has a copy of this file.

Site-specific Information

Focused FS or EE/CA. Military-specific wastes need to be addressed in site-specific analyses when determining the applicability of the containment presumptive remedy to military landfills. High-hazard military-specific waste materials (e.g., military munitions) require special consideration when applying the presumptive remedy.

As noted on pages 1 and 2 of this directive, the presumptive remedy approach allows you to streamline and focus the FS or EE/CA by eliminating the technology screening step from the feasibility study process. EPA has already conducted this step on a generic basis in the *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*. Thus, the FS analyzes only alternatives comprised of components of the containment remedy identified in Highlight 1. In addition, the focused FS or EE/CA should include a site-specific explanation of how the application of the presumptive remedy satisfies the National Contingency Plan's three site-specific remedy selection criteria (i.e., compliance with state applicable or relevant and appropriate requirements, state acceptance, and community acceptance).

CONCLUSION

This directive provides guidance for the use of the containment presumptive remedy at appropriate military landfills. The remedies selected at numerous military installations indicate that source containment is applicable to a significant number of military landfills. These landfills need not be identical to municipal landfills in all regards. Key factors determining whether the containment presumptive remedy should be applied to a specific military landfill include the size of the landfill; volume and the type of landfill contents; future land use of the area; and the presence, proportion, and distribution of military-specific wastes.

REFERENCES

California Base Closure Environmental Committee, *Integrating Land Use and Cleanup Planning at Closing Bases*, December 1994.

Federal Register, 1996. Volume 61, No. 85, May 1, 1996; *Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities, Advance Notice of Proposed Rulemaking.*

Federal Register, 1990. Volume 55, No. 145, July 27, 1990; 40 CFR Parts 264, 265, 270 and 271; *Corrective Action for Solid Waste Management Units at Hazardous Waste Facilities; Proposed* (proposed Subpart S regulations).

U.S. Environmental Protection Agency, OSWER Directive 93557-04, *Land Use in the CERCLA Remedy Selection*, May 25, 1995.

U.S. Environmental Protection Agency, OSWER Directive 9356.0-03, EPA/540/R-94/081, *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*, August 1994.

U.S. Environmental Protection Agency, OSWER Directive 9902.3-2A, EPA/520/R-94/004, *RCRA Corrective Action Plan*, May 1994.

U.S. Environmental Protection Agency, OSWER Directive 9355.0-49FS, *Presumptive Remedy for CERCLA Municipal Landfill Sites*, September 1993.

U.S. Environmental Protection Agency, OSWER Directive 9355.0-47FS, EPA/540/F-93/047, *Presumptive Remedy: Policy and Procedures*, September, 1993.

U.S. Environmental Protection Agency, OSWER Publication 9380.3-06FS, *Guide to Principal Threat and Low Level Threat Wastes*, November 1991.

U.S. Environmental Protection Agency, OSWER Directive 9355.0-30, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, April 22, 1991.

U.S. Environmental Protection Agency, OERR, EPA/540/P-91/001, *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*, February 1991.

U.S. Environmental Protection Agency, OSWER Directive 9833.3A.1, *Final Guidance on Administrative Records for Selecting CERCLA Response Actions*, December 3, 1990.

U.S. Environmental Protection Agency, OSWER Directive 9355.3-11FS, *Streamlining the RI/FS for CERCLA Municipal Landfill Sites*, September 1990.

U.S. Department of Navy, *Interservice Responsibilities for Explosive Ordnance Disposal* OPNAVINST 8027.1G (also known as MCO 8027.1D, AR 75-14; or AFR 32-3002), February 14, 1992.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Brunswick NAS, Sites 1 and 3 (OU1), ME, Region 1 6/16/92	Site 1, 8.5 acres; Site 3, 1.5 acres. Sites are in close proximity and not easily distinguishable; the combined volume of Sites 1 and 3 is 300,000 cy	Household refuse, waste oil, solvents, pesticides, paints, isopropyl alcohol	Metals, VOCs, PAHs, PCBs, pesticides	**Remedy:** Capping (permanent, low-permeability, RCRA Subtitle C cap), of 12 acres with a slurry wall and pump and treat ground water within cap and slurry wall.
Brunswick NAS, Sites 5 and 6 (OU3), ME, Region 1 8/31/93	Site 5, 0.25 acres, 12 cy	Asbestos-covered pipes	Asbestos	**Remedy:** Excavation, containerization, and transport to landfill Sites 1 and 3 for use as fill under cap.
Brunswick NAS, Sites 5 and 6 (OU3), ME, Region 1 8/31/93	Site 6, 1.0 acre, 8,800 - 18,700 cy	Construction debris, and aircraft parts, asbestos pipes	Asbestos	**Remedy:** Excavation, containerization, and transport to Sites 1 and 3 landfill for use as fill under cap.
Brunswick NAS, Site 8 (OU4), ME, Region 1 8/31/93	Site 8, 0.6 acres, 5,600 - 14,000 cy	Rubble, debris, trash, and possibly solvents	Metals, pesticides, PCBs[1]	**Remedy:** Excavation, containerization, and transport to landfill Sites 1 and 3 for use as fill under cap.
Loring AFB, Landfills 2 and 3 (OU2), ME, Region 1 9/30/94	Landfill 2, 9 acres	Domestic waste, construction debris, flightline wastes, sewage sludge and oil-filled switches	PCBs, VOCs, SVOCs, metals, DDT[1]	**Remedy:** Capping (low-permeability cover system which meets RCRA Subtitle C and Maine hazardous waste landfill cap requirements), passive gas venting system and controls, and institutional controls.
Loring AFB, Landfills 2 and 3 (OU2), ME, Region 1 9/30/94	Landfill 3, 17 acres	Waste oil/fuels, solvents, paints, thinners, and hydraulic fluids	VOCs, SVOCs, DDT, PCBs, metals[1]	**Remedy:** Capping (low-permeability cover system which meets RCRA Subtitle C and Maine hazardous waste landfill cap requirements), passive gas venting system and controls, and institutional controls.

[1] Contaminants of Potential Concern

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Newport Naval Education and Training Center, McAllister Point Landfill, RI, Region 1 9/27/93	McAllister Point Landfill, 11.5 acres	Domestic refuse, spent acids, paints, solvents, waste oils, and PCB-contaminated transformer oil	VOCs, PAHs, PCBs, pesticides, phenols, metals	**Remedy:** Capping (RCRA Subtitle C, multi-layer cap), landfill gas management, surface controls, and institutional controls.
Otis Air National Guard, Camp Edwards, Massachusetts Military Reservation, MA, Region 1 1/14/93	Landfill Number 1 (LF-1), 100 acres	General refuse, fuel tank sludge, herbicides, blank ammunition, paints, paint thinners, batteries, DDT, hospital wastes, sewage sludge, coal ash, possibly live ordnance	VOCs, SVOCs, inorganics	**Remedy:** Capping (composite-low-permeability cover system), institutional controls, soil cover inspection, and ground water monitoring.
Pease AFB (OU1), NH, Region 1 9/27/93	LF-5, 23 acres	Domestic and industrial wastes, waste oils and solvents, and industrial wastewater treatment plant sludge	VOCs, PAHs, arsenic and other metals	**Remedy:** Excavation, dewatering and consolidation and regrading of waste under a composite-barrier type cap, institutional controls, and extraction and treatment of ground water with discharge to base wastewater treatment facility.
Fort Dix Landfill Site, NJ, Region 2 9/24/91	Main area, 126 acres	Domestic waste, paints and paint thinners, demolition debris, ash, and solvents	VOCs, metals	**Remedy:** Capping 50-acre portion (New Jersey Administrative Code 7:26 closure plan for hazardous waste), installing gas venting system and an air monitoring system, ground water, surface water, and air monitoring, and institutional controls.
Naval Air Engineering Center (OU3), NJ, Region 2 9/16/91	Site 26, 1500 sq. ft., volume not reported	Oil, roofing materials, building debris	No contamination was detected	**Remedy:** Source: No action.
Naval Air Engineering Center (OU3), NJ, Region 2 9/16/91	Site 27, 6.4 acres	Scrap steel cable	No contamination was detected	**Remedy:** Source: No action.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Naval Air Engineering Center (OU17), NJ, Region 2 9/26/94	Site 29, 20 acres	Construction debris, metal, asbestos, solvents, other miscellaneous wastes	VOCs, SVOCs, metals	**Remedy:** Source: No action.
Plattsburgh AFB, LF-022, NY, Region 2 9/30/92	LF-022, approx. 13.7 acres, approx. 524,000 cy	Household refuse	Metals, pesticides	**Remedy:** Capping (NY State requirements for solid waste landfills, 12 inch soil cap), and institutional controls.
Plattsburgh AFB, LF-023, NY, Region 2 9/30/92	LF-023, approx. 9 acres, approx. 406,000 cy	Household refuse, debris, car parts	Metals, VOCs, SVOCs, PCB, pesticides	**Remedy:** Capping (NY State requirements for solid waste landfills, low permeability cap), and institutional controls.
U.S. Army Aberdeen Proving Grounds (OU 1), MD, Region 3 6/30/92	Michaelsville Landfill, 20 acres, greater than 100,000 cy	Household refuse, limited quantities of industrial waste, burned sludges, pesticide containers, paint, asbestos shingles, solvents, waste motor oils, grease, PCB transformer oils, possible pesticides	Metals, pesticides, VOCs, PCBs, PAHs	**Remedy:** Capping (multi-layer cap in accordance with MDE requirements for sanitary landfills, using a geosynthetic membrane, 0-2 feet compacted earth material), surface water controls, and gas venting system.
Marine Corps Base, Camp Lejeune (OU1), NC, Region 4 9/15/94	Site 24, 100 acres, volume not reported	Fly ash, cinders, solvents, used paint stripping compounds, sewage sludge, spiractor sludge, construction debris	Pesticides, metals, SVOCs, PCBs	**Remedy:** Source: No action.
Robins AFB (OU1), GA, Region 4 6/25/91	Main area (Landfill No. 4), 45 acres, greater than 100,000 cy	Household refuse, industrial waste	VOCs, metals	**Remedy:** Capping (to maintain a minimum 2-foot cover over the waste materials), renovation of current soil cover including clearing, filling, regrading, adding soil and clay cover material and seeding to maintain a minimum 2-foot cover over the waste material.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Twin Cities AFB Reserve, MN, Region 5 3/31/92	Main area, approx. 2 acres, volume not reported	Household refuse, small amounts of industrial; *some burned waste*	VOCs, metals	**Remedy:** Source: Institutional controls, natural attenuation, ground water and surface water monitoring.
Wright-Patterson AFB, (*Source Control Operable* Unit) OH, Region 5 7/15/93	LF-8, 11 acres, 187,300 cy	General refuse and hazardous materials	PAHs, pesticides, PCBs, VOCs, metals, inorganics	**Remedy:** Capping (low-permeability clay cap that complies with Ohio EPA regulations for sanitary landfills which meet or exceed RCRA Subtitle D requirements), institutional controls, ground water treatment and monitoring.
Wright-Patterson AFB, (Source Control Operable Unit) OH, Region 5 7/15/93	LF-10, 8 acres, 171,600 cy	General refuse and hazardous materials	PAHs, pesticides, PCBs, VOCs, metals, inorganics	**Remedy:** Capping (low-permeability clay cap that complies with Ohio EPA regulations for sanitary landfills which meet or exceed RCRA Subtitle D requirements), institutional controls, ground water treatment and monitoring.
Hill AFB (OU4), UT, Region 8 6/14/94	Landfill 1, 3.5 acres, 140,000 cy	Burned solid waste, small amounts of waste oils and solvents (from vehicle maintenance facility).	VOCs (TCE)	**Remedy:** Capping (clay or multi-media cap), pumping, treating, and discharging ground water to POTW, treating contaminated surface water, soil vapor extraction, implementing institutional controls and access restrictions.
Defense Depot, Ogden (OU1), UT, Region 8 6/26/92	Plain City Canal Backfill Area, 4,000 cy	Electrical wire, glass, ash, charcoal, asphalt, wood, concrete, plastic and metal fragments	Metals, PCBs, dioxins, furans, VOCs	**Remedy:** Excavation, sorting, and off-site disposal in a RCRA permitted facility.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Chemical Warfare Agent Identification Kit Burial Area, 100 cy	Vials of chemical surety agents, broken glass	Metals, chemical warfare agents	**Remedy:** Excavation, sorting, and off-site disposal in a RCRA permitted facility.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Riot Control and Smoke Grenade Burial Area, 90 cy	Unfused grenades and grenade fragments, as well as riot control grenades	No contaminants identified	**Remedy:** Excavation, sorting, and off-site disposal in a RCRA permitted facility.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Compressed Gas Cylinder Reburial Area	Two compressed gas cylinders and four smaller steel tanks removed from the Chemical Warfare Agent Identification Kit and Riot Control and Smoke Grenade burial areas	Unknown, possible chemical warfare agents	**Remedy:** Excavation of compressed gas cylinders and disposal by a commercial operator.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Miscellaneous Items Burial Area, 230 cy	Chemical Warfare Agent Identification Kits containing no CWAs, World War II gas mask canisters, paint, broken glass, wooden boxes, and pieces of iron	No contaminants identified	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted hazardous waste landfill.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Water Purification Tablet Burial Area, 110 cy	Bottles containing halazone water purification tablets	No contaminants identified	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted industrial waste landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-A, 7500, sq. ft., 3000 cy	Wood, crating materials, paper, greases, debris, medical waste, oils, some burned waste	Pesticides, VOCs, PCBs	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted hazardous waste landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-B, (inside 4-E), less than 7,500, sq. ft.	Fluorescent tubes	No contaminants identified	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-C, 6,000 sq. ft	Food products, sanitary landfill waste	Pesticides, VOCs, PCBs	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted landfill.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-D, 2,000 sq. ft.	Methyl bromide cylinders, halazone tablets (jars)	Possibly methyl bromide	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted industrial landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-E, 7,500 sq. ft., volume not reported	Oils, spent solvents, industrial waste	PCBs, VOCs, pesticides	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted hazardous landfill.
Rocky Mountain Arsenal, Shell Section 36 Trenches (OU23), CO, Region 8 5/3/90	Shell Trench Area, 8 acres	Rags, plastic and metal cans, glass jars, piping, pipe fittings, insulation, refuse, insulation, liquid and solid wastes generated from the manufacture of pesticides	VOCs, SVOCs, pesticides[2]	**Remedy:** Capping (physical barrier with a soil and vegetative cover).
Fort Ord Landfills (OU2), CA, Region 9 8/23/94	Landfills, 150 acres	Household and commercial refuse, dried sewage sludge, construction debris, small amounts of chemical waste including paint, oil, pesticides, and epoxy adhesive, electrical equipment	VOCs	**Remedy:** Capping (California Code of Regulations for non-hazardous waste), institutional controls, extraction, treatment, and recharge of ground water.
Riverbank Army Ammunition Plant Site, CA, Region 9 3/24/94	Landfill, 4.5 acres	Paper, oils, greases, solvents, hospital wastes, construction debris, and industrial sludges	Metals	**Remedy:** Capping (a multi-layer cap as specified in Dispute Resolution Agreement), pump and treat ground water, discharge treated water to on-site ponds.

[2] Contaminants identified as emanating from the trenches but not contaminants of concern

DATA SUMMARY TABLE FOR MILITARY LANDFILLS APPENDIX (CONT.)

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Williams AFB (OU1), AZ, Region 9 5/18/94	Landfill LF-04, 90 acres, 59,000 cy	Dried sewage sludge, domestic trash and garbage, wood, metal, brush, construction debris, some solvents and chemicals	Soil, pesticides, SVOCs, inorganics, including beryllium, lead, zinc	**Remedy:** Capping (a permeable cap with a 24 inch soil cover), stormwater runoff controls, institutional actions, and soil and ground water monitoring.
Williams AFB (OU1), AZ, Region 9 5/18/94	Pesticide Burial Area (DP-13), 0.4 acre	Pesticides	Pesticides, VOCs, metals	**Remedy:** Source: No action.
Williams AFB (OU1), AZ, Region 9 5/18/94	Radioactive Instrumentation Burial Area (RW-11), 100 sq. ft.	Cement; radioactive instruments	Radium (background levels)	**Remedy:** Source: No action.
Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF05, 17 acres	General refuse, scrap metal, used chemicals and other scrap material	VOCs, PCBs, metals, PAHs	**Remedy:** Source: No action.
Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF07, 35 acres	Base generated refuse, scrap metal, construction rubble, drums of asphalt, empty pesticide containers, small amounts of shop wastes, and asbestos wastes	VOCs, PCBs, metals, PAHs	**Remedy:** Source: No action.
Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF13, 2 acres	Empty drums, metal piping, drums of asphalt, and small quantities of quicklime	VOCs, PCBs, metals, PAHs	**Remedy:** Source: No action.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF59, 2 landfills (.5 acres each)	General refuse and construction debris, and tar seep	VOCs, PCBs, metals, PAHs	**Remedy**: Source: No action.
Fairchild AFB (OU1), WA, Region 10 2/13/93	Southwest area, 12.6 acres, 407,300 cy	Coal ash, solvents, dry cleaning filters, paints, thinners, possibly electrical transformers.	VOCs	**Remedy**: Capping (low-permeability cap designed to meet the closure requirements of Washington State's Minimum Functional Standards for Solid Waste handling and of federal RCRA Subtitle D), SVE/ treatment system, extracting contaminated ground water and treating by air stripping and granular activated carbon, disposal off-site, monitoring off-site water supply wells.
Fairchild AFB (OU1), WA, Region 10 2/13/93	Northeast area, 6 acres, 291,000 cy	Coal ash, solvents, dry cleaning filters, paints, thinners, possibly electrical transformers.	VOCs	**Remedy**: Capping (low-permeability cap designed to meet the closure requirements of Washington State's Minimum Functional Standards for Solid Waste handling and of federal RCRA Subtitle D), SVE/ treatment system, extracting contaminated ground water and treating by air stripping and granular activated carbon, disposal off-site, monitoring off-site water supply wells.
Fort Lewis Military Reservation, Landfill 4 and the Solvent Refined Coal Pilot Plant, WA, Region 10 9/24/93	LF4, 52 acres	Domestic and light industrial solid waste (no landfill records were maintained).	VOCs, metals	**Remedy**: Source: Institutional controls, treat ground water and soil using SVE and air sparging system.
Naval Air Station, Whidbey Island, Ault Field (OU1), WA, Region 10 12/20/93	Area 6 Landfill, 40 acres. Within Area 6 there are 2 distinct areas where wastes were disposed.	Household waste, construction debris, and yard waste	VOCs	**Remedy**: Capping (low-permeability cap to meet Washington State Minimum Functional Standards for non-hazardous closure), air stripping ground water, ground water monitoring, and institutional controls.
Naval Air Station, Whidbey Island, Ault Field (OU2), WA, Region 10 12/20/93	Area 2, 13 acres; Area 3, 1.5 acres. Both treated together due to close proximity.	Solid waste from the base, industrial wastes, and construction and demolition debris	Metals, PAHs	**Remedy**: Source: Institutional controls, ground water monitoring.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Naval Reactor Facility, ID, Region 10 9/27/94	Landfill Unit 8-05-1, (350 ft. by 450 ft. by 4-25 ft.)	Construction debris, small quantities of paints, solvents, cafeteria wastes, and petroleum products	Metals, VOCs	**Remedy:** Capping (24-inch native soil cover), institutional controls.
Naval Reactor Facility, ID, Region 10 9/27/94	Landfill Unit 8-05-51, (450 ft. by 100 -175 ft. by 10-15 ft.)	Construction debris, small quantities of paints, solvents, cafeteria wastes, and petroleum products	Metals, VOCs	**Remedy:** Capping (24-inch native soil cover), institutional controls.
Naval Reactor Facility, ID, Region 10 9/27/94	Landfill Unit 8-06-53, (900 ft. by 1200 ft. by 7- 10 ft.)	Construction debris, small quantities of paints, solvents, cafeteria wastes, and petroleum products	Metals, VOCs	**Remedy:** Capping (24-inch native soil cover), institutional controls.

United States
Environmental Protection
Agency
Washington, D.C. 20460

APPENDIX B

REMEDIAL ALTERNATIVE COST ESTIMATES

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI
Site 1 FS
Alternative 2: Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/Culvert Cleanout and Sediment Removal, LUCs and Groundwater Monitoring
Capital Cost

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Construction/Work Plans	100	hr			$38.00		$0	$0	$3,800	$0	$3,800
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	2	ea			$170.00	$522.00	$0	$0	$340	$1,044	$1,384
3 FIELD SUPPORT											
3.1 Office Trailer	1	mo				$375.00	$0	$0	$0	$375	$375
3.2 Field Office Equipment, Utilities, & Support	1	mo		$470.00			$0	$470	$0	$0	$470
3.3 Storage Trailer	1	mo				$99.00	$0	$0	$0	$99	$99
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	$1,250.00				$1,250	$0	$0	$0	$1,250
3.5 Construction Layout Survey	1	day	$1,675.00				$1,675	$0	$0	$0	$1,675
3.6 Site Superintendent	15	day		$135.00	$390.00		$0	$2,025	$5,850	$0	$7,875
3.7 Site Health & Safety and QA/QC	15	day		$135.00	$360.00		$0	$2,025	$5,400	$0	$7,425
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	2,000	gal		$0.20			$0	$400	$0	$0	$400
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$781.00	$0	$0	$0	$781	$781
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$706.00	$0	$0	$0	$706	$706
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$950.00				$950	$0	$0	$0	$950
5 EXCAVATION AND FILL											
5.1 Dozer, 140 hp	8	day			$340.40	$682.00	$0	$0	$2,723	$5,456	$8,179
5.2 Front End Loader, 3 to 4.5 cy	0	day			$340.40	$541.00	$0	$0	$0	$0	$0
5.3 Compactor, 125 h.p. (2 each)	5	day			$340.40	$594.90	$0	$0	$1,702	$2,975	$4,677
5.4 Site Labor, (3 laborers)	8	day			$252.80		$0	$0	$2,022	$0	$2,022
5.5 Off Site Soil Disposal, Non-Hazardous	165	ton	$35.00				$5,775	$0	$0	$0	$5,775
5.6 Characterization/Offsite Disposal Soil Testing	2	ea	$1,000.00	$20.00			$2,000	$40	$0	$0	$2,040
5.7 Confirmatory Sampling, (72 hr TAT)	5	ea	$480.00	$10.00			$2,400	$50	$0	$0	$2,450
5.8 Select Fill	118	cy		$15.00			$0	$1,770	$0	$0	$1,770
5.9 Topsoil, loam (6 in)	30	cy		$22.42			$0	$673	$0	$0	$673
6 PIPE AND DITCH CLEANOUT											
6.1 Upper Layer, sand/gravel	0	cy		$8.50			$0	$0	$0	$0	$0
6.2 Dozer, 140 hp	0	day			$340.40	$682.00	$0	$0	$0	$0	$0
6.3 Compactor, 125 h.p. (2 each)	0	day			$340.40	$594.90	$0	$0	$0	$0	$0
6.4 Site Labor, (3 laborers)	3	day			$252.80		$0	$0	$758	$0	$758
6.5 Cleanout concrete pipe/culverts	1	ls	$12,000.00				$12,000	$0	$0	$0	$12,000
6.6 Cleanout drainage ditches/sediment removal	1	ls	$8,000.00				$8,000	$0	$0	$0	$8,000
7 MONITORING WELL INSTALLATION											
7.1 Well Installation (6 wells)	90	lf	$80.00				$7,200	$0	$0	$0	$7,200
7.2 Well Development	24	hr	$200.00				$4,800	$0	$0	$0	$4,800
7.3 Protective Well Casing & Apron	6	ea	$750.00				$4,500	$0	$0	$0	$4,500
7.4 Abandon Wells (10 wells)	150	lf	$12.50				$1,875	$0	$0	$0	$1,875
7.5 IDW Transport & Disposal, solid non-haz	4	drum	$195.00				$780	$0	$0	$0	$780
7.6 IDW Transport & Disposal, liquid non-haz	4	drum	$185.00				$740	$0	$0	$0	$740
8 POST CONSTRUCTION COST											
8.1 Contractor Completion Report	60	hr			$38.00		$0	$0	$2,280	$0	$2,280
8.2 Remedial Action Closeout Report	80	hr			$38.00		$0	$0	$3,040	$0	$3,040
8.3 Prepare LUC Document	120	hr			$38.00		$0	$0	$4,560	$0	$4,560
8.4 LUC Survey Support	2	day	$1,675.00				$3,350	$0	$0	$0	$3,350
Subtotal							$57,295	$11,173	$36,721	$16,786	$121,974
Local Area Adjustments							100.0%	103.7%	89.6%	89.6%	
Subtotal							$57,295	$11,586	$32,902	$15,040	$116,823
Overhead on Labor Cost @ 30%									$9,871		$9,871
G & A on Labor, Material, Equipment, & Sub Cost @ 10%							$5,730	$1,159	$3,290	$1,504	$11,682
Tax on Materials and Equipment Cost @ 7%								$811		$1,053	$1,864
Total Direct Cost							$63,025	$13,556	$46,063	$17,597	$140,240
Indirects on Total Direct Cost @ 25%											$35,060
Profit on Total Direct Cost @ 10%											$14,024
Subtotal											$189,323
Health & Safety Monitoring @ 2%											$3,786
Total Field Cost											$193,110
Contingency on Total Field Costs @ 25%											$48,277
Engineering on Total Field Cost @ 5%											$9,655
TOTAL CAPITAL COST											**$251,043**

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI
Site 1 FS

Alternative 2: Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/Culvert Cleanout and Sediment Removal, LUCs and Groundwater Monitoring

Annual Cost

Item	Item Cost year 1	Item Cost years 2 & 3	Item Cost years 4 to 30	Item Cost every 5 years	Notes
Site Inspection & Report	$2,350	$2,350	$2,350		Labor and supplies once a year to inspect Land Use Controls with
Cover Inspection	$3,100	$3,100	$3,100		Visit to inspect cover twice a year
Cover Maintenance	$20,000	$20,000	$20,000		Cut (mow) cover 20 times a year
Cover Repair	$0	$0		$0	Cover repair in years 1, 2, 3, 5, 10,15, 20, 25, & 30
Sampling	$35,000	$17,500	$8,750		Labor and supplies to collect samples from wells using a crew of two.
Analysis/Water	$18,480	$9,240	$4,620		Analyze groundwater samples from 12 wells for VOCs and metals in years 1 through 30. Collect samples 4 times a year in year 1, twice a year in years 2 & 3, and once a year for years 4 through 30.
Report	$6,000	$3,000	$1,500		Document sampling & results
Five Year Site Review				$15,000	Labor and supplies to evaluate site every five years for 5-year review
Subtotal	$84,930	$55,190	$40,320	$15,000	
Contingency @ 10%	$8,493	$5,519	$4,032	$1,500	
TOTAL	$93,423	$60,709	$44,352	$16,500	

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI
Site 1 FS
Alternative 2: Focused Excavation, Maintaining Existing Soil Cover, Strom Water Drainage Pipe/Culvert Cleanout and Sediment Removal, LUCs and Groundwater Monitoring

Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$251,043		$251,043	1.000	$251,043
1		$93,423	$93,423	0.935	$87,351
2		$60,709	$60,709	0.873	$52,999
3		$60,709	$60,709	0.816	$49,539
4		$44,352	$44,352	0.763	$33,841
5		$60,852	$60,852	0.713	$43,387
6		$44,352	$44,352	0.666	$29,538
7		$44,352	$44,352	0.623	$27,631
8		$44,352	$44,352	0.582	$25,813
9		$44,352	$44,352	0.544	$24,127
10		$60,852	$60,852	0.508	$30,913
11		$44,352	$44,352	0.475	$21,067
12		$44,352	$44,352	0.444	$19,692
13		$44,352	$44,352	0.415	$18,406
14		$44,352	$44,352	0.388	$17,209
15		$60,852	$60,852	0.362	$22,028
16		$44,352	$44,352	0.339	$15,035
17		$44,352	$44,352	0.317	$14,060
18		$44,352	$44,352	0.296	$13,128
19		$44,352	$44,352	0.277	$12,286
20		$60,852	$60,852	0.258	$15,700
21		$44,352	$44,352	0.242	$10,733
22		$44,352	$44,352	0.226	$10,024
23		$44,352	$44,352	0.211	$9,358
24		$44,352	$44,352	0.197	$8,737
25		$60,852	$60,852	0.184	$11,197
26		$44,352	$44,352	0.172	$7,629
27		$44,352	$44,352	0.161	$7,141
28		$44,352	$44,352	0.15	$6,653
29		$44,352	$44,352	0.141	$6,254
30		$60,852	$60,852	0.131	$7,972
				TOTAL PRESENT WORTH	**$910,489**

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI
Site 1 FS
Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Management, and Long-Term Groundwater Monitoring
Capital Cost

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Construction/Work Plans	300	hr			$38.00		$0	$0	$11,400	$0	$11,400
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	12	ea			$170.00	$522.00	$0	$0	$2,040	$6,264	$8,304
3 FIELD SUPPORT											
3.1 Office Trailer	6	mo				$375.00	$0	$0	$0	$2,250	$2,250
3.2 Field Office Equipment, Utilities, & Support	6	mo		$470.00			$0	$2,820	$0	$0	$2,820
3.3 Storage Trailer	6	mo				$99.00	$0	$0	$0	$594	$594
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	$1,250.00				$1,250	$0	$0	$0	$1,250
3.5 Construction Layout Survey	4	day	$1,675.00				$6,700	$0	$0	$0	$6,700
3.6 Site Superintendent	120	day		$135.00	$390.00		$0	$16,200	$46,800	$0	$63,000
3.7 Site Health & Safety and QA/QC	120	day		$135.00	$360.00		$0	$16,200	$43,200	$0	$59,400
4 DECONTAMINATION											
4.1 Decontamination Services	6	mo		$1,220.00	$2,245.00	$1,550.00	$0	$7,320	$13,470	$9,300	$30,090
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	10,000	gal		$0.20			$0	$2,000	$0	$0	$2,000
4.4 Decon Water Storage Tank, 6,000 gallon	6	mo				$781.00	$0	$0	$0	$4,686	$4,686
4.5 Clean Water Storage Tank, 4,000 gallon	6	mo				$706.00	$0	$0	$0	$4,236	$4,236
4.6 Disposal of Decon Waste (liquid & solid)	6	mo	$950.00				$5,700	$0	$0	$0	$5,700
5 EXCAVATION AND GAS MANAGEMENT LAYER											
5.1 Dozer, 140 hp	60	day			$340.40	$682.00	$0	$0	$20,424	$40,920	$61,344
5.2 Front End Loader, 3 to 4.5 cy	60	day			$340.40	$541.00	$0	$0	$20,424	$32,460	$52,884
5.3 Compactor, 125 h.p. (2 each)	80	day			$340.40	$594.90	$0	$0	$27,232	$47,592	$74,824
5.4 Site Labor, (3 laborers)	90	day			$252.80		$0	$0	$22,752	$0	$22,752
5.5 Ditch Dredging, Gradall	20	day			$340.40	$958.80	$0	$0	$6,808	$19,176	$25,984
5.6 Site Labor, (3 laborers)	40	day			$252.80		$0	$0	$10,112	$0	$10,112
5.7 Grading Layer, sand/gravel	15,185	cy		$13.50			$0	$204,998	$0	$0	$204,998
5.8 Geotextile	45,600	sy	$1.52				$69,312	$0	$0	$0	$69,312
5.9 Vent Layer, sand/gravel	7,600	cy		$13.50			$0	$102,600	$0	$0	$102,600
5.10 Gas Vent Pipes, 4" dia. perforated PE	6,000	lf		$0.78			$0	$4,680	$0	$0	$4,680
5.11 Gas Vent Pipes, 6" dia. header PE	700	lf		$1.78			$0	$1,246	$0	$0	$1,246
5.12 Trench for Pipe	12	day				$59.60	$0	$0	$0	$715	$715
5.13 Dozer, 140 hp	20	day			$340.40	$682.00	$0	$0	$6,808	$13,640	$20,448
5.14 Compactor, 125 h.p. (2 each)	30	day			$340.40	$594.90	$0	$0	$10,212	$17,847	$28,059
5.15 Site Labor, (3 laborers)	40	day			$252.80		$0	$0	$10,112	$0	$10,112
5.16 Geosynthetic Clay Liner, GCL	410,000	sf	$1.08				$442,800	$0	$0	$0	$442,800
6 COVER AND SITE RESTORATION											
6.1 Upper Layer, sand/gravel	15,185	cy		$13.50			$0	$204,998	$0	$0	$204,998
6.2 Dozer, 140 hp (2 each)	30	day			$340.40	$682.00	$0	$0	$10,212	$20,460	$30,672
6.3 Compactor, 125 h.p. (2 each)	30	day			$340.40	$594.90	$0	$0	$10,212	$17,847	$28,059
6.4 Site Labor, (3 laborers)	40	day			$252.80		$0	$0	$10,112	$0	$10,112
6.5 Topsoil, loam (6 in)	7,600	cy		$27.42			$0	$208,392	$0	$0	$208,392
6.6 Dozer, 140 hp (2 each)	20	day			$340.40	$682.00	$0	$0	$6,808	$13,640	$20,448
6.7 Site Labor, (3 laborers)	25	day			$252.80		$0	$0	$6,320	$0	$6,320
6.8 Seeding Disturbed Areas	410	msf	$76.55				$31,386	$0	$0	$0	$31,386
6.9 Ditch Lining, riprap/concrete	1,500	sy		$69.50	$24.00	$9.85	$0	$104,250	$36,000	$14,775	$155,025
7 MONITORING WELL INSTALLATION											
7.1 Well Installation (6 wells)	90	lf	$80.00				$7,200	$0	$0	$0	$7,200
7.2 Well Development	24	hr	$200.00				$4,800	$0	$0	$0	$4,800
7.3 Protective Well Casing & Apron	6	ea	$750.00				$4,500	$0	$0	$0	$4,500
7.4 Abandon Wells (10 wells)	150	lf	$12.50				$1,875	$0	$0	$0	$1,875
7.5 IDW Transport & Disposal, solid non-haz	8	drum	$195.00				$1,560	$0	$0	$0	$1,560
7.6 IDW Transport & Disposal, liquid non-haz	8	drum	$185.00				$1,480	$0	$0	$0	$1,480
8 POST CONSTRUCTION COST											
8.1 Contractor Completion Report	150	hr			$38.00		$0	$0	$5,700	$0	$5,700
8.2 Remedial Action Closeout Report	200	hr			$38.00		$0	$0	$7,600	$0	$7,600
8.3 Prepare LUC Document	150	hr			$38.00		$0	$0	$5,700	$0	$5,700
8.4 LUC Survey Support	2	day	$1,675.00				$3,350	$0	$0	$0	$3,350
Subtotal							$581,913	$878,203	$352,458	$270,202	$2,082,776
Local Area Adjustments							100.0%	103.7%	89.6%	89.6%	
Subtotal							$581,913	$910,697	$315,802	$242,101	$2,050,513
Overhead on Labor Cost @ 30%									$94,741		$94,741
G & A on Labor, Material, Equipment, & Sub Cost @ 10%							$58,191	$91,070	$31,580	$24,210	$205,051
Tax on Materials and Equipment Cost @ 7%								$63,749		$16,947	$80,696
Total Direct Cost							$640,104	$1,065,515	$442,123	$283,258	$2,431,000
Indirects on Total Direct Cost @ 25%											$607,750
Profit on Total Direct Cost @ 10%											$243,100
Subtotal											$3,281,850
Health & Safety Monitoring @ 2%											$65,637
Total Field Cost											$3,347,487
Contingency on Total Field Costs @ 25%											$836,872
Engineering on Total Field Cost @ 5%											$167,374
TOTAL CAPITAL COST											**$4,351,734**

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI
Site 1 FS
Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Management, and Long-Term Groundwater Monitoring
Annual Cost

Item	Item Cost year 1	Item Cost years 2 & 3	Item Cost years 4 to 30	Item Cost every 5 years	Notes
Site Inspection & Report	$2,350	$2,350	$2,350		Labor and supplies once a year to inspect Land Use Controls with
Cover Inspection	$3,100	$3,100	$3,100		Visit to inspect cover twice a year
Cover Maintenance	$20,000	$20,000	$20,000		Cut (mow) cover 20 times a year
Cover Repair	$6,500	$6,500		$6,500	Cover repair in years 1, 2, 3, 5, 10,15, 20, 25, & 30
Sampling	$35,000	$17,500	$8,750		Labor and supplies to collect samples from wells using a crew of two.
Analysis/Water	$18,480	$9,240	$4,620		Analyze groundwater samples from 12 wells for VOCs and metals in years 1 through 30. Collect samples 4 times a year in year 1, twice a year in years 2 & 3, and once a year for years 4 through 30.
Report	$6,000	$3,000	$1,500		Document sampling & results
Five Year Site Review				$23,000	Labor and supplies to evaluate site every five years for 5-year review
Subtotal	$91,430	$61,690	$40,320	$29,500	
Contingency @ 10%	$9,143	$6,169	$4,032	$2,950	
TOTAL	$100,573	$67,859	$44,352	$32,450	

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI
Site 1 FS
Alternative 3: Low Permeability Cap, LUCs, Landfill Gas Management, and Long-Term Groundwater Monitoring

Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$4,351,734		$4,351,734	1.000	$4,351,734
1		$100,573	$100,573	0.935	$94,036
2		$67,859	$67,859	0.873	$59,241
3		$67,859	$67,859	0.816	$55,373
4		$44,352	$44,352	0.763	$33,841
5		$76,802	$76,802	0.713	$54,760
6		$44,352	$44,352	0.666	$29,538
7		$44,352	$44,352	0.623	$27,631
8		$44,352	$44,352	0.582	$25,813
9		$44,352	$44,352	0.544	$24,127
10		$76,802	$76,802	0.508	$39,015
11		$44,352	$44,352	0.475	$21,067
12		$44,352	$44,352	0.444	$19,692
13		$44,352	$44,352	0.415	$18,406
14		$44,352	$44,352	0.388	$17,209
15		$76,802	$76,802	0.362	$27,802
16		$44,352	$44,352	0.339	$15,035
17		$44,352	$44,352	0.317	$14,060
18		$44,352	$44,352	0.296	$13,128
19		$44,352	$44,352	0.277	$12,286
20		$76,802	$76,802	0.258	$19,815
21		$44,352	$44,352	0.242	$10,733
22		$44,352	$44,352	0.226	$10,024
23		$44,352	$44,352	0.211	$9,358
24		$44,352	$44,352	0.197	$8,737
25		$76,802	$76,802	0.184	$14,132
26		$44,352	$44,352	0.172	$7,629
27		$44,352	$44,352	0.161	$7,141
28		$44,352	$44,352	0.15	$6,653
29		$44,352	$44,352	0.141	$6,254
30		$76,802	$76,802	0.131	$10,061
			TOTAL PRESENT WORTH		**$5,064,330**

CLIENT:	**NCBC GULFPORT**	JOB NUMBER:	112G00700 11.110
SUBJECT:	Site 1 FS		
BASED ON:		DRAWING NUMBER:	
BY: MJ Date: 10/12	CHECKED BY: Date:	APPROVED BY:	DATE:

For Alternatives 2 and 3:

Annual Costs

Yearly Site Inspection/Visit for LUCs Implementation (1 person)

Assume out of town travel to site.

Air	$400	
Car	$100	
Hours	$900	(12 hours * $75/hr)
Misc	$150	
	$1,550	

Report: Document site visit $800

Total Site Inspection and Report = $2,350

Semi-Annual Cover Inspection & Report (1 person)

Car, 2 days	$200	
Hours	$2,600	(40 hours * $65/hr)
Misc	$300	
	$3,100	

Cover Maintenance

Mowing

assume $1,000 per 20 times a year $20,000

Sampling

Labor & Materials, per round (2 wells per day: 12 wells)

Assume 6 days to sample with 2 people, local

2 people @ $60.00 per hour for 10 hours per day for 6 days =	$7,200
car for 4 days =	$600
IDW Disposal =	$500
Misc supplies, copying, etc. =	$450
	$8,750

Analytical, per round for 30 years

Collect water samples from wells and analyze for VOCs and metals:

type	cost each	number	total
VOCs	$150	12	$1,800
metals	$125	12	$1,500
			$3,300
		40% QA/QC & Data Validation	$1,320
			$4,620

Sampling Report - assume $1,500 per round $1,500

5-year review

Site Visit and 5-year Review Report $23,000