FEASIBILITY STUDY SITE 2 NORTHWEST OPEN DISPOSAL AREA NAS WHITING FIELD FL

12/1/1998

HARDING LAWSON ASSOCIATES

FEASIBILITY STUDY

SITE 2, NORTHWEST OPEN DISPOSAL AREA

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

UNIT IDENTIFICATION CODE: N60508
CONTRACT NO.: N62467-89-D-0317/116

DECEMBER 1998

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
29418

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Unit Identification Code: N60508

Contract No.: N62467-89-D-0317/116

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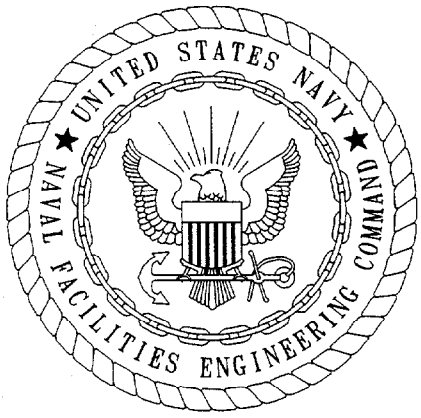
December 1998



CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/116 are complete and accurate and comply with all requirements of this contract.

DATE: December 31, 1998

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NAME AND TITLE OF CERTIFYING OFFICIAL: F. Joseph Ullo, P.E.
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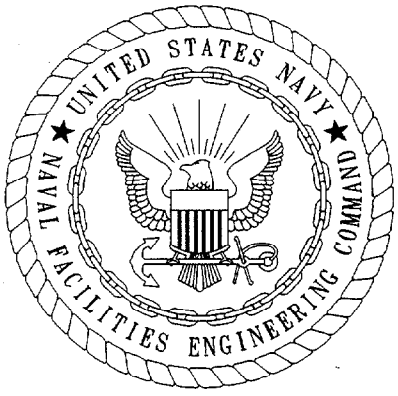
(DFAR 252.227-7036)



The engineering evaluations and professional opinions rendered in this planning document describing the feasibility study for Site 2, Northwest Open Disposal Area, Naval Air Station Whiting Field, Milton, Florida, were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document is not intended to be used for construction of the selected alternative.

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FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, and/or disposal of hazardous materials. Through accidental spills or leaks or as a result of and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by current standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at their facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act, and the Hazardous and Solid Waste Amendments of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private sector and Federal facilities. The CERCLA and SARA form the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Naval Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IR program.

The IR program is conducted in several stages as follows:

- preliminary assessment (PA),
- site inspection (SI) (formerly the PA and SI steps were called the initial assessment study under the NACIP program),
- remedial investigation and feasibility study, and
- remedial design and remedial action.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection (formerly Florida Department of Environmental Regulation) oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. All aspects of the program are conducted in compliance with State and Federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1859, at (843) 820-5574.

EXECUTIVE SUMMARY

Harding Lawson Associates (HLA) has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command to complete a feasibility study (FS) for Site 2, Northwest Open Disposal Area, at Naval Air Station (NAS) Whiting Field, Milton, Florida. The FS report is being completed under contract number N62467-89-D-0317-116. The FS report for Site 2 is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (HLA, 1998a) and Remedial Investigation (RI) report (HLA, 1998b) to present the results of the overall RI/FS for the site. This FS report includes the development, screening, and evaluation of potential remedial alternatives that address contaminated media at Site 2.

Site 2 is a 12-acre parcel of land located along the northwestern facility boundary of NAS Whiting Field. The site is a former disposal site that received wood debris, pallets, asphalt rubble, sheet metal, tires, furniture, and crushed paint cans. These disposal activities occurred at the site from 1976 until 1984.

Based on the results of the RI, which included a risk assessment, the primary chemical of concerns (COCs) at Site 2 are arsenic and beryllium in surface soil. The risk assessment indicated an excess lifetime cancer risk (ELCR) of 2×10^{-6} for adult and adolescent trespassers, 3×10^{-6} for occupational workers, and 2×10^{-5} for adult and child residents exposed to arsenic and beryllium in surface soil at the site. These ELCRs are within the U.S. Environmental Protection Agency (USEPA) target risk range but exceed the Florida Department of Environmental Protection (FDEP) risk threshold. However, the maximum detected concentration of arsenic is less than the site-specific soil cleanup goal established for arsenic at NAS Whiting Field covered landfill sites (refer to Appendices A and B). The use of the site-specific cleanup goal for arsenic at these covered landfill sites requires that land-use controls (LUCs) be implemented.

Groundwater at NAS Whiting Field has been identified as a separate site (Site 40) and will be investigated and remediated separately from Site 2. However, no COCs or unacceptable risks were identified for this medium in the RI Report for Site 2 (HLA, 1998b).

The purpose of the FS is to identify remedial action objectives (RAOs); identify and evaluate remedial action alternatives that will achieve those objectives; and recommend, based on the evaluation, the alternative that best meets the evaluation criteria. The FS contains the identification and discussion of applicable or relevant and appropriate requirements (ARARs), and a brief overview of the findings of the RI and the risk assessment in order to identify RAOs. For Site 2, two RAOs were established.

RAO 1: Establish and maintain an LUC plan for Site 2.

RAO 2: Complete closure of the disposal area in accordance with State and Federal ARARs for landfill closure.

Remedial technologies that address site-specific considerations established in the RAOs were identified and screened; those technologies that pass the screening phase were then developed into remedial alternatives. For this FS, a limited number of technologies were identified based on guidance established under the

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations, Part 300). This guidance indicates that, because landfill (or disposal) sites typically have similar characteristics, similar waste management approaches will be required for remediation. Furthermore, it is expected that containment technologies will generally be appropriate for landfills that pose a relatively low long-term threat or where treatment is impractical. Based on this guidance, a limited number of remedial technologies and alternatives were identified in this FS.

After screening of remedial technologies, alternatives were developed and analyzed in detail for comparison in the comparative analysis. Three remedial alternatives were identified to address the RAOs. These alternatives included

- the no action alternative (Alternative 1), which would include 5-year site reviews as required by CERCLA, estimated cost is $23,000;
- a site closure alternative (Alternative 2), which would include 5-year site reviews, LUCs, and development of a site closure plan, estimated cost is $193,000; and
- a site capping alternative (Alternative 3), which would include all of Alternative 2 actions, placement of a soil cover over the existing disposal site, and operation and maintenance including LUCs and 5-year site review, estimated cost is $4,342,000.

In the comparative analysis, each alternative was compared against each other based on three criteria: threshold, primary balancing, and modifying. This analysis indicates the following:

- Alternative 1 would not achieve the established RAOs.
- The implementation of Alternative 2 would provide a measure of continued protection of human health and the environment because the alternative includes LUCs and a site closure plan. In this manner, Alternative 2 would achieve the RAOs established for the site, and would therefore achieve ARARs.
- Alternative 3 would also achieve the RAOs, but would temporarily adversely affect the existing environment at the site. Construction of a cap at the site would result in destruction of habitat and other features of the site. Implementation of Alternative 3 may also have potential short-term effects of exposure to site workers.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CT	central tendency
ECPC	ecological contaminant of potential concern
ELCR	excess lifetime cancer risk
EPC	exposure point concentration
FDEP	Florida Department of Environmental Protection
FGGC	Florida Groundwater Guidance Concentration
FS	feasibility study
FSCG	Florida Soil Cleanup Goal
GIR	General Information Report
HHRA	human health risk assessment
HLA	Harding Lawson Associates
IR	Installation Restoration
LUC	land-use control
LUCAP	Land-Use Control Assurance Plan
LUCIP	Land-Use Control Installation Plan
MCL	maximum contaminant level
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
RA	risk assessment
RAO	remedial action objectives
RBC	risk-based concentration
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act
SCTL	soil cleanup target level
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SU	standard unit
TBC	to be considered
USEPA	U.S. Environmental Protection Agency
yd^3	cubic yard

1.0 INTRODUCTION

Harding Lawson Associates (HLA) has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to complete a feasibility study (FS) for Site 2, Northwest Open Disposal Area, at Naval Air Station (NAS) Whiting Field, Milton, Florida. The FS is being completed under contract number N62467-89-D-0317/116. The FS report for Site 2 is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (GIR) (HLA, 1998a) and Remedial Investigation (RI) Report (HLA, 1998b) to present the results of the overall RI/FS for the site. This FS report includes the development, screening, and evaluation of potential remedial alternatives that address contaminated media at Site 2.

Investigations at NAS Whiting Field, a facility listed on the National Priority List, are being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR], Part 300). The investigations at the facility are being conducted under the Navy's Installation Restoration (IR) program, which is designed to identify and abate or control contaminant migration resulting from past operations at naval installations while working within the aforementioned regulatory framework. SOUTHNAVFACENGCOM is the agency responsible for the Navy's IR program in the southeastern United States. Therefore, SOUTHNAVFACENGCOM has the responsibility to process NAS Whiting Field through preliminary assessment, site inspection, RI/FS, and remedial response selection.

The goals of the RI/FS for Site 2 at NAS Whiting Field are (1) to assess the extent, magnitude, and impact of contamination at the site, (2) to qualitatively and quantitatively assess the risk posed to human health and the environment by site-related contamination, and (3) to develop remedial alternatives that address threats to human health and/or the environment. The first two elements have been discussed in the GIR and RI reports; the remaining element will be presented and discussed in this FS Report.

The GIR provides information common to all sites at NAS Whiting Field, such as

- facility information and history,
- description of physical characteristics of the facility (climatology, hydrology, soil, geology, and hydrogeology),
- summary of previous investigations,
- summary of the field investigation activities conducted during the RI,
- risk assessment (RA) methodology for both human health and ecological receptors, and
- a summary of the facilitywide background evaluation.

The RI serves as the mechanism for collecting data to identify the source of contamination and migration pathway characteristics, for conducting a baseline

The RI serves as the mechanism for collecting data to identify the source of contamination and migration pathway characteristics, for conducting a baseline RA, and for collecting physical measurements and chemical analytical data necessary for remedial alternative evaluation in the FS. The RI provides the basis for determining whether or not remedial action is necessary. The RI Report for Site 2 at NAS Whiting Field provides the following information:

- a site description and a summary of previous investigations for Site 2;
- a summary of the field investigation methods used during the RI at the site;
- a site-specific data quality assessment;
- an assessment of the extent, magnitude, and impact of contamination at the site; and
- a qualitative and quantitative assessment of risks to human health and the environment.

The FS, described in more detail later in this chapter, uses the results of the RI and the information presented in the GIR to identify remedial action objectives (RAOs) and to develop, screen, and evaluate potential remedial alternatives. The FS is prepared in accordance with the following regulations and guidance documents: CERCLA, as amended by SARA (references made to CERCLA in this report should be interpreted as "CERCLA, as amended by SARA"); the NCP; 40 CFR, Part 300; and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (RI/FS Guidance) (U.S. Environmental Protection Agency [USEPA], 1988).

The remaining sections in this chapter describe the FS process for CERCLA sites (Section 1.1), present how this process is applied to NAS Whiting Field sites (Section 1.2), and provide the conceptual understanding of Site 2 environmental conditions as of the completion of the RI report (Section 1.3).

1.1 THE CERCLA FS PROCESS. The development of remedial alternatives for CERCLA sites consists of developing RAOs and then identifying applicable technologies and developing those technologies into remedial alternatives to meet the RAOs. The NCP requires that a range of alternatives be presented in the FS to the maximum practicable extent.

The first step in the FS process is to develop RAOs that specify the contaminants, media of interest, exposure pathways, and preliminary remedial goals that permit a range of alternatives to be developed. The preliminary remedial goals are developed based on chemical-specific applicable or relevant and appropriate requirements (ARARs); when available, site-specific risk-based factors; or other available information.

Once RAOs are identified, general response actions for each medium of interest are developed. General response actions typically fall into the following categories: no action, containment, excavation, extraction, treatment, disposal, or other actions, that singularly or in combination, may be taken to satisfy the RAOs for the site.

cannot be implemented technically. Those technologies that pass the screening phase are then assembled into remedial alternatives. Remedial alternatives are then described and analyzed in detail using seven criteria described in the NCP, including

- overall protection of human health and the environment;
- reduction of toxicity, mobility, or volume of contaminants through treatment;
- compliance with ARARs;
- long-term effectiveness and permanence;
- short-term effectiveness;
- implementability; and
- economics (i.e., cost).

Alternatives are evaluated against two additional factors after State participation and the public comment period for the FS:

- State acceptance and
- community acceptance.

The results of the detailed analyses (for the first seven criteria) are summarized and compared in a comparative analysis. The alternatives are compared with each other against several criteria, including the following:

Threshold criteria:

- protection of human health and the environment; and

- attainment of Federal and State human health and environmental requirements identified for the site.

Primary balancing criteria:

- cost effectiveness;

- use of permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable; and

- preference for treatment that reduces toxicity, mobility, or volume of contaminants as a principal element.

These criteria are used because SARA requires them to be considered (TBC) during remedy selection. **Modifying criteria**, which include State and community acceptance, are also evaluated. State acceptance is evaluated when the State reviews and comments on the draft FS report and a proposed plan is then prepared in consideration of the State's comments. Community acceptance is evaluated based on comments received on the FS and proposed plan during a public comment period. This evaluation is described in a responsiveness summary in the Record of Decision (ROD).

The entire FS process provides the technical information and analyses that form the basis for a proposed remedial action plan (proposed plan) and subsequent ROD that documents the identification and selection of the remedy.

1.2 PURPOSE OF THE FS REPORT FOR SITE 2. The purpose of the FS report for Site 2 at NAS Whiting Field is to document the results of the study that includes developing RAOs to address contaminated media at the site and developing, screening, and evaluating potential remedial alternatives to meet these objectives. The FS was based on the results and conclusions of the RI completed for the site, and the information presented in the GIR. Information presented in these reports will not be repeated in this FS report.

The FS report for Site 2 was developed in accordance with the NCP and with USEPA's *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a); both of these documents provide guidance for identifying technologies for municipal landfills. Because municipal landfill sites typically have similar characteristics, the USEPA recognizes that similar waste management approaches will be required for remediation. The NCP states that the USEPA expects containment technologies will generally be appropriate for wastes (e.g., landfills) that pose a relatively low long-term threat or where treatment is impractical (Section 300.430[a][1][iii][B]). Additionally, the USEPA expects physical and/or thermal treatment TBC for identifiable areas of highly toxic and/or mobile material that constitutes the principal threat(s) posed by the site (Section 300.430[a][1][iii]-[A]).

Therefore, the purpose of the FS report for Site 2 is not to present all the possible variations and combinations of remedial actions that could be taken at the site, but to present distinctly different alternatives representing a range of opportunities for meeting the RAOs. It is expected that these different alternatives can be adjusted during the proposed plan and decision process, and to a lesser extent during detailed design, to accomplish RAOs in a manner similar to the initially proposed alternative. The FS report also does not present information on alternatives that fail to meet the RAOs, except for a no action alternative, which provides a baseline for comparison of all alternatives.

The following components are considered in identifying appropriate remedial action for Site 2:

- Remedial Action Objectives - Chapter 2.0. RAOs are developed to specify the contaminants, media of interest, exposure pathways, and remedial action goals for the site.
- Applicable Technologies - Chapter 3.0. Technologies applicable for addressing contaminated media at the site are identified and screened. Technologies that cannot be implemented are eliminated.
- Remedial Alternatives - Chapter 3.0. Technologies that pass the screening phase are assembled into remedial alternatives.
- Detailed Analysis - Chapter 4.0. Selected remedial alternatives are described and evaluated using seven of the nine criteria outlined in the NCP.
- Comparative Analysis - Chapter 5.0. Remedial alternatives identified for Site 2 are compared against each other using threshold and primary balancing criteria.

Upon completion of the FS report, a proposed plan will be developed. The proposed plan will identify the preferred remedial alternative for Site 2. This document will be written in community-friendly language, and will be made available for public comment. Upon receipt of public comments, responses to these comments will be developed in a responsiveness summary, and the ROD will be prepared. The ROD will document the chosen alternative for the site, and will include the responsiveness summary as an appendix. Once the ROD is signed, the chosen remedial alternative will be implemented.

1.3 **SITE 2 ENVIRONMENTAL CONDITIONS**. Site 2, Northwest Open Disposal Area, is a 12-acre parcel located along the northwestern facility boundary near the North Air Field at NAS Whiting Field (Figure 1-1). The site is an old borrow pit that currently is a surface depression. The relief at the site is approximately 25 feet (Figure 1-2). The site is currently covered with dense, low-lying vegetation. Some wood debris is located in the center portion of the site.

According to the U.S. Department of Agriculture ([USDA], 1980), the soil at Site 2 is classified as Troup Loamy Sand. Because the soil at the site is predominantly silty sand, precipitation at the site infiltrates directly into the soil. Some surface water runoff collects in the lowest area of the site prior to infiltrating into the subsurface.

The results of previous investigations suggest that Site 2 received a variety of wastes including wood debris, asphalt rubble, sheet metal, furniture, and crushed paint cans from NAS Whiting Field from 1976 until 1984. These waste items are listed as typical components of municipal solid wastes (Tchobanoglous, et al., 1993). Previous investigation also indicated that the site was first utilized as a borrow area and then subsequently used as a landfill. Based on the results of the RI, the wastes present in the landfill do not pose a principal threat to human health or the environment. Consequently, the Navy believes that Site 2 exhibits the characteristics of a CERCLA municipal landfill site and will be addressed as such in this FS.

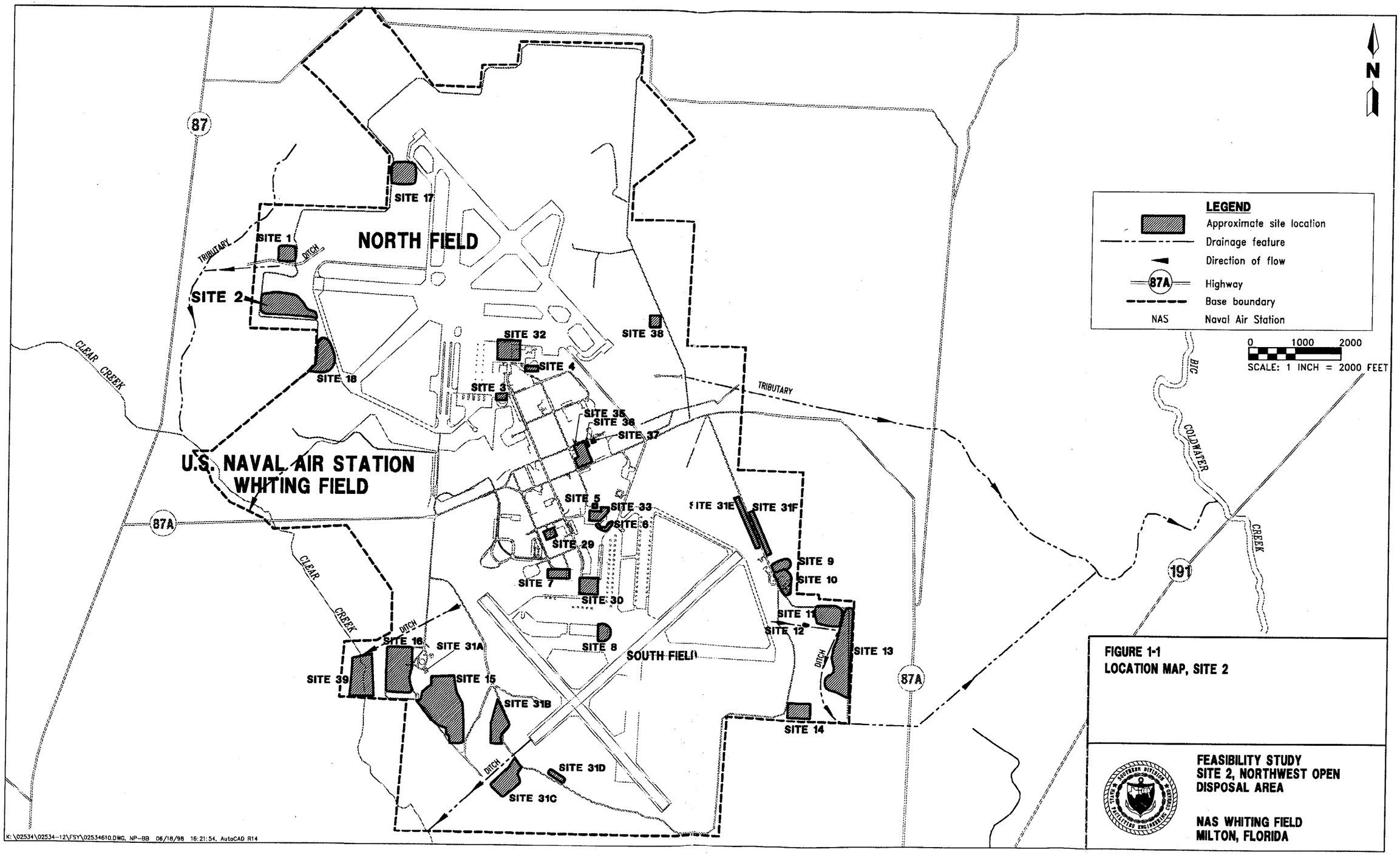

FIGURE 1-1
LOCATION MAP, SITE 2

FEASIBILITY STUDY
SITE 2, NORTHWEST OPEN DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

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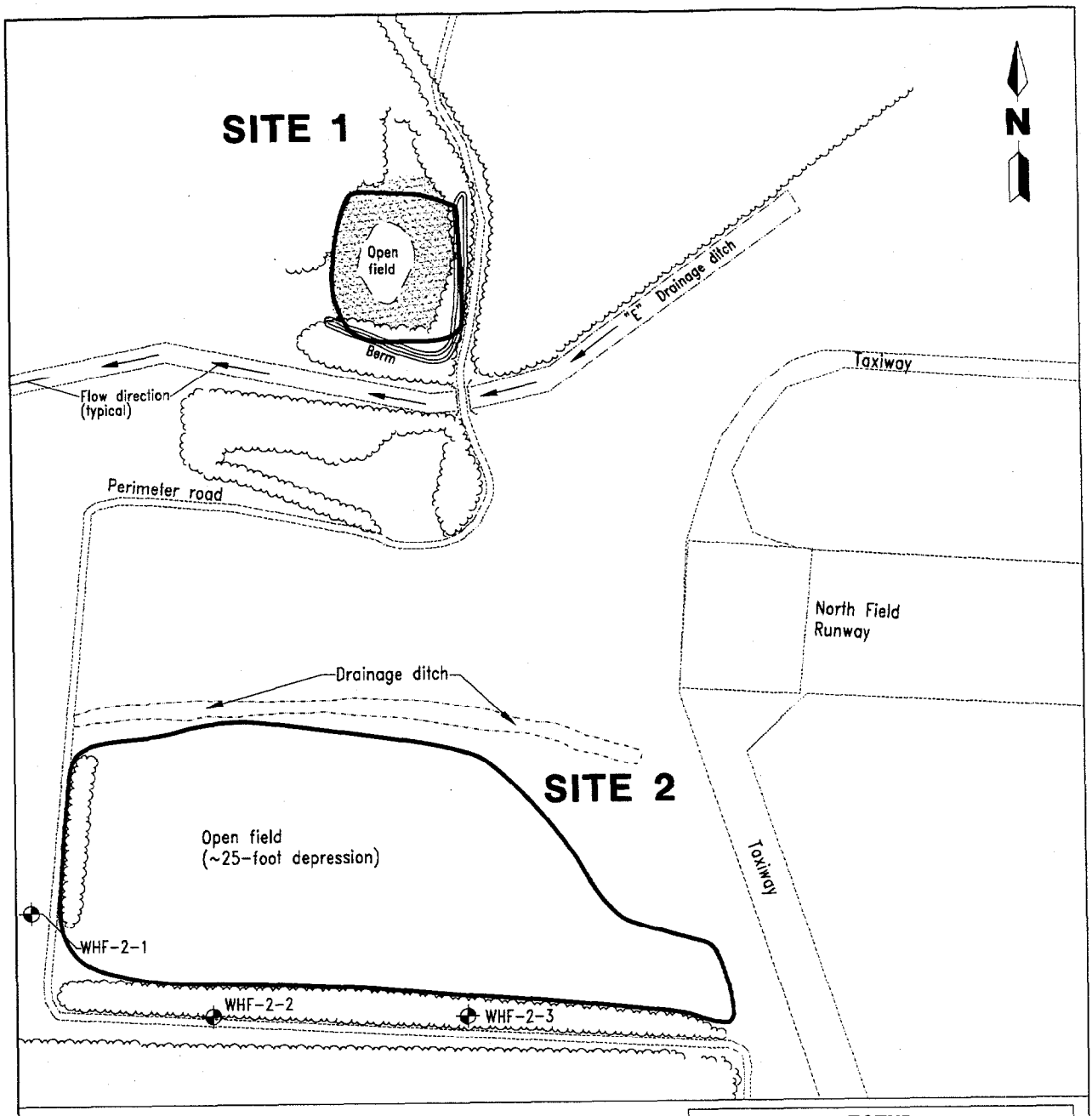

FIGURE 1-2
SITE 2, GENERAL FEATURES

FEASIBILITY STUDY
SITE 2, NORTHWEST OPEN DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

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2.0 REMEDIAL ACTION OBJECTIVES

This section presents the goals and objectives for remedial action at Site 2 that provide the basis for selecting appropriate RAOs and, subsequently, identifying remedial technologies and developing alternatives to address contamination at the site. To establish these objectives, ARARs are first identified (Section 2.1). Next, RAOs are defined based on consideration of ARARs, the results and conclusions of the RI, the RA, and other criteria (Section 2.2). Finally, general response actions appropriate for technology identification are discussed (Section 2.3). The information presented in this chapter will be used to identify appropriate remedial technologies for the site (presented in Chapter 3.0).

2.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS. ARARs are Federal and State human health and environmental requirements used to define the appropriate extent of site cleanup, identify sensitive land areas or land uses, develop remedial alternatives, and direct site remediation. CERCLA and the NCP require that remedial actions comply with State ARARs that are more stringent than Federal ARARs, are legally enforceable, and are consistently enforced statewide.

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 that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance found at a CERCLA site. State standards that may be applicable are only those which (1) have been identified by the State in a timely manner, (2) are consistently enforced, and (3) are 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 that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

"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. Once a requirement is identified as an ARAR, the selected remedy must comply with ARARs, even if the ARAR is not required to ensure protectiveness. The general relevant and appropriate requirements apply only to actions at the site. Applicable requirements apply to both on- and off-site remedial actions.

Other requirements "to be considered" are Federal and State nonpromulgated guidance or advisories that are not legally binding and do not have the status

of potential ARARs (i.e., they have not been promulgated by statute or regulation). 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 SARA, State and Federal ARARs are categorized as

- chemical-specific (i.e., governing the extent of site remediation with regard to specific contaminants and pollutants),
- location-specific (i.e., governing site features such as wetland, floodplains, and sensitive ecosystems and pertaining to existing natural and man-made site features such as historical or archaeological sites), and
- action-specific (i.e., pertaining to the proposed site remedies and governing the implementation of the selected site remedy).

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

2.1.1 **Chemical-Specific ARARs** Chemical-specific requirements are standards that limit the concentration of a chemical found in or discharged to the environment. They govern the extent of site remediation by providing either actual cleanup levels or the basis for calculating such levels. The State of Florida has provided Soil Cleanup Target Levels (SCTLs) for sites in Florida (Florida Department of Environmental Protection [FDEP], 1998a). The USEPA Region III has also developed risk-based concentrations (RBCs) for contaminants in soil.

2.1.2 **Location-Specific ARARs** Location-specific ARARs govern site features (e.g., wetland, floodplains, wilderness areas, and endangered species) and man-made features (e.g., places of historical or archaeological significance). These ARARs place restrictions on concentrations of hazardous substances or the conduct of activities based solely on the site's particular characteristics or location. Observations made during the ecological survey of NAS Whiting Field indicate that no State or federally listed rare, threatened, or endangered species or species of concern are known to exist at Site 2 (Nature Conservancy, 1997). Site 2 does not contain wetland areas and no part of the site is located in a 100-year flood plain. In addition, because Site 2 was originally a borrow pit and then used as a landfill, the soils at the site are reworked. Therefore, no areas of historical or archeological significance exist at Site 2.

2.1.3 **Action-Specific ARARs** Action-specific ARARs are technology- or activity-based limitations controlling activities for remedial actions. Action-specific ARARs generally set performance or design standards, controls, or restrictions on particular types of activities. To develop technically feasible alternatives, applicable performance or design standards must be considered during the detailed analysis of remedial alternatives. During the detailed analysis of alternatives, each alternative will be analyzed to determine compliance with action-specific ARARs.

Table 2-1
Synopsis of Federal and State ARARs and Guidance for Site 2

Feasibility Study
Site 2, Northwest Open Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the National Hazardous Substance and Contingency Plan Regulations (40 Code of Federal Regulations [CFR], Section 300.430)	Discusses the types of institutional controls to be established at CERCLA sites.	**Applicable.** These regulations may be used as in establishing appropriate institutional controls at Site 2.	Action-specific
Occupational Safety and Health Act (29 CFR, Part 1910)	Requires establishment of programs to ensure worker health and safety at hazardous waste sites.	**Applicable.** These requirements apply to response activities conducted in accordance with the National Contingency Plan. During the implementation of any remedial alternative for Site 2, these regulations must be attained.	Action-specific
Resource Conservation and Recovery Act (RCRA) Regulations, Landfills (40 CFR, Part 264, Subpart N)	Provides monitoring, inspection, closure and post-closure care requirements for landfills that contain hazardous waste.	**Relevant and Appropriate.** These regulations may be relevant and appropriate when considering a cover for the landfill as a remedial alternative.	Action-specific
RCRA Regulations, Releases from Solid Waste Management Units (40 CFR, Part 264, Subpart F)	Contains general groundwater monitoring requirements. Establishes detection and compliance monitoring programs that apply to owners and operators of solid waste units.	**Relevant and Appropriate.** These regulations provide guidance for establishing and conducting a groundwater monitoring program at sites contaminated with RCRA wastes, if necessary.	Action-specific
Safe Drinking Water Act (SDWA) (40 CFR, Parts 141 and 143)	Establishes maximum concentration levels for contaminants in groundwater. Levels are determined based on protection of human health, technologies available for treatment, and cost data.	**Applicable.** These values should be considered when evaluating data from the groundwater monitoring program, if necessary.	Chemical-specific
USEPA, Design and Construction of RCRA/CERCLA Final Covers (May 1991)	Provides guidance on components of landfill closure, including long-term maintenance, groundwater monitoring, and institutional controls. Recommends groundwater sampling frequency and strategy.	**TBC.** This guidance may be used for establishing remedial action alternatives for closure of the Site 2 disposal area.	Guidance
USEPA Region III, Risk-Based Concentrations (October 1998)	Provides acceptable risk-based concentrations for contaminants in soil considering various exposure scenarios.	**Applicable.** These values should be considered when evaluating concentrations of contaminants in soil.	Chemical-specific

See notes at end of table.

Table 2-1 (Continued)
Synopsis of Federal and State ARARs and Guidance for Site 2

Feasibility Study
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Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Solid Waste Disposal Act Regulations, Criteria for Municipal Solid Waste Landfills (40 CFR, Part 258)	Establishes minimum national criteria under RCRA, as amended, for all municipal solid waste landfill (MSWLF) units.	**Relevant and Appropriate.** Although this regulation applies to RCRA municipal landfills, not CERCLA landfills, some applications may apply.	Guidance
Florida Groundwater Classes, Standards and Exemptions (Chapter 62-520, Florida Administrative Code [FAC])	Designates groundwater of the State into five classes and establishes minimum "free from" criteria. The regulation also specifies that classes I & II must meet the primary and secondary drinking water standards listed in FAC, Chapter 62-550.	**Applicable.** These regulations may be used to evaluate data from a groundwater monitoring program, if necessary.	Chemical-specific
Florida Drinking Water Standards (Chapter 62-550, FAC)	Provides maximum concentration levels for contaminants in groundwater in the State of Florida. Implements the Federal SDWA by adopting the primary and secondary drinking water standards and by creating additional rules to fulfill State requirements.	**Applicable.** The values in this guidance should be considered when evaluating data from the groundwater monitoring program, if necessary.	Chemical-specific
Florida Groundwater Guidance Concentrations (June 1994)	Provides maximum concentration levels for contaminants in groundwater in the State of Florida. Groundwater with concentrations less than the listed values are considered "free from" contamination.	**TBC.** The values in this guidance should be considered when evaluating data from the groundwater monitoring program, if necessary.	Guidance
Florida Soil Cleanup Goals (September 1995)	Provides guidance for soil cleanup levels that can be developed on a site-by-site basis.	**TBC.** These guidelines aid in determining health and leachability-based cleanup goals for soil, if necessary.	Guidance
Florida Solid Waste Regulations (62-701)	Provides guidance for design and closure of solid waste landfills in the State of Florida.	**Relevant and Appropriate.** These regulations may be relevant and appropriate when considering a cover for the disposal site as a remedial alternative.	Action-specific
Florida Hazardous Waste Rules (Chapter 62-730, FAC)	Adopts, by reference, specific sections of the Federal hazardous waste regulations, including the section regulating hazardous waste landfills (40 CFR, Part 264, Subpart N) and makes additions to these regulations.	**Relevant and Appropriate.** These requirements may be used as guidance for developing a landfill inspection program.	Chemical-specific; Action-specific

See notes at end of table.

Table 2-1 (Continued)
Synopsis of Federal and State ARARs and Guidance for Site 2

Feasibility Study
Site 2, Northwest Open Disposal Area
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Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Florida Rules on Hazardous Waste Warning Signs (Chapter 62-736, FAC)	Requires warning signs at National Priorities List (NPL) sites to inform the public of the presence of potentially harmful conditions.	**Applicable.** This requirement is applicable for sites that are on the NPL.	Action-specific
Florida Brownfields Cleanup Criteria Rule (Chapter 62-785, FAC).	Provides both default cleanup target levels and a process for the derivation of site-specific alternative cleanup target levels that are protective of human health and safety and the environment.	**Applicable.** The values in this guidance should be considered when evaluating data from the soil monitoring program, if necessary.	Chemical-specific

Notes: ARAR = *applicable or relevant and appropriate requirement.* TBC = *"to be considered" guidance materials.*
USEPA = U.S. Environmental Protection Agency.

Certain action-specific ARARs include permit requirements. Under CERCLA Section 121(e), permits are not required for remedial actions conducted entirely on site at Superfund sites. This permit exemption applies to all administrative requirements, including approval of or consultation with administrative bodies, documentation, record keeping, and enforcement. However, the substantive requirements of these ARARs must be attained.

2.1.4 **TBC Criteria** As previously stated, TBCs are Federal and State nonpromulgated guidance or advisories that are not legally binding and do not have the status of being potential ARARs (i.e., have not been promulgated by statute or regulation). However, if there are no specific regulatory requirements 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.

2.2 **IDENTIFICATION OF RAOs**. RAOs are defined in the CERCLA RI/FS guidance manual as media-specific goals that are established to protect human health and the environment, and are typically based on COCs, exposure routes, and receptors present or available at the site. RAOs are developed to ensure compliance with ARARs. RAOs for Site 2 will be identified by consideration of ARARs, the RI, and the RA.

Groundwater. Although groundwater at NAS Whiting Field has been identified as a separate site (Site 40), which will be investigated and remediated separately from Site 2, chemical-specific ARARs and TBCs for groundwater were considered when identifying RAOs for Site 2 based on ARARs. The concentration of two chemicals detected in unfiltered groundwater samples from the shallow portion of the surficial aquifer were greater than the Federal maximum contaminant level (MCL), Florida drinking water standard, and/or Florida groundwater guidance concentration (FGGC). These two chemicals, aluminum and iron, are inorganics and are regulated under the Federal and State secondary drinking water standards. Table 2-2 lists these chemicals and their respective concentrations, Federal MCL, Florida drinking water standard, and FGGC. Although concentrations of these chemicals exceed their respective secondary regulatory standards, an RAO will not be established for surficial groundwater for Site 2 because the noncarcinogenic risk posed by the consumption of groundwater by humans at the site is less than the USEPA and FDEP hazard index of 1. Also, these chemicals do not contribute to carcinogenic risks. The groundwater evaluation in the human health risk assessment (HHRA) indicate that COCs detected do no pose an unacceptable risk to receptors using USEPA guidance and target risk ranges. The ecological assessment completed for Site 2 did not include exposure to groundwater by ecological receptors because the depth of the aquifer is approximately 70 feet below land surface and the nearest surface water body (Clear Creek) is several thousand feet downgradient.

The ecological assessment completed for Site 2 did not include exposure to groundwater by ecological receptors. This is because there are no current or future predicted exposure pathways for ecological receptors to groundwater. In reference to the ecological assessment of the RI, groundwater at Site 2 is approximately 70 feet below the ground surface and is not expected to discharge to surface water within several thousand feet of the site. The unnamed tributary is to the west-southwest of Site 2. Although groundwater flows in the south-southwest direction, potentiometric contours show little evidence of potential discharge west of the site. If discharge were to occur, it would likely be

Table 2-2
Summary of Chemicals Exceeding Chemical-Specific ARARs and TBCs in Groundwater at Site 2

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Analyte	Frequency of Detection[1]	Range of Detected Analyte Concentrations	Background Screening Value[3]	Federal MCL[4]	Florida Groundwater Guidance	
					Concentration[5]	Basis[6]
Inorganic Analytes (µg/ℓ)						
Aluminum	2/3	82 to 248	654	200	200	S
Iron	2/3	59.7 to 1,280	964	[8]300	300	S

[1] Frequency of detection is the fraction of total samples analyzed in which the analyte was detected.
[2] The mean of detected concentrations is the arithmetic mean of all environmental samples in which the analyte was detected. The arithmetic mean does not include those environmental samples in which the analyte was not detected.
[3] Background screening values are two times the arithmetic mean detected background concentrations.
[4] Federal MCLs are maximum permissible concentrations of contaminants in water that are delivered to a user by a public water system.
[5] Source: Florida Department of Environmental Protection, Florida Groundwater Guidance Concentration (June 1994).
[6] The Florida Groundwater Guidance Concentrations are based on a number of enforceable and nonenforceable State of Florida regulations:
S = secondary drinking water standards based on Florida Administrative Code Rule 17-550.310, .320.
[7] Average of sample and its duplicate.
[8] Secondary MCL.

Notes: Facilitywide groundwater has been identified as a separate site (Site 40) at NAS Whiting Field. This site will be addressed under a separate remedial investigation and feasibility study.

ARARs = applicable or relevant and appropriate requirements.
TBC = "to be considered" guidance material.
MCL = maximum contaminant level.
µg/ℓ = micrograms per liter.

farther south, in the vicinity of Clear Creek. Therefore, no RAOs will be established for groundwater based on ecological receptor exposure.

Surface Soil. Chemical-specific ARARs and TBCs for surface soil were considered when identifying RAOs based on ARARs. The concentration of one chemical, arsenic, detected in surface soil exceeded its respective residential and industrial Florida SCTLs and USEPA Region III RBC. Table 2-3 provides a summary of the detected concentrations of arsenic and its respective cleanup target levels.

The HHRA completed for Site 2 evaluated risks to current and future users of the site. The risks posed to site maintenance workers and excavation workers based on exposure to surface soil at Site 2 via direct contact, ingestion, or inhalation of particulates are less than the USEPA target risk range and the FDEP risk threshold. The excess lifetime cancer risks (ELCRs) posed to adult and adolescent trespassers ($2x10^{-6}$), occupational workers ($3x10^{-6}$), and adult and child residents ($2x10^{-5}$) based on the same exposure pathways and reasonable maximum exposure (RME) assumptions are within the acceptable USEPA risk range and greater than the FDEP risk threshold, due mainly to concentrations of arsenic and beryllium in surface soil at the site. Noncancer risks for the adult and child resident were within the acceptable USEPA and FDEP risk thresholds.

The human health assessment for Site 2 also considered the adult and adolescent trespasser, occupational worker, and adult and child residents exposed to surface soil at the site using central tendency (CT), or average, exposure assumptions. The risk posed to an occupational worker is less than the USEPA target risk range and the FDEP threshold. The ELCR posed to the aggregate (adult and child) resident based on the CT exposure assumptions is $4x10^{-6}$, which is within the acceptable USEPA risk range and greater than the FDEP risk threshold. The ELCR posed to the aggregate trespasser based on the CT exposure assumptions is $3x10^{-6}$, which is within the acceptable USEPA risk range and greater than the FDEP risk threshold. The range of ELCR presented by the RME and CT exposure scenarios provides the risk managers and decision makers with a perspective of the potential risk range presented by the site.

Potential risks to ecological receptors were quantitatively and/or qualitatively evaluated for ecological contaminants of potential concern (ECPCs) identified in surface soil samples collected from Site 2, NAS Whiting Field.

Risks associated with exposure to ECPCs in surface soil were evaluated for terrestrial wildlife based on the food-web model that predicts the amount of contaminant exposure via the diet and incidental ingestion of soil. Comparison of the predicted dose for representative wildlife species with thresholds for both lethal and sublethal effects (reference toxicity values) is the basis of risk evaluation. Based on this comparison, exposure to Site 2 surface soil is unlikely to result in adverse effects to wildlife receptors.

Risks for plants and invertebrates were evaluated based on the comparison of maximum and average ECPCs with literature-reported toxicity values. Based on this comparison, risks were not predicted for invertebrates because all maximum exposure point concentrations (EPCs) were below available toxicity values.

Although the maximum EPC of vanadium exceeded its respective phytotoxicity benchmark, risks are unlikely because the Site 2 surface soil concentration of vanadium is within the range found in background surface soil at NAS Whiting

Table 2-3
Summary of Chemicals Exceeding Chemical-Specific ARARs and TBCs in Surface Soil at Site 2

Feasibility Study
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Milton, Florida

Analyte	Frequency of Detection[1]	Range of Detected Analyte Concentrations	Background Screening Value[2]	USEPA Region III RBCs Residential/Industrial[3]	Site-Specific Soil Cleanup Goal[4]	Soil Cleanup Target Levels Direct Exposure (mg/kg)		
						I*	II**	Leachability
Arsenic	6/6	[5]0.82 to [5]3.95	2.6	0.43 /3.8	4.62	0.8	3.7	NA
Beryllium	4/6	0.11 to 0.45	0.36	160/4,100	NA	120	700	NA

[1] Frequency of detection is the fraction of total samples analyzed in which the analyte was detected.
[2] Background screening values are two times the arithmetic mean detected background concentration.
[3] USEPA Region III RBCs for soil ingestion based on an excess lifetime cancer risk of 1×10^{-6} or an adjusted hazard quotient of 0.1 (October, 1998).
[4] The site-specific cleanup goal for arsenic for covered landfill sites at Naval Air Station Whiting Field was approved by FDEP on April 27, 1998 (see Appendix B for a copy of this acceptance).
[5] Average of sample and its duplicate.

Notes: ARAR = applicable or relevant and appropriate requirement.
TBC = "to be considered" guidance material.
USEPA = U.S. Environmental Protection Agency.
RBC = risk-based concentration.
mg/kg = milligrams per kilogram.
I = based on a dermal absorption of 0.0001.
* = values based on residential-use assumptions.
II = based on acute toxicity considerations.
** = values based on worker industrial exposure assumptions.
NA = not available.

Field. Therefore, it appears that detected concentrations of vanadium at Site 2 may be representative of background conditions. Additionally, stressed vegetation was not apparent at the site. Therefore, risks to terrestrial plants are not predicted and no RAOs will be developed.

Because Site 2, and several other sites at NAS Whiting Field, are disposal sites where present day surface soil is the result of exposing subsurface soil from excavation of a borrow pit, the Navy requested that the FDEP consider a site-specific soil cleanup goal for arsenic. The Navy recommended a soil cleanup goal for arsenic at NAS Whiting Field covered landfill sites (Sites 1, 2, 9, 10, 11, 12, 13, 14, 15, and 16) of 4.62 milligrams per kilogram (HLA, 1998a). This request is included as Appendix A of this report.

The FDEP responded to this request in a letter dated April 27, 1998 (FDEP, 1998b). The FDEP concurred with the recommendation for the site-specific soil cleanup goal for arsenic at NAS Whiting Field covered landfill sites (Sites 1, 2, 9, 10, 11, 12, 13, 14, 15, and 16), given the following conditions:

- The sites may be utilized for activities that involve less than full-time contact with the site. This may include, but is not limited to, 1) parks 2) recreation areas that receive heavy use (such as soccer or baseball fields), or 3) agricultural sites where farming practices result in moderate site contact (approximately 100 days per year, or less).

- The Navy must ensure adherence to the land use by incorporating the site and conditions in a legally binding Land-Use Control (LUC) Agreement.

- The above soil cleanup goal shall not be utilized at any other site without specific FDEP approval.

Based on the establishment of this site-specific cleanup goal for arsenic at Site 2, the establishment of a chemical-specific RAO for arsenic is not necessary. This is because the concentrations of arsenic detected in surface soil at Site 2 do not exceed the site-specific soil cleanup goal.

However, in order to apply this site-specific cleanup goal, the Navy must adhere to the conditions of the FDEP concurrence letter. Namely, the Navy must establish a legally binding LUC Agreement. Therefore, the following RAO has been established for Site 2:

RAO 1:

- Establish and maintain a LUC plan for Site 2.

As shown in Table 2-3, concentrations of the inorganic chemical beryllium did not exceed the Florida SCTLs.

Subsurface Soil. Chemical-specific ARARs and TBCs for subsurface soil were considered when identifying RAOs based on ARARs. The chemicals detected in subsurface soil at Site 2 were compared to the Florida industrial II standards and USEPA industrial RBCs and no exceedances were noted. Based on this analysis, no RAOs will be developed for subsurface soil at Site 2.

Action-specific ARARs related to landfill and disposal area closure were considered for identifying RAOs. These ARARs are identified and described on Table 2-1.

RAO 2:

- Complete closure of disposal area in accordance with State and Federal ARARs.

Other Considerations. The *Draft Technical Manual for Solid Waste Disposal Criteria* (USEPA, 1992) (guidance document for implementation of Federal Solid Waste Disposal criteria) provides information regarding statistical evaluation of groundwater monitoring data (where a groundwater monitoring program is necessary). Portions of the referenced guidance were used as a template for the various components of the selected remedial actions for Site 2, when appropriate.

In addition, guidance published for CERCLA sites provides information regarding closure of CERCLA landfills. Specifically, the NCP states that closure of CERCLA landfills that are not subject to specific closure regulations (as stated above) can be achieved by "hybrid-landfill closure." Hybrid-landfill closure is further described in the USEPA guidance document, *Design and Construction of RCRA/CERCLA Final Covers* (USEPA, 1991b). This guidance suggests the following items be considered for hybrid-landfill closures:

- covers, which may be permeable, to prevent a direct-contact threat;
- limited long-term cover maintenance;
- groundwater monitoring; and
- institutional controls, as necessary.

Based on consideration of referenced guidance and the recommendations of the RI (including the RA), some or several of these components will be considered in developing remedial alternatives for Site 2.

Summary of RAOs. Two RAOs have been established for Site 2. Table 2-4 lists these RAOs.

Table 2-4
Summary of Remedial Action Objectives for Site 2

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Remedial Action Objectives	Description
1	Establish and maintain a land-use control plan for Site 2.
2	Complete closure of disposal area in accordance with State and Federal ARARs for landfill closure.

Note: ARARs = applicable or relevant and appropriate requirements.

2.3 IDENTIFICATION OF GENERAL RESPONSE ACTIONS. General response actions describe potential medium-specific measures that may be employed to address RAOs. Potential response actions for CERCLA sites include the following general response categories:

- no action
- limited action
- containment
- treatment (either *in situ* or *ex situ*)
- disposal

However, Site 2 is a former disposal site, and the NCP and USEPA provide further guidance for developing general response actions for such sites. The USEPA has produced a document entitled *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a). Because landfill (or disposal) sites typically have similar characteristics, the USEPA recognizes that similar waste management approaches will be required for remediation. The NCP states that the USEPA expects containment technologies will generally be appropriate for landfills that pose a relatively low long-term threat or where treatment is impractical (Section 300.430[a][1][iii][B]). Therefore, the number of general response actions identified for Site 2 were limited based on these guidance documents, and presumptive remedies for Site 2 include containment technologies.

Furthermore, the USEPA states in the document entitled *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a) that physical and/or thermal treatment technologies should be considered for identifiable areas of highly toxic and/or mobile material that constitute the principal threat(s) posed by the site (i.e., "hot spots"); (Section 300.430[a][1][iii][A]). The RI for this site did not identify any hot spots; therefore, the general response actions identified for Site 2 did not include treatment technologies for such areas.

In summary, the general response actions identified for Site 2 include

- no action,
- limited action, and
- containment (i.e., landfill closure and postclosure activities).

These general response actions were selected based on the aforementioned guidance and the agreement with FDEP established for arsenic (Appendix B). The agreement with FDEP requires the use of LUCs to restrict land use to nonresidential uses to ensure protection of human health and the environment. Because of this requirement and CERCLA's preference for evaluation of a range of alternatives, an evaluation of other potential general response actions was performed in the FS.

3.0 REMEDIAL ACTION ALTERNATIVES

The approach and rationale leading to the development of remedial alternatives for Site 2 are presented in this chapter. The development of remedial alternatives for CERCLA sites consists of identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives that accomplish the RAOs identified in Chapter 2.0.

The NCP requires that a range of remedial alternatives be considered. SARA emphasizes the use of treatment technologies. Treatment alternatives range from those that eliminate the need for long-term management to those that reduce toxicity, mobility, or volume of contaminants. The range of alternatives considered in this FS include alternatives from the following categories:

- no action,
- limited action, and
- containment.

As discussed in Section 2.3, the NCP and USEPA provide further guidance for developing remedial alternatives (USEPA, 1991a). Because municipal landfill sites typically have similar characteristics, the USEPA recognizes that similar waste management approaches will be required for remediation. The NCP states that the USEPA expects containment technologies will generally be appropriate for waste (e.g., landfills) that poses a relatively low long-term threat or where treatment is impractical (Section 300.430[a][1][iii][B]). In this FS, the number of technologies and alternatives evaluated for Site 2 were limited in scope based on these guidance documents.

Additionally, the USEPA states in this guidance document that treatment technologies should be considered for identifiable areas of highly toxic and/or mobile material that constitute the principal threat(s) posed by the site (i.e., "hot spots") (Section 300.430[a][1][iii][A]). The RI for this site did not identify any hot spots; therefore, the treatment technologies and alternatives were not identified for Site 2.

The remaining sections of this chapter identify the types of technologies that contribute to achieving the RAOs, evaluate and select representative technologies for each technology type, and develop remedial alternatives using the selected technologies. A detailed evaluation of remedial alternatives is presented in Chapter 4.0.

3.1 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES FOR SITE 2. The purpose of this section is to identify and screen appropriate technologies for assembly into remedial alternatives that address RAOs identified for Site 2. Each technology is then screened based on site- and waste-limiting characteristics.

Site characteristics considered during this process included the following:

- site geology, hydrogeology, and terrain;
- availability of space and resources necessary to implement the technology; and

- presence of special site features (e.g., wetlands, floodplains, or endangered species).

The following waste characteristics were also considered:

- contaminated media,
- types and concentrations of waste constituents, and
- physical and chemical properties of the waste (e.g., volatility, solubility, and mobility).

Table 3-1 presents the remedial technologies applicable for addressing the RAOs for Site 2. This table also presents the screening of those technologies. The technology screening process reduces the number of potentially applicable technologies by evaluating the applicability of each technology to site- and waste-limiting factors. Technologies deemed ineffective or not implementable were eliminated from further consideration. The remaining technologies are assembled into remedial alternatives in Section 3.2.

3.2 REMEDIAL ALTERNATIVES FOR SITE 2. Remedial technologies that passed the technology screening are assembled into alternatives that will meet the RAOs. Table 3-2 presents the alternative development for Site 2. The alternatives for Site 2 were developed to address closure of the landfill in accordance with ARARs.

Based on the applicable technologies identified in the preceding section, three remedial alternatives were developed for Site 2. These alternatives are options under the no action, limited action, and containment general response categories. The no action alternative was developed to provide a baseline for comparison with other alternatives (USEPA, 1988). The alternatives developed for Site 2 are discussed in the following subsections.

3.2.1 Alternative 1: No Action The NCP requires the development of the no action alternative to provide a baseline for comparison against other remedial alternatives. This alternative (i.e., Alternative 1) does not involve the implementation of any remedial technologies to treat wastes at Site 2. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. The 5-year site review typically involves an administrative review of site records. For this FS, Alternative 1 would include 5-year reviews for a period of 30 years. A period of 30 years for 5-year site reviews was chosen for costing purposes only. Under CERCLA, 5-year reviews must continue as long as hazardous substances, pollutants, or contaminants remain at the site.

3.2.2 Alternative 2: Site Closure Alternative 2 consists of activities necessary for complete closure of the disposal site at Site 2:

- development and implementation of a closure and postclosure plan for the disposal area,
- LUCs (i.e., deed restrictions and LUC documents), and
- 5-year site reviews.

A closure and postclosure plan for Site 2 would be prepared under Alternative 2 and would describe the planned operations, maintenance, and monitoring of the

Table 3-1
Identification and Screening of Remedial Technologies for Site 2

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General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
No Action				
No action	No remedial actions are taken at Site 2. Five-year site reviews would be required.	Applicable.	Applicable.	Retained. This alternative is retained for a baseline for comparison with other alternatives as required by CERCLA.
Five-year site reviews	Under CERCLA, if wastes are left on a site after closure, the site should be reviewed every 5 years.	Applicable.	Applicable.	Retained. This alternative is retained based on the CERCLA requirement that if wastes remain on site after closure, a review of the site must be completed every 5 years.
Site Closure				
Land-use controls (LUCs)	Use of deed restrictions and LUC documents to maintain the site for nonresidential purposes.	Applicable.	Applicable.	Retained. This alternative is retained because it would achieve RAO 1.
Containment				
Closure plan development	Development of a closure plan for site monitoring (includes visual observation as well as sample collection and analysis) and maintenance. Plan includes a description of the disposal history and the effectiveness of the existing landfill design.	Applicable.	Applicable.	Retained. May be necessary to obtain landfill closure certification.

See notes at end of table.

Table 3-1 (Continued)
Identification and Screening of Remedial Technologies for Site 2

Feasibility Study
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General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
Containment (Continued)				
Soil cover				
Site clearing and grubbing	Removal of vegetation, shrubs, and small and large brush to allow for proper grading of landfill cap.	Applicable.	Not applicable.	Retained. May be necessary if the disposal area is capped.
Placement of compacted soil cover	Placement, grading, and compacting of low-permeability capping system.	Applicable. Low-permeability cap does not exist; suitable low-permeability soil will be obtained from an off-site borrow source.	Applicable. Presence of clean cover would minimize human and ecological direct contact exposure to existing surface contaminants at Site 2.	Retained. May be necessary if the disposal area is capped.
Vegetative support layer	A 6-inch-thick soil cover is placed over a compacted soil cover to reduce water infiltration and erosion and enhance evapotranspiration through vegetative growth.	Applicable. Reduces infiltration of precipitation, thus providing source control at Site 2.	Applicable. Would reduce infiltration of precipitation into the waste.	Retained. May be necessary if the disposal area is capped.
Vegetative cover	Establishment of vegetation by fertilizing, mulching, seeding, and planting.	Applicable. Vegetation would reduce infiltration and reduce erosion of soil cover.	Applicable. Would reduce direct contact with exposed waste.	Retained. May be necessary if the disposal area is capped.
Surface water management	The final cover design will consist of side slopes of approximately 33 percent to comply with Florida landfill regulations.	Applicable. Would minimize erosion and maintenance.	Applicable. Would reduce erosion of contaminated soil.	Retained. This design will comply with Florida regulations.

Notes: CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
RAO = remedial action objective.

Table 3-2
Development of Remedial Alternatives for Site 2

Feasibility Study
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Alternative	Description of Key Components
Alternative 1: No action	Five-year site review.
Alternative 2: Site closure	Closure plan (including postclosure care) development to monitor and maintain site. Land-use controls (LUCs) including LUC assurance and implementation plans. Five-year site review.
Alternative 3: Site closure with capping	Closure plan (including postclosure care) development to monitor and maintain site. LUCs including LUC assurance and implementation plans. Posting of warning signs. Removal of surface debris. Disposal of surface debris. Clearing and grubbing of landfill site. Cap construction. Vegetative establishment to minimize erosion of final cover and enhance evapotranspiration. Surface water runoff management to minimize erosion of final cover and minimize maintenance requirements. Five-year site review.

disposal area upon closure. The closure and postclosure plan would be certified by an independent Florida-registered Professional Engineer.

LUCs or other documents that restrict the use of the land in the vicinity of a landfill and place regulatory controls on excavation of soil would be drafted, implemented, and enforced in compliance with local regulations as a part of this alternative. The LUCs will be placed on the parcel of land encompassing the disposal site, including a typical buffer zone, as is currently used at other landfill sites in the Florida.

Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years.

3.2.3 Alternative 3: Site Closure and Capping One containment alternative was developed for Site 2 that consists of all components of Alternative 2 with the addition of a capping component. Containment alternatives require no treatment of contaminated materials.

Under this alternative, a cover system would be constructed over the former landfill to minimize potential risks associated with direct contact. Surface water runoff controls would also be included to minimize erosion. The cover design would be in accordance with USEPA guidance provided in *Design and Construction of RCRA/CERCLA Final Covers* for hybrid-landfill closure (USEPA, 1991b).

Prior to cap construction, the site would be cleared, grubbed, and graded. To minimize run-on, erosion from runoff, and infiltration, landfill slopes would be graded to a 1:3 slope (1 horizontal:3 vertical). The initial soil layer would consist of clean fill compacted to a minimum thickness of 18 inches. Six inches of soil would then be placed on top of the clean fill. Once in place, the soil layer would be seeded.

During the construction phase of this alternative, temporary erosion control measures would be in place. These measures would remain in place until a vegetative cover was established.

Postclosure monitoring and maintenance of the installed cover system would be required until the cover system stabilized. This monitoring program would include visual inspections and maintenance of the vegetative cover. For cost estimating purposes, monitoring is estimated for a minimum of 30 years after closure.

Groundwater monitoring was not included in the postclosure monitoring because no unacceptable risks were identified in site groundwater. Additionally, groundwater is currently being investigated as a separate site at NAS Whiting Field.

In addition, LUCs and 5-year reviews would be implemented as previously discussed. The 5-year site review will assess the need for continued landfill monitoring.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

This chapter presents detailed analyses of alternatives for Site 2 at NAS Whiting Field. A detailed analysis is performed to provide decision makers with sufficient information to select the appropriate remedial alternative for a site. The detailed analysis has been conducted in accordance with CERCLA Section 121, the NCP, and USEPA RI/FS guidance (USEPA, 1988). The detailed evaluation of each remedial alternative includes the following:

- a detailed description of the alternative, emphasizing the applications of the technology or actions proposed for each alternative; and
- a detailed analysis of the alternative against seven of the nine criteria.

The remedial alternatives are examined with respect to the requirements stipulated by CERCLA and factors described in the USEPA's *Guidance for Conducting RI/FS Under CERCLA* (USEPA, 1988). The nine criteria from the RI/FS guidance document are

- overall protection of human health and the environment,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction of toxicity, mobility, and volume of contaminants through treatment,
- short-term effectiveness,
- implementability,
- cost,
- State acceptance, and
- community acceptance.

This FS presents evaluation of the first seven criteria in the alternative evaluation process. Table 4-1 outlines the specific elements considered for these seven criteria.

Typically, State acceptance (i.e., the eighth criteria) is addressed when comments on the draft FS report have been received from the State of Florida. Therefore, State comments will be addressed in the final FS report, and a summary of State acceptance of this FS will be included in the final FS report.

Community acceptance (i.e., the ninth criteria) is addressed upon receipt of public comments on the proposed plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

4.1 DETAILED ANALYSIS FOR ALTERNATIVE 1: NO ACTION. Alternative 1 is a no action alternative. Under this alternative, no actions would be taken to address contamination at the site. A description of this alternative is presented in Subsection 4.1.1, and a technical assessment of this alternative is presented in Subsection 4.1.2.

4.1.1 Detailed Description of Alternative 1 In accordance with the NCP, the no-action alternative is used as a baseline for comparison against other alterna-

Table 4-1
Criteria for Detailed Analysis of Remedial Alternatives

Feasibility Study
Site 2, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Criteria	Considerations
Overall protection of human health and the environment	How risks are eliminated, reduced, or controlled. Short-term or cross-media effects.
Compliance with ARARs	Compliance with chemical-specific ARARs. Compliance with location-specific ARARs. Compliance with action-specific ARARs.
Long-term effectiveness and permanence	Magnitude of residual risk. Adequacy of controls. Reliability of controls.
Reduction of mobility, toxicity, and volume of contaminants through treatment	Treatment process and remedy. Amount of hazardous materials destroyed or treated. Reduction of mobility, toxicity, or volume through treatment. Irreversibility of treatment. Type and quantity of treatment residual.
Short-term effectiveness	Protection of community during remedial action. Protection of workers during remedial action. Environmental effects. Time until RAOs are achieved.
Implementability	Ability to construct technology. Reliability of technology. Ease of undertaking additional remedial action, if necessary. Coordination with other agencies.
Cost	Capital cost. Operation and maintenance cost. Total present worth of alternative.

Notes: ARAR = applicable or relevant and appropriate requirement.
RAO = remedial action objective.

tives. Because hazardous substances, pollutnats, or contaminants would be left in place at Site 2 as part of this alternative, this alternative would include 5-year site reviews. There would be no restrictions on land-use types; therefore, the site could be used for residential use or other high-exposure uses.

Five-Year Site Reviews. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. It is assumed, for this FS, that these reviews would occur over a 30-year period. These reviews would consist of evaluating changes to site conditions at the site (e.g., construction, demolition, change in potential receptors, migration pathways, qualitative risks, etc.) to assess whether or not human health and the environment continue to be protected by the alternative. The appropriateness of this alternative would then be compared to other remedial alternatives to confirm that it is still the most appropriate selection.

4.1.2 Technical Criteria Assessment of Alternative 1 This subsection provides the technical criteria assessment of Alternative 1 against the seven criteria.

Overall Protection of Human Health and the Environment. This alternative would provide no additional protection to human receptors who may be exposed to soil at Site 2. If this alternative were selected, 5-year site reviews would be instituted.

No adverse short-term or cross-media effects are anticipated with this no-action alternative.

Compliance with ARARs. This alternative would not comply with chemical-specific ARARs or TBCs (e.g., MCLs, FGGCs, or Florida Soil Cleanup Goals [FSCG]) in the short term.

Long-Term Effectiveness and Permanence. Human risks due to exposure to site soil would not be addressed via this alternative. Therefore, these risks would remain over a period of time until natural processes reduce the contaminant concentrations and reduce the mobility of the contaminants or other LUCs are implemented.

Administrative actions proposed in this alternative (e.g., 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative, but would not provide a permanent remedy for the site. Administrative actions are considered to be reliable controls.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. This alternative would not provide a reduction in contaminant mobility or volume because no active mitigation of contaminant mobility or reduction in volume is proposed. No treatment residuals would be produced if this alternative were implemented.

Short-Term Effectiveness. This alternative would not reduce human health risks in the short term because no land-use restrictions would be implemented.

This alternative would not comply with RAOs in the short term because the only means of contaminant reduction posed by this alternative is natural degradation processes.

This alternative does not pose a threat to workers through exposure to contaminated soil because remedial construction activities are not proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as 5-year site reviews are easily implemented.

Cost. The present worth cost of Alternative 1 is presented on Table 4-2. The 5-year site reviews proposed out over a 30-year monitoring period. A 30-year period was chosen only because the RI/FS guidance suggests using this time frame. The total present worth cost of Alternative 1 is $23,000. Cost estimates are presented in Appendix C.

Table 4-2
Cost Summary Table, Alternative 1: No Action

Feasibility Study
Site 2, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Operation and Maintenance Cost (O&M) (per event)		
5-year site review		$6,000
	Total O&M cost (per event)	$6,000
	Total O&M cost (present worth of semiannual O&M for 30 years)	$21,000
	Contingency (10 percent)	$2,000
	Total cost of Alternative 1: No Action	$23,000

4.2 DETAILED ANALYSIS FOR ALTERNATIVE 2: SITE CLOSURE. Alternative 2 consists of administrative actions to limit the exposure to soil at Site 2. A description of this alternative is presented in Subsection 4.2.1, and a technical assessment of this alternative is presented in Subsection 4.2.2.

4.2.1 Detailed Description of Alternative 2 Under this alternative, LUCs would be implemented that would provide protection of human receptors. These LUCs would involve the use of institutional controls, which would restrict land use to nonresidential uses in the vicinity of Site 2. Additionally, LUCs would place regulatory controls on the excavation of soil or similar activities that have the potential to disturb the site soil or increase the likelihood of exposure to the site soil. The LUCs would be placed on a parcel of land slightly larger than the boundaries of the current disposal area. This would ensure that an appropriate buffer zone is created and maintained between the disposal area and other areas of NAS Whiting Field.

The following components would be included as part of this alternative:

- LUCs
- site closure plan
- 5-year site reviews

LUCs. Under new USEPA Region IV guidance, the use of LUCs as a remedy for contaminated sites requires the development of an LUC Assurance Plan (LUCAP) and

an LUC Implementation Plan (LUCIP). These two documents detail the actions required when LUCs are selected as a remedy for a site.

The LUCAP is developed for the entire facility on which LUCs are necessary. In this case, an LUC Assurance Plan (LUCAP) would be developed for NAS Whiting Field. This document would identify an individual at the facility who is responsible for ensuring that no activities occur at a site where LUCs are necessary that would violate what has been specified in the LUCs.

The LUCIP is then developed for each site where LUCs are necessary on the facility. The LUCIP would include details regarding additional required activities, such as quarterly and annual inspection and reporting for the specific area. These measures ensure that the selected LUCs will remain adhered to through time.

Site Closure Plan. A closure and postclosure plan for Site 2 would be prepared in accordance with Florida landfill closure regulations (Chapter 62-701, Parts 600 and 610, FAC, and 40 CFR, Part 300). This plan would describe the planned operations, maintenance, and monitoring of Site 2 upon closure. The closure plan would be certified by an independent Florida-registered Professional Engineer.

5-Year Site Reviews. Refer to Subsection 4.1.1 for a detailed description of these reviews.

4.2.2 **Technical Criteria Assessment of Alternative 2** This subsection presents the technical criteria assessment of Alternative 2.

Overall Protection of Human Health and the Environment. Human receptors, namely residents, would be protected if this alternative were implemented. Regulatory controls (i.e., LUCs) would prohibit potential future residents from exposure to the site because residential use of the site would be restricted under the proposed LUCs. However, this alternative would not provide protection for ecological receptors at the site.

The threat to adult and adolescent trespassers is considered to be minimal. Access to the base is restricted and continued operation of the base is expected. Additionally, the site is remote (i.e., far from base housing), and the risk only slightly exceeds the FSCGs.

By implementing this alternative, no adverse short-term or cross-media effects are anticipated.

Compliance with ARARs. This alternative would not comply with chemical-specific ARARs or TBCs (e.g., MCLs, FGGCs, or FSCGs) in the short term. Eventually, this alternative may comply with ARARs if natural processes in the soil and groundwater reduce contaminant concentrations.

Long-Term Effectiveness and Permanence. The risks presented to the future resident based on exposure to surface soil at the site would be addressed via the LUCs. The long-term effectiveness and permanence of these controls will be controlled by the facility under the LUCAP developed for NAS Whiting Field.

Administrative actions proposed in this alternative (e.g., LUCs and 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative.

These administrative actions are considered to be reliable controls, as long as the facility maintains its LUCAP/LUCIP.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. This alternative would not provide a reduction in contaminant mobility or volume because no active mitigation of contaminant mobility or reduction in volume is proposed. No treatment residuals would be produced if this alternative were implemented.

Short-Term Effectiveness. Alternative 2 would reduce human health risks in the short term by reducing the potential exposure to Site 2 soils by human receptors. However, ecological receptors would not be affected by implementation of this alternative.

The threat to adult and adolescent trespassers is considered to be minimal. Access to the base is restricted, and continued operation of the base is expected. Additionally, the site is remote (i.e. far from base housing), and the risk only slightly exceeds the FSCGs.

This alternative does not pose a threat to workers through exposure to contaminated soils because only limited remedial construction activities (e.g., posting signs) are proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as LUCs and 5-year site reviews, are easily implemented.

Cost. The present worth cost of Alternative 2 is presented on Table 4-3. Both the LUCs and 5-year site reviews were costed out over a 30-year monitoring period. A 30-year period was chosen only because that is what the RI/FS guidance recommends. The total present worth cost of Alternative 2 is $193,000. Cost estimates are presented in Appendix C.

Table 4-3
Cost Summary Table, Alternative 2: Site Closure

Feasibility Study
Site 2, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Direct Cost		
Land-use controls and Site Closure Plan		$21,000
	Total direct cost	$21,000
Operation and Maintenance Cost (O&M) (per event)		
5-year site review		$ 6,000
Annual Operation and Maintenance Costs		$10,000
	Total O&M cost (per event)	$ 16,000
	Total O&M cost (present worth of annual O&M for 30 years)	$154,000
	Total Direct and O&M	$175,000
	Contingency (10 percent)	$18,000
	Total cost of Alternative 2: Site Closure	$193,000

4.3 DETAILED ANALYSIS FOR ALTERNATIVE 3: SITE CLOSURE AND SOIL COVER. Alternative 3 will consist of all of the activities detailed in Alternative 2 with the addition of the construction of an engineered soil cover at Site 2. A description of this alternative is presented in Subsection 4.3.1, and a technical criteria assessment of this alternative is presented in Subsection 4.2.2.

The design criteria presented in this section are intended for cost comparison purposes only and are not intended to be final design specifications. If Alternative 3 is the selected remedy for Site 2, it is recommended that land surveying, additional field sampling, and geotechnical testing be completed prior to preparing design plans and specifications. Final design plans and specifications should be prepared and sealed by a Florida-registered Professional Engineer.

4.3.1 Detailed Description of Alternative 3 Alternative 3 is designed to address closure of the disposal area and exposure to surface soil at Site 2.

The selected disposal area cover design for Alternative 3 is primarily based on the Florida landfill closure regulations (Florida landfill closure regulations [Chapter 62-701.600 and 62-701.610, FAC]). These regulations were used to develop appropriate criteria for a soil cover design and to formulate a cost estimate for the detailed evaluation of this alternative (USEPA, 1991b). The components of this site closure and covering alternative are described below.

- Site preparation, clearing, and grubbing
- Disposal area covering
- Surface water drainage
- Postclosure care

Where RCRA closure is not applicable, the Superfund program has been using hybrid closure alternatives. The proposed hybrid closure alternative for Site 2 is the alternate land disposal closure. Alternate land disposal closure is identical to RCRA landfill closure except that the cover requirements are relaxed due to wastes at low concentrations, but still above "walk-away" levels (USEPA, 1988b; 40 CRF, Part 300, Volume 53, Number 245).

Site Preparation, Clearing, and Grubbing. A stockpile area, with a 12-inch-thick gravel base, would be installed at the site and would be large enough to provide sufficient volume for several days of filling and grading operations associated with this alternative. An area adjacent to the stockpile area would be prepared with a 12-inch-thick gravel base to be used as a parking area for construction-support trailers and heavy equipment. Equipment mobilized to the site would include earth-moving equipment such as backhoes, front-end loaders, bulldozers, and dump trucks.

Surface debris, consisting primarily of wooden debris, was observed at Site 2. All surface debris will be removed with a trackhoe or other type of excavation equipment prior to grading Site 2. The debris will be removed prior to construction of the disposal area cover to avoid stability impacts of settlement. The debris will be staged on site at a designated location. The debris will then be characterized for disposal at either a construction and demolition debris disposal facility or an RCRA-permitted hazardous waste disposal facility. Based on information collected during the RI, it is anticipated that the debris can be disposed of as nonhazardous material. Partially- or fully-buried debris will be

left in place and covered during the site grading and placement of the compacted soil cover.

The topography relief at Site 2 is assumed to be a 25 feet, extending to the site boundary, with steep slopes at the edge. Only ten percent of the site is assumed to be covered by trees; a dense layer of kudzu covers the remainder of the site. Pine trees, shrubs, and other vegetation will be cleared with a trackhoe or other type of excavation equipment to provide a cleared surface for placement of the disposal area cover. Small brush and vegetation will be chopped and spread over the disposal area surface. Large trees will be disposed of as yard waste at an appropriate mulching or tree recycling facility, or chipped and spread over the disposal area surface prior to construction of the soil cover.

Soil Cover. Because risks to human and ecological receptors based on exposure to groundwater were not identified, there is no need to prevent infiltration through the soil cover. A fine-grained soil layer (145,700 cubic yards [yd^3]) with a compacted permeability (1×10^{-5} centimeters per second) will be obtained from an off-site borrow source (FDEP, Chapter 62-701.600, FAC for Class III landfills 7-6-98). The borrow soil will be tested to verify that it is "clean" fill and exhibits a pH between 6 and 7.5 standard units (SUs). One composite sample will be collected and analyzed for TAL metals and CLP VOCs to ensure that the soil is "clean" fill.

This soil will be compacted with a sheepsfoot or smooth roller to achieve a structurally stable surface. The final cover design will consist of a minimum 1.5-foot soil cover, and side slopes of an angle no greater than a 3 to 1 ratio (18.7 degree angle) to maintain structural stability.

A final 6-inch layer of soil (10,400 yd^3) will be placed over the compacted soil to support vegetative growth. The soil will be obtained from an off-site borrow source to provide the adequate soil composition required to stimulate and support natural vegetation. The soil will be tested by taking one composite sample, collected and analyzed for TAL metals and CLP volatiles to verify that it is "clean" fill and exhibits a pH between 6 and 7.5 SUs.

Selected seed and fertilizer will be placed on the vegetative support layer to establish vegetation. Hay will be used to protect the seed and fertilizer during initial development. Postclosure care will include provisions to stimulate growth. The vegetative cover will minimize erosion by developing root systems within the vegetative support layer, which overlies the compacted soil cover material. The vegetation will also provide evapotranspiration of moisture contained in the soil cover, which will increase the cover's structural stability.

Surface Water Drainage. Natural surface water drainage that exists at the site will be maintained to the extent possible. The final topographic surface and permeability of the disposal area cover will allow drainage, which emulates current conditions closely.

Postclosure Care. Postclosure care will consist of the activities listed below, performed on an annual basis for a period of 5 years after cover construction.

- Visually inspecting, seeding, watering, and otherwise maintaining the vegetation on the surface of the closed disposal area.

- Visually inspecting the disposal area cover for signs of wear or discontinuities, such as seeps, pits, cracks, or other imperfections that may compromise the cover's structural integrity.

4.3.2 Technical Criteria Assessment of Alternative 3 This subsection presents the technical criteria assessment of Alternative 3.

Overall Protection of Human Health and the Environment. Protection of human receptors would be provided by the implementation of this alternative in that a disposal area cover and regulatory controls (i.e., LUCs) would prohibit potential human receptors from coming into contact with the soils at Site 2. This alternative would also provide protection for ecological receptors at the site; however, in doing so, this alternative may alter the native ecological habitat present at the site.

Compliance with ARARs. Landfill closure requirements under RCRA Subtitles C and D, as well as Florida Solid Waste Disposal Facilities Regulations, were appropriately followed concerning the soil cover design. The landfill cover proposed is based on the memorandum regarding the applicability of soil cleanup goals for Florida (FDEP, 1996) and guidance was provided by Florida regulations in Chapter 62-701.600, FAC.

Worker safety standards will be maintained during construction activities to comply with ARARs. Dust control will be used to minimize the spread of wind-blown soil during site grading. A site-specific health and safety plan will be developed and implemented during all site activities. However, contact with disposal area wastes is not anticipated during construction of the cover.

Five-year site reviews will be prepared to assess the effectiveness of the alternative.

Long-Term Effectiveness and Permanence. The construction of a soil cover will prevent human health risks posed by dermal contact, ingestion, and inhalation of surface soil and wind-blown particulates and ecological risks.

Alternative 3 can be viewed as a permanent method of reducing or eliminating human health risks posed by dermal contact, ingestion, and inhalation of surface soil and wind-blown particulates if the cover stability shows permanence after completion of the 5-year review.

Similar to human health risk reduction, the soil cover will also be designed to prevent risks posed to ecological receptors. A vegetative cover will be placed over the compacted soil to allow growth of native vegetation. The vegetation will increase evapotranspiration and reduce cover erosion. The risk posed to local species by ingesting biota that contain contaminants in their tissue, or by directly ingesting surface soil that contains contaminants, will be eliminated by placement of the compacted soil.

Alternative 3 will include clearing and grubbing vegetation that currently exists on the disposal area. Existing vegetation will be removed, and ecological diversity will be reduced at Site 2. This ecological loss is not permanent; new vegetation will be planted on the final cover to induce continued ecological growth. However, this new vegetation will consist of mostly grass and small brush, which is not quite as diverse as the natural vegetation that currently

exists (due to the removal of some trees). The clearing and grubbing of the existing vegetation can be viewed as a permanent long-term ecological impact.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Alternative 3 does not include treatment of contaminants, and does not physically or chemically alter contaminants contained in the disposal area. Thus, this alternative does not reduce the toxicity, mobility, and/or volume of contaminants through treatment. However, the cover design will effectively reduce the mobility of contaminants contained in surface soil by preventing the spread of wind-blown particulates. The cover will also prevent the uptake of contaminants contained in surface soil, which will prevent biomagnification of contaminants through the local ecological food chain.

Short-Term Effectiveness. During the clearing, grubbing, and grading of the site, fugitive dust will be generated. This dust may contain hazardous particulates that pose an inhalation risk to human receptors. Dust suppression by the use of water trucks and hoses is included in this alternative to minimize these potential short-term risks.

Site workers will be exposed to increased risks by dermal contact, ingestion, and inhalation during construction activities. Appropriate personal protective equipment can be used to minimize this increased risk.

Alternative 3 will include clearing and grubbing vegetation that currently exists. Ecological species that depend upon the surface of the disposal area for food and other natural resources will be impacted by the removal of existing vegetation. This unavoidable construction item is an adverse short-term impact that will be reversed upon the growth of new vegetation. Construction operations are expected to last for 2 to 3 months, and new vegetation will likely require years to mature. Thus, the short-term ecological impacts as a result of clearing and grubbing the site may be significant.

Implementability. Equipment and materials are readily available to construct the cover designed for Alternative 3. Site work will be completed within a 3-month period, and will require standard construction expertise. Because of the difficulty in obtaining borrow soil in the vicinity of the site, compacted soil will be obtained from a nonlocal borrow source. The lack of local borrow sources would result in additional transportation cost, but does not render the alternative infeasible.

Cost. The cost estimate for Alternative 3 is presented in Table 4-4, and detailed cost calculations are provided in Appendix C. This estimate is based on the preliminary design criteria presented in this section. If this alternative is selected, land surveying, additional field sampling, and geotechnical testing should be performed during design to prepare a complete set of design plans and specifications. The total present worth cost of Alternative 3 is approximately $4,342,000.

Table 4-4
Cost Summary Table, Alternative 3: Site Closure and Capping

Feasibility Study
Site 2, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Direct Cost		
Mobilization		$30,000
Site preparation		$23,000
Site clearing and grubbing		$16,000
Soil cover		$2,566,000
Vegetative support layer		$184,000
Dust control		$15,000
Site restoration		$37,000
Land-use controls		$17,000
Site closure plan		$2,000
	Total direct cost	$2,890,000
Indirect Cost		
Health and safety (3 percent)		$86,700
Administration and permitting (3 percent)		$86,700
Engineering and design (10 percent)		$289,000
Construction support services (10 percent)		$289,000
	Total indirect cost	$751,400
	Total capital cost (direct + indirect)	$3,641,400
Operation and Maintenance (O&M) Cost		
Land-use controls		$114,000
5-year site review		$20,000
	Total O&M cost	$134,000
	Total Capital and O&M costs	$3,775,400
	Contingency (15 percent)	$566,300
	Total cost of Alternative 3: Site Closure and Capping	$4,341,700

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Remedial alternatives for Site 2 were developed in Chapter 3.0 and were individually evaluated in Chapter 4.0 using seven technical criteria. For comparative purposes, these criteria are grouped into the following categories:

- threshold criteria,
- primary balancing criteria, and
- modifying criteria.

The remainder of this chapter presents a comparison of remedial alternatives with respect to these criteria. This comparison is intended to provide technical information required to support the selection of a preferred alternative for Site 2.

5.1 OVERALL APPROACH TO COMPARATIVE ANALYSIS. As presented in Chapter 4.0, remedial alternatives were developed to accomplish the RAOs identified for the site. The three sets of criteria identified above are used to streamline the comparison between alternatives, while ensuring compliance with the RAOs. Components of these criteria are described below.

5.1.1 Threshold Criteria Because the selected remedy must be protective of human health and the environment, as well as comply with ARARs, the following two threshold criteria are essential:

- overall protection of human health and the environment, and
- compliance with ARARs.

An individual assessment of each alternative with respect to these criteria was presented in Chapter 4.0. An overall comparative analysis of alternatives using threshold criteria is presented in Section 5.2.

5.1.2 Primary Balancing Criteria Primary balancing criteria consist of the following five components:

- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume of contaminants through treatment;
- short-term effectiveness;
- implementability; and
- cost.

These criteria are used to provide an assessment of the permanence of each remedial alternative, while ensuring their implementability and cost effectiveness. An individual assessment of each alternative with respect to these criteria is presented in Chapter 4.0. An overall comparative analysis of alternatives using primary balancing criteria is presented in Section 5.2.

5.1.3 **Modifying Criteria** The final two criteria are as follows:

- State acceptance, and
- community acceptance.

Typically, State acceptance (i.e., the eighth factor of the modifying criteria) is addressed when comments on the draft FS report have been received from the State. Therefore, State comments will be addressed in the final FS report, and a summary of State acceptance of this FS will be included in the final FS report.

Community acceptance (i.e., the ninth factor of the modifying criteria) is addressed upon receipt of public comments on the proposed plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

Based on this information, an evaluation of modifying criteria is not included in this FS.

5.2 **COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE 2**. This section provides the comparative analysis for remedial alternatives for Site 2 with respect to the criteria described in Section 5.1.

5.2.1 **Comparison of Threshold Criteria** The remedial alternatives for Site 2 were first compared to the two threshold criteria, overall protection of human health and the environment, and compliance with ARARs.

Alternative 1 does not provide a means of restricting future land use of the area. Therefore, this alternative does not protect potential future residents from environmental conditions at the site. RAO 2 (landfill closure) was established based on compliance with ARARs for the site. Alternative 1 would not achieve RAO 2; therefore, it would not achieve ARARs.

The implementation of Alternative 2 would provide a measure of continued protection of human health and the environment because the alternative includes LUCs and a site closure plan. In this manner, Alternative 2 would achieve the RAOs established for the site, and would therefore achieve ARARs.

Alternative 3 would also achieve the RAOs, but would adversely affect the existing environment at the site. Construction of a cap would result in some habitat destruction at the site. Implementation of Alternative 3 may also have potential short-term effects of exposure to site workers.

5.2.2 **Comparison of Primary Balancing Criteria** The primary balancing criteria emphasize long-term effectiveness and permanence and reduction in mobility, toxicity, and volume of contaminants through treatment. The alternatives evaluated for Site 2 would not reduce the toxicity, mobility, or volume of contaminants at the site because none of the alternatives involve treatment of contaminants in media at the site. Alternative 3 would provide a reduction in the leaching of contaminants from waste at the disposal area; however, it does not appear that contaminants are currently leaching from wastes to the groundwater.

Alternative 3 would provide the greatest direct adverse short-term impacts on potential ecological receptors via clearing and grubbing activities. These impacts could be mitigated if Alternative 2 were implemented. No short-term impacts to the environment are expected during implementation of Alternative 2.

The implementability of Alternative 2 would be comparatively easy. However, a LUCAP and LUCIP would need to be developed. The documents should be easy to complete, but implementation of the LUCs may be extended until agreement is reached among the regulatory agencies as to the format for these documents at NAS Whiting Field. Alternative 2 carries with it long-term agreement conditions including periodic reevaluation requirements.

The implementation of Alternative 3 would be the most difficult and time consuming. Further, because accurate topographic data does not exist for the site a detailed site survey would have to be performed prior to implementation. Detailed design plans would also be required. The appropriate substantive requirements of the permit requirements for landfill capping would also need to be met prior to implementation of this alternative. Additionally, given the lack of accurate topographic conditions at the site, costs associated with Alternative-3, as detailed in Section 4.0, are the least accurate. Therefore, actual implementation costs of this alternative could be substantially greater if assumptions regarding the current topography of the site prove to be inaccurate. Regardless of topographic conditions, Alternative 3 would be the most costly of the alternatives evaluated.

Groundwater will be addressed as a separate site and only remedy proposed for sitewide groundwater shall take into consideration the effects on the specific remedy selected for Site 2. The investigation at Site 40 may include additional sampling or any other investigations necessary for assessment of the soil and groundwater at the site.

5.2.3 **Modifying Criteria** As stated in Subsection 5.1.3, an evaluation of modifying criteria will not be included in this FS.

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USEPA. 1991b. *Design and Construction of RCRA/CERCLA Final Covers.* Office of Research and Development. Washington, D.C. (May).

USEPA. 1992. *Draft Technical Manual for Solid Waste Disposal Facility Criteria.*

APPENDIX A

NAVY'S REQUEST FOR SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC AT COVERED LANDFILL SITES AT NAS WHITING FIELD

Appendix A

Evaluation of Background Arsenic Concentrations for Covered Landfill Sites

Naval Air Station (NAS) Whiting Field, Milton, Florida

At NAS Whiting Field nine soil types, as identified by the U. S. Department of Agriculture, Soil Conservation Service (USSCS), are present. The Remedial Investigation (RI) sites at NAS Whiting Field are associated with seven of the nine soil types. The background surface soil data set for each RI site was initially determined to be comprised of background surface soil samples from the same USSCS soil types as occur on the individual sites. However, available information and review of historical aerial photographs indicated that in the construction of landfills at the facility, a borrow pit was dug to an approximate depth of 10 to 15 feet below land surface (bls) and the excavated soil was piled to the side. Following landfill operations, the borrow materials comprised of undifferentiated surface and subsurface soils, were used for the landfill cover. Any additional soils required to complete the landfill cover are believed to have been obtained from other borrow pits located at the facility.

If a mix of surface and subsurface soils were used in the cover for landfills, it would be appropriate to use the combined data set of surface and subsurface soil samples as the background screening value. However in order to be protective of human health and the environment, it is proposed that the background surface and subsurface data set be combined to a single value as be used as the "Industrial Use Soil Cleanup Goal". This modified "Industrial Use Soil Cleanup Goal" is specifically limited to the covered landfill sites including: Site 1, 2, 9, 10, 11, 13, 14, 15, and 16 and to the inorganic analyte arsenic.

Tables 3-8 through 3-18 in the General Information Report (ABB-ES, 1998) present the detected concentrations and summarize the analytical data for the individual background soil samples collected at NAS Whiting Field. A summary of the arsenic background data set and the modified "Industrial Use Soil Cleanup Goal" for arsenic is presented Table A-1. As indicated on the table the modified "Industrial Use Soil Cleanup Goal" for arsenic to be used at covered landfill sites is 4.62 mg/kg.

Table A - 2
Comparison of Detected Arsenic Concentrations in Surface and Subsurface Soil Samples to Florida Soil Cleanup Goals

Remedial Investigation
Naval Air Station
Whiting Field, Florida

Analyte	Minimum Detected Concentration	Maximum Detected Concentration	Mean of Detected Concentrations	Soil Cleanup Goals for Florida (Residential)[1]	Soil Cleanup Goals for Florida (Industrial)[1]	modified Industrial Use Cleanup Goal[2]
Inorganic Analyte (mg/kg)						
Arsenic	0.52	6.3	2.31	0.8	3.7	4.62

[1] Source: FDEP Memorandum from John Ruddell, Director Division of Waste Management, to District Directors and Waste Program Administrators. Subject: Applicability of Soil Cleanup Goals for Florida, January 19, 1996.
[2] The modified Industrial Use Cleanup Goal for arsenic is twice the mean of detected concentrations in the surface and subsurface soil samples.

Notes: mg/kg = milligram per kilogram.

APPENDIX B

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S RESPONSE AND ACCEPTANCE OF THE SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC AT COVERED LANDFILL SITES AT NAS WHITING FIELD

Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

April 27, 1998

Ms. Linda Martin
Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, PO Box 190010
North Charleston, SC 29419-9010

file: arsenic1.doc

RE: Request for Site-Specific Arsenic Soil Cleanup Levels: Covered Landfill Sites, NAS Whiting Field

Dear Ms. Martin:

I have reviewed the request for approval of a site-specific Soil Cleanup Goal for arsenic at the "covered landfill sites" at NAS Whiting Field from Mr. Gerald Walker, ABB Environmental Services, dated April 22, 1998 (received April 22, 1998). Based on the prior presentation to Department Staff and the summary information furnished in the letter and the attached Appendix I, the request is granted to utilize a site-specific Soil Cleanup Goal for arsenic of 4.62 mg/kg at Sites 1, 2, 9, 10, 11, 12, 13, 14, 15 and 16., with the following conditions:

1. The sites may be utilized for activities that involve less than full-time contact with the site. This may include, but is not limited to, a.) parks b.) recreation areas that receive heavy use (such as soccer or baseball fields) or, c.) agricultural sites where farming practices result in moderate site contact (approximately 100 days/year, or less).

2. The Navy must assure adherence to the land use by incorporating the site and conditions in a legally binding Land Use Contol agreement.

3. The above Soil Cleanup Goal shall not be utilized at any other site without specific Department approval.

If you have questions or require further clarification, please contact me at (904) 921-4230.

Sincerely,

James H. Cason, P.G.
Remedial Project Manager

APPENDIX C

COST CALCULATIONS FOR REMEDIAL ALTERNATIVES

ALTERNATIVE #1: NO ACTION - SITE 2

	Quantity	Unit	Unit Cost	Total Cost
FIVE YEAR SITE REVIEW COSTS				
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	20	hrs	$90.00	$1,800
Mid-level Engineer	30	hrs	$60.00	$1,800
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total 5-year costs				*$6,360*
Present Worth of 5-year costs at i= 6%				*$20,783*
TOTAL FIVE YEAR SITE REVIEW COSTS				**$20,783**
CONTINGENCY @ 10 PERCENT				**$2,078**
TOTAL COST OF ALTERNATIVE #1				**$22,862**

ALTERNATIVE #2: SITE CLOSURE - SITE 2

	Quantity	Unit	Unit Cost	Total Cost
FIVE YEAR SITE REVIEW COSTS				
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	20	hrs	$90.00	$1,800
Mid-level Engineer	30	hrs	$60.00	$1,800
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total 5-year costs				*$6,360*
Present Worth of 5-year costs at i=6%				*$20,783*
TOTAL FIVE YEAR SITE REVIEW COSTS				**$20,783**
Land Use Controls and Site Closure Plan				
Direct Costs				
Survey Plat	1	lump sum	$7,500.00	$7,500
Land Use Restriction Fees (Filling, Legal, etc.)	1	lump sum	$5,000.00	$5,000
Land Use Implementation Plan				
Senior Scientist	20	hrs	$90.00	$1,800
Mid-level Engineer	80	hrs	$60.00	$4,800
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Site Closure Plan				
Senior Scientist	5	hrs	$90.00	$450
Mid-level Engineer	20	hrs	$60.00	$1,200
ODCs (includes photocopying, etc.)	1	lump sum	$500.00	$500
Total Direct Costs for Land Use Controls and Site Closure Plan				$21,500
Annual Operation and Maintenance Costs				
Quarterly Inspection				
Senior Scientist	0	hrs	$90.00	$0
Mid-level Engineer	80	hrs	$60.00	$4,800
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$320.00	$320
Quarterly Reporting				
Senior Scientist	8	hrs	$90.00	$720
Mid-level Engineer	32	hrs	$60.00	$1,920
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$1,000.00	$1,000
Annual Reporting				
Senior Scientist	2	hrs	$90.00	$180
Mid-level Engineer	8	hrs	$60.00	$480
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$250.00	$250
Total Annual Operation and Maintenance Costs				$9,670
Present Worth of Land Use Control costs at i=6%				*$133,108*

ALTERNATIVE #2: SITE CLOSURE - SITE 2

	Quantity	Unit	Unit Cost	Total Cost
TOTAL LAND USE CONTROL COSTS and SITE CLOSURE PLAN				$154,608
COST OF ALTERNATIVE #2				$175,391
CONTINGENCY @10 PERCENT				$17,539
TOTAL COST OF ALTERNATIVE #2				$192,930

ALTERNATIVE #3: SITE CLOSURE AND SOIL COVERING, SITE 2

	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
TOTAL DIRECT COSTS				
Mobilization				
Miscellaneous				
Office Trailer	7	mon	$150.00	$1,050
Storage Trailer	7	mon	$150.00	$1,050
Trailer Delivery, Setup, Removal	7	each	$300.00	$2,100
Telephone Service	7	mon	$50.00	$350
Electrical Hookup/Power	7	mon	$50.00	$350
Toilet/Water Cooler Service	7	mon	$50.00	$350
Miscellaneous Equipment	1	LS	$2,500.00	$2,500
Labor (Site Preparation)				
Electrician (2 men @ 5 days @ 10 hrs/day)	100	hrs	$42.00	$4,200
Carpenter (2 men @ 5 days @ 10 hrs/day)	100	hrs	$42.00	$4,200
Foreman (1 man @ 5 days @10 hrs/day)	50	hrs	$60.00	$3,000
Equipment (Mobilization)				
Front End Loader	4	each	$500.00	$2,000
Dozer	4	each	$500.00	$2,000
Grad-all	4	each	$500.00	$2,000
Dump Truck (15 cyd)	10	each	$250.00	$2,500
Water Truck	1	each	$250.00	$250
Backhoe	2	each	$250.00	$500
Pressure Washer	1	each	$250.00	$250
Equipment	1	LS	$1,200.00	$1,200
General Site Mobilization	1	LS	$250.00	$250
Mobilization				**$30,100**
Site Preparation				
Labor (Site Preparation)				
Laborers (2 men @ 2 days @ 8 hrs/day)	32	hrs	$36.00	$1,152
Foreman (Labor included in Mobilization)				
Equipment and Disposal Costs				
Backhoe and Operator	2	days	$1,200.00	$2,400
Front End Loader and Operator	2	days	$700.00	$1,400
Micellaneous Tools	1	LS	$300.00	$300
Trans and Disposal - Wood Debris	3	tons	$69.00	$207
Silt fencing	3300	lf	$5.00	$16,500
Signs	8	ea	$50.00	$400
Site Preparation				**$22,359**

ALTERNATIVE #3: SITE CLOSURE AND SOIL COVERING, SITE 2

	Quantity	Unit	Unit Cost	Total Cost
Clearing and Grubbing				
Foreman (1 wk @ 50 hrs/wk)	50	hrs	$60.00	$3,000
Grubbing, Removal and Stockpile (Labor Included)	1.4	acres	$3,500.00	$4,900
Transport and Disposal (Grub and Stumps)	120	tons	$69.00	$8,280
Clearing and Grubbing				**$16,180**
Soil Cover - 13.6 Acres				
Grade Site (4 Dozers and Operators)	4	dy	$1,650.00	$6,600
Common Fill - minimum 1.5' layer, Purchase & Haul	145600	cy	$15.00	$2,184,000
Common Fill - min. 1.5' layer, Spread & Compact	145600	cy	$2.00	$291,200
Site Superintendant (28.0 wks @ 50 hrs/wk)	1400	hr	$60.00	$84,000
Soil Cover				**$2,565,800**
Vegetative Support Layer				
Topsoil - 6" layer, Purchase & Haul	10400	cy	$15.00	$156,000
Topsoil - 6" layer, Spread	10400	cy	$1.00	$10,400
Site Superintendant (3 days @ 10 hrs/day)	270	hrs	$60.00	$16,200
TAL/TCL Analysis	1	ea	$900.00	$900
Vegetative Support Layer				**$183,500**
Dust Control				
Water Truck and Driver	28	wk	$550.00	$15,400
Dust Control				**$15,400**
Site Restoration				
Fertilize, Seed, Mulch	14	acres	$2,000.00	$27,200
Demob of equipment	1	LS	$10,000.00	$10,000
Site restoration				**$37,200**
Land Use Controls - Direct Costs				
Total LOE for Implementation Plan				$4,200
Total ODCs for Implementation Plan				$250
Survey Plat				$7,500
Land Use Restriction Fees (Filling, Legal, etc.)				$5,000
Land Use Controls - Direct Costs				**$16,950**
Site Closure Plan (see Alternative #2)				
Total LOE for Closure Plan				$1,650
Total ODCs for Closure Plan				$500
Site Closure Plan				**$2,150**
TOTAL DIRECT COSTS				**$2,889,639**

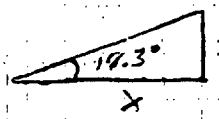
ALTERNATIVE #3: SITE CLOSURE AND SOIL COVERING, SITE 2

	Quantity Unit	Unit Cost	Total Cost
INDIRECT COSTS			
Health and Safety (@3% of Direct Costs)			$86,689
Administrative Fees (@3% of Direct Costs)			$86,689
Engineering and Design (@10% of Direct Costs)			$288,964
Construction Support Services (@10% of Direct Costs)			$288,964
TOTAL INDIRECT COSTS			**$751,306**
TOTAL CAPITAL COSTS = Total Direct Costs +Total Indirect Costs			**$3,640,945**
OPERATION AND MAINTENANCE COSTS (annual)			
5-Year Site Review (see Alternative #1)			
Total LOE			$6,000
Total ODCs			$360
Subtotal Cost			$6,360
Present Worth (capitalized @ 6%, 30 years)			**$20,783**
Land Use Controls - Quarterly and Annual Inspection and Reporting (see Alt. #2)			
Total Direct Costs			$13,850
Present Worth (capitalized @ 6%, 30 years)			$100,072
Total Costs for Land Use Controls			**$113,992**
TOTAL O&M COSTS (5-Year Reviews, LUCs)			**$134,775**
TOTAL CAPITAL COSTS AND O&M COSTS			**$3,775,720**
CONTINGENCY (@ 15%)			**$566,358**
TOTAL COST OF ALTERNATIVE #3			**$4,342,078**

PROJECT	COMP. BY	JOB NO.
NAS-WF Site 2 Land Fill Cover	MBC	2534.42
	CHK. BY	DATE 6/16/98

at 33% grade, Figure distance of slope into fill before flattening to 1.5' cover:

(From Cap pg. 1)
Angle x = 18.3° ✓



$\tan 18.3° = \frac{23.5}{x}$

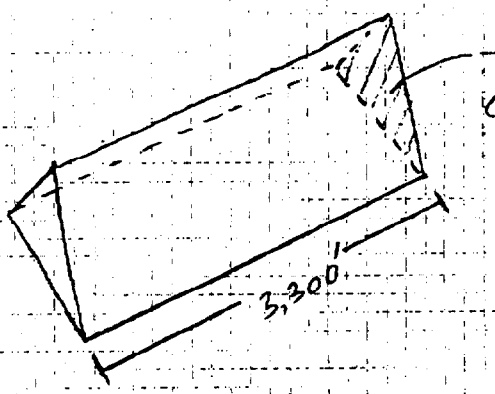
$x \cong 71.06$ ✓

or $23.5 * 3 = 70.5$

$A_{Triangle}$ $\frac{1}{2} l * h$ or 828.4 Ft² Cross section of Slope portion

From Cap design pg 1 Approx perimeter of Fill =

810' + 600' + 120' + 450' + 810' + 510' = 3,300 Ft ✓



3,300 Ft * 828.4 Ft² = 2,733,720 Ft³ ✓

NOTE: Because the inside diameter is actually shorter than the outside this is an OVER Estimate!

(3)

PROJECT NAS-WF Site 2 Land Fill Cover	COMP. BY NBC	JOB NO. 2534.42
	CHK. BY	DATE 7/16/98

841,050 Ft³ Base 1.5'
+ 2,733,720 Ft³ Slope Portion
3,574,770 Ft³ ✓ Total Fill needed

Add compaction factor * 1.10 (see cap Asump.)

✓ 3,932,247 Ft³ = 145,638 ✓ yd³.

Total acrage to cover (From pg. 6 cap design with seed) = ✓ 13,678 Acres

Std

0.5' Top soil cover

595,814
~~560,700~~ Ft² * 0.5 Ft = ~~280,350~~ Ft³ = ~~10,383~~ yd³
13.678 acres * 43,560 ~~Ft²~~/acre 297,907 Ft³ 11,034 yd³

145,638 yd³
Std ~~+ 10,383 yd³~~ 11,034 yd³
~~156,021 yd³~~ Total Soil + Fill
~~156,672 yd³~~

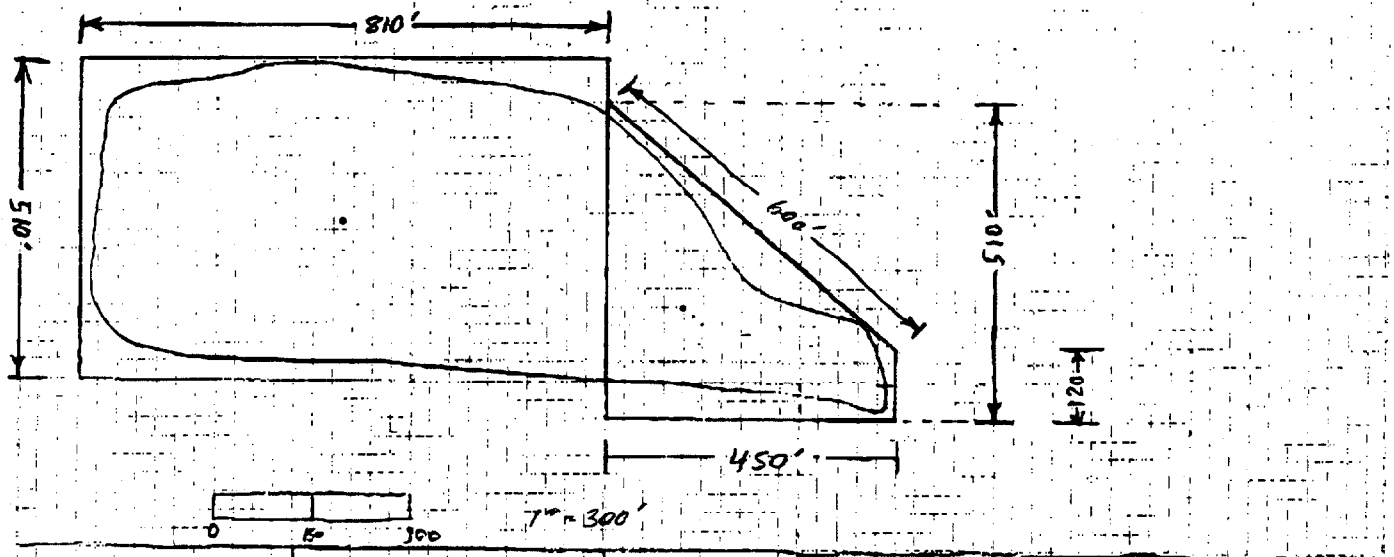
PROJECT	COMP. BY	JOB NO.
NAS Whiting Field – Site 2 FS Cap	MBC	2.53[illegible].02
	CHK. BY	DATE 8/12/98

Objective – Draw a landfill cap for Site 2, NAS Whiting Field

Assumptions – ① Compacted soil cover slope will not exceed 4%

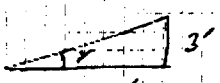
FL Regs ② Side slopes at edge of cap not > 33%
③ Minimum design grade 3%
④ 1' minimum cover over entire landfill

Schematic



$\tan = \frac{O}{A}$

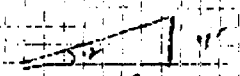
3% Grade



$\tan x = 3/100$

$x = 1.71°$

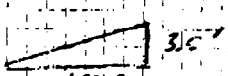
4% Grade



$\tan x = 4/100$

$x = 2.29°$

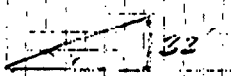
3.5% Grade



$\tan x = 3.5/100$

$x = 2.00°$

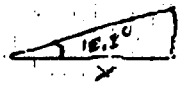
33% Grade



$\tan x = 33/100$

$x = 18.3°$ ✓

Horizontal distance for a 1' rise at 33% Grade



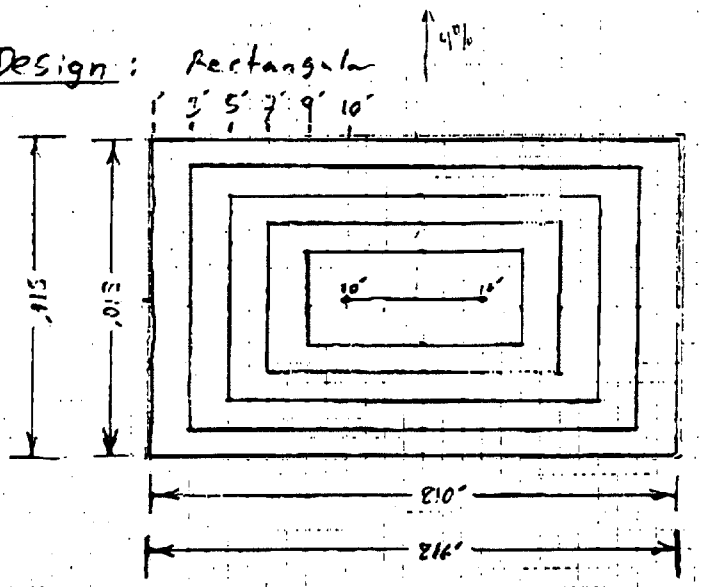
$X = 3'$

(2)

PROJECT	COMP. BY	JOB NO.
NAS-JAX Site 2 FS Cap	MSC	2534.47
	CHK. BY	DATE 6/12/98

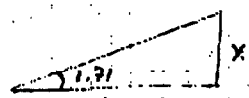
From Schematic — we will handle the cap as two separate fills, 1 rectangular, and 1 Triangular with a drainage Swail between.

Design: Rectangular



Planimeter results				
Edge	A_0	488	4.88 in² =	439,200 ft² ✓
1'	A_1	464		417,600 ft²
3'	A_2	329		296,100 ft²
5'	A_3	211		189,900 ft²
7'	A_4	120		108,000 ft²
9'	A_5	57		51,300 ft²
Top Ridge 10'	A_6	2.10' x 10'	=	2,100 ft²

∴ Vertical Rise 3% over 405'

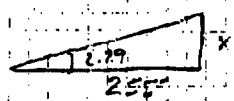


3%

$\tan 1.71 = \frac{x}{405}$

x = 12.09' min!

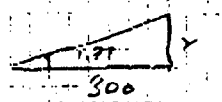
Vertical Rise 4% over 255'



x = 10.20' max!

∴ We need to extend the high Point to a line 2.10' Long and redo calc

Vertical Rise 2% over 300'

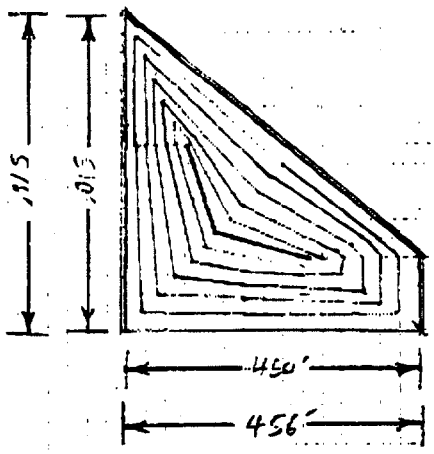


x = 8.96 min! good

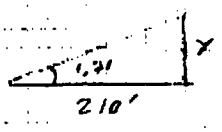
2 points 10 Ft high

PROJECT	COMP. BY	JOB NO.
NAS - JAX Site 2 FS cap	MBC.	2531.42
	CHK. BY	DATE 6/14/98

Design: Triangular



3% Grade



$\tan 1.71 = \frac{X}{210}$

$X = 6.27$

Height of triangular section

Planimeter results

A_0	174	= 1.74 in^2 =	156,600 ft^2 ✓
A_1	159		143,100 ft^2
A_2	122		109,800 ft^2
A_3	89		80,100 ft^2
A_4	58		52,200 ft^2
A_5	33		29,700 ft^2
A_6	16		14,400 ft^2
Ridge A_7	300' x 10"	=	3000 in^2

PROJECT NAS Whiting Field cap	COMP. BY MBC	JOB NO. 2534.47
	CHK. BY	DATE 6/15/98

Objective - Estimate volume of soil cover (min 1' thick at edge) + vegitative cover required to cover site 2 NAS - INF.

Assumptions - Current Topography at site is level
Compacted volume = 110% of bulk volume
Min 1' thick soil cover at edge of site
0.5 ft vegitative support layer

Estimates:

Rectangular section:

$A_0 - A_1$ $\quad \frac{439,200 + 417,600}{2} * 1' \text{ Lift} = 428,400 \text{ ft}^3$

$A_1 - A_2$ $\quad \frac{417,600 + 296,100}{2} * 2' \text{ Lift} = 713,700 \text{ ft}^3$

$A_2 - A_3$ $\quad \frac{296,100 + 189,900}{2} * 2' \text{ Lift} = 484,000 \text{ ft}^3$

$A_3 - A_4$ $\quad \frac{189,900 + 108,000}{2} * 2' \text{ Lift} = 297,900 \text{ ft}^3$

$A_4 - A_5$ $\quad \frac{108,000 + 51,300}{2} * 2' \text{ Lift} = 159,300 \text{ ft}^3$

$A_5 - A_6$ $\quad \frac{51,300 + 2,100}{2} * 1' \text{ Lift} = 26,700 \text{ ft}^3$

PROJECT NAS WF — Site 2 FS Cap	COMP. BY NBC	JOB NO. 2534.42
	CHK. BY	DATE 6/15/98

Volume Rectangular: $L_1 + L_2 + L_3 + L_4 + L_5 + L_6$

478,400 + 713,700 + 486,000 + 297,900 + 159,300 + 26,700 =

2,112,000 ft³

Apply Compation Factor * 1.10

2,373,200 ft³ → 86,044 yd³

Vegitative support layer

439,200 ft² * 0.5 ft = 219,600 ft³ → 8,133 yd³

Estimates:

Triangular section:

$A_0 - A_1$ $\frac{156,600 + 143,100}{2}$ * 1.0 ft L.ft = 149,850 ft³

$A_1 - A_2$ $\frac{143,100 + 109,800}{2}$ * 1.0 ft L.ft = 126,450 ft³

$A_2 - A_3$ $\frac{109,800 + 80,100}{2}$ * 1.0 ft L.ft = 94,950 ft³

$A_3 - A_4$ $\frac{80,100 + 52,200}{2}$ * 1.0 ft L.ft = 66,150 ft³

$A_4 - A_5$ $\frac{52,200 + 29,700}{2}$ * 1.0 ft L.ft = 40,950 ft³

PROJECT	COMP. BY	JOB NO.
NAS-WF-Site 2. FS Cap	ABC	2534.42
	CHK. BY	DATE 6/15/98

$A_5 - A_6$ $\quad \frac{29,700 + 14,400}{2} * 1 ft = 22,050\ ft^3$

$A_6 - A_7$ $\quad \frac{14,400 + 3,000}{2} * 0.27 ft = 2,349\ ft^3$

Volume Triangle = $L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7$

$149,850 + 126,450 + 94,950 + 66,150 + 40,950 + 22,050 + 2,349 =$

$= \boxed{502,749\ ft^3}$

Apply compaction factor * 1.10

$\boxed{553,024\ ft^3} \longrightarrow \boxed{20,482\ yd^3}$

Vegetative Support Layer

$156,600\ ft^2 * 0.5 ft = \boxed{78,300\ ft^3} \longrightarrow \boxed{2,900\ yd^3}$

Total compacted soil vol = $86,044\ yd^3 + 20,482\ yd^3 = \boxed{106,526\ yd^3}$

Total vegetative support layer = $8,133\ yd^3 + 2,900\ yd^3 = \boxed{11,033\ yd^3}$

Total Acreage to cover = $439,200\ ft^2 + 156,600\ ft^2 = \sqrt{595,800\ ft^2}$

$595,600\ ft^2 * 2.2957 \times 10^{-5} = Acres/ft^2 = \boxed{13.678\ Acres}$ √

End—

ALTERNATIVE #1: NO ACTION - SITE 2

	Quantity	Unit	Unit Cost	Total Cost
FIVE YEAR SITE REVIEW COSTS				
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	20	hrs	$90.00	$1,800
Mid-level Engineer	30	hrs	$60.00	$1,800
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total 5-year costs				*$6,360*
Present Worth of 5-year costs at i= 6%				*$20,783*
TOTAL FIVE YEAR SITE REVIEW COSTS				**$20,783**
CONTINGENCY @ 10 PERCENT				**$2,078**
TOTAL COST OF ALTERNATIVE #1				**$22,862**

PROJECT	COMP. BY	JOB NO.
NAS Whiting Field Site 2 Alternative 1 - No Action	MS CHK. BY	25341.11 DATE 12/24/98

Estimates:

Five year Site Reviews (every 5 years for 30 years)

Direct Costs Per Mtg.

Preparation of site reviews
photocopying, presentation materials, misc
$250/mtg * 1 mtg = $250

participation and presentation per mtg.
Rental Vehicle 1 MTG × $50/mtg = $50
perdiem 1 MTG × 2 person/mtg × $30/mtg = $60

Total OPCs for participation, preparation & presentation per Mtg.
$250 + $50 + $60 = $360

Five year site revie total cost per ~~month~~ MTG
total cost = LOE + OPCs = 6000 + 360 = $6360

$6000 = MTG (inc travel) 1440
Sn. Scientist 960
5 year rpt. Report 1850
Sr. Scientist
mid level engs. 1800
6000 ✓

present worth analysis Five year site reviews.

$A = P(A/P, 6\%, 5)$
$= 6360 (.2374)$
$= \$1510/yr$

present worth $P = A(P/A, 6\%, 30)$
$= \$1510 (13.765)$
$= 20,785/30 yr = \underline{20785/30yr}$

10% contingency 2078.50

total = $22863 ✓

[redacted]

APPENDIX D

COMMENTS AND RESPONSES ON THE DRAFT FEASIBILITY STUDY REPORT, SITE 2 NORTHWEST OPEN DISPOSAL AREA

Final Response to FDEP Comments
Final Draft Feasibility Study - Site 2, Northwest Open Disposal Area
Naval Air Station Whiting Field, Milton, Florida

Comment 1. Section 2.2 Identification of RAOs, page 2-8: this section appears to be continued on page 2-10 after Table 2-3. Please evaluate and correct this as necessary. It appears that Table 2-3 should be corrected with respect to beryllium since the new cleanup target levels, as represented in Chapter 62-785, F.S. are greater than the old Florida Soil Cleanup Guidelines; additionally, the RAOs should be re-evaluated as necessary.

Response: The text on page 2-8 does continue on page 2-10 after Table 2-3. This will be corrected in the final document.

A column will be added to Table 2-3 to indicate the SCTLs for the Site 2 chemicals of concern. The addition of the SCTLs in Table 2-3 does not change the RAOs for surface soil at Site 2.

Comment 2. Section 2.1.1 Chemical-Specific ARARs: Florida has promulgated default soil cleanup target levels in Chapter 62-785, F.A.C. Since these default levels represent the Department's most current derivation of target levels, please insert this information in this section, in Table 2-1 and other appropriate sections as needed in place of references to the 1995 Soil Cleanup Goals. Place the rule reference in the Reference section. Finally, please consider and document the effect of these default cleanup target levels on the site and the proposed actions in the Feasibility Study.

Response: SCTLs will be included in Section 2.1.1, Table 2-1, text, and the reference section, as appropriate. The addition of the SCTLs does not change the RAOs for surface soil at Site 2.

Comment 3. Page 2-10, discussion of Surface Soil: this paragraph contains errors in that Florida now has promulgated soil cleanup target levels (see previous comment) which <u>are</u> applicable to subsurface soils. Florida uses the upper 2 feet of soils as a guide for direct exposure scenarios. This does not mean that contamination below that level does not have to be considered; in the case of site ground water contamination by a contaminant, the appropriate leachability criteria must be applied to the surface <u>and</u> subsurface soil.

Response: Leachability criteria will be applied to surface and subsurface soil.

Comment 4. I recognize that the ground water at NAS Whiting Field has been named as a separate unit; however, for clarity and for the record, please assure that we have adequately shown that the proposed remedy or recommendation is consistent with any ground water contamination at Site 2. Once the remedy is in place, we don't want to discover in the future ground water evaluation that we should have addressed the problem in the approved remedy for this site. If the evaluation shows that is that there is no problem in this regard, please clearly state that this is the case. In my review of Table 2-2, it appears that of the two ground water contaminants at Site 2, aluminum and iron, iron exceeds the "2 times the arithmetic mean of background concentration" guideline which

would indicate that the iron may be site related. This should be properly considered and addressed, notably in Section 5.2.2.

Response: The groundwater evaluation in the human health risk assessment indicates that COCs detected do not pose an unacceptable risk to receptors using USEPA guidance and target risk ranges. The ecological assessment completed for Site 2 did not include exposure to groundwater by ecological receptors because the depth of the aquifer is approximately 70 feet below land surface and the nearest surface water body (Clear Creek) is several thousand feet downgradient. Additional text will be added to Section 2.2 to clarify these points.

Text will also be added to Section 5.2.2 stating that groundwater will addressed as a separate site and any remedy proposed for site-wide groundwater shall take into consideration the effects on the specific remedy selected for Site 2. The investigation at Site 40 may include additional sampling of the soil at Site 2 or any other investigations necessary for assessment of the soil and groundwater at the site.

Comment 5. Section 4.2.1., page 4-4: references to deed restrictions are not applicable in this document. Please remove them.

Response: References to deed restrictions will be removed, as appropriate.

Comment 6. Section 4.2.2. Long Term Effectiveness and Permanence: the discussion of how "biological activity" may reduce concentrations of soil contaminants appears to be inappropriate, considering that arsenic is the primary soil contaminant.

Response: References to natural degradation of arsenic will be removed from Section 4.2.2 and other sections of the FS as appropriate.

Comment 7. Section 5.2.2: paragraph 3 should include (following "Whiting Field") this statement - "Alternative 2 carries with it long-term agreement conditions including periodic re-evaluation requirements."

Response: The above statement will be added to paragraph 3, Section 5.2.2.

Comment 8. Appendix B: Please utilize the official signed correspondence for this section.

Response: A copy of the official FDEP signed letter on April 27, 1998 regarding Navy's request for a site-specific arsenic cleanup goal for covered landfill sites at NAS Whiting Field will be used in the Final FS.

Final Response to EPA Comments
EPA Comments on the Final Draft Feasibility Study
Site 2, Northwest Open Disposal Area, NAS Whiting Field

General Comments

Comment 1. The report lacks a dedicated and organized background information section. *The Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (Table 6-5, Page 6-15) recommends that the feasibility report contain background information including the site description, site history, nature and extent of contamination, contaminant fate and transport, and baseline risk assessment (summarized from the RI report). This information is not presented in a clear and logical manner in the report. Section 1.3 should be modified to include the additional text, or additional sections should be added to Chapter 1.

Response: In an effort to streamline the FS reports at NAS Whiting Field, the results of the RI report (which includes the result of the baseline risk assessment) will not be repeated in the FS reports. The RI report contains detailed information on the site description, site history, nature and extent of contamination, contaminant fate and transport, and the baseline risk assessment. As stated in Section 1.2 of the Draft FS, 'the purpose of the FS report is ...to develop RAOs to address contaminated media at the site and develop, screen, and evaluate potential remedial alternatives to meet these objectives.' The FS is based on the results and conclusions of the RI, rather than adding redundant information from the RI, the FS focuses on RAOs and potential alternatives to meet those objectives.

Comment 2. It appears from the FS Report that the soil was only screened against State criteria (the Florida Soil Cleanup Goals). However, the groundwater was compared to both federal (MCLs) and State (Florida Groundwater Guidance) criteria. The FS Report should clarify whether the soil was also screened against federal criteria (e.g. Region III Risk Based concentrations [RBCs]) and, if not, provide the rationale for not doing so.

Response: Additional columns containing Region III RBCs and Florida Soil Cleanup Target Levels (FAC 62-785) will be added to Table 2-3.

Comment 3. The Summary of Chemicals tables (Tables 2-2 and 2-3) present the Mean Analyte Concentration. The FS Report should clarify the purpose of presenting this value in the tables and also if (and how) these values are used in the interpretation or evaluation of the data.

Response: The mean analyte concentrations were presented in the RI and carried over into the FS. These values are not used in the FS and will be removed from Tables 2-2 and 2-3.

Comment 4. In several areas of the report, the *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* guidance is cited. From the information provided in Section 1.3, it is not clear that the disposal area could be characterized as a municipal-type landfill. The FS Report should address this discrepancy.

Response: The last paragraph on page 1-5 will be changed to the following:

"The results of previous investigations suggest that Site 2 received a variety of wastes including wood debris, asphalt rubble, sheet metal, furniture, and crushed paint cans from NAS Whiting Field from 1976 until 1984. These waste items are listed as typical components of municipal solid waste (Tchobanoglous, et al., 1993). Previous investigations also indicated that the site was first utilized as a borrow area and then subsequently used as a landfill. Based on the results of the RI, the wastes present in the landfill do not pose a principal threat to human health or the environment. Consequently, the Navy believes that Site 2 exhibits the characteristics of a CERCLA municipal landfill site and will be addressed as such in this FS."

The reference to Tchobanoglous, et al., will also be added to the reference list.

Comment 4a. In the response to Comment No. 4, while it can be argued that wood debris, asphalt rubble, sheet metal, furniture and crushed paint cans do not necessarily constitute municipal solid waste; but rather construction/demolition type waste, the overall outcome for Site 2 does not change and the response can stand.

Comment 5. The Site-Specific Cleanup Goal for arsenic in soil is 4.62 mg/kg which the State approved with certain conditions. The levels of arsenic detected in 6 samples ranged from 0.82 milligram per kilogram (mg/kg) to 3.95 mg/kg. Technically, if the cleanup goals are not exceeded (as in this case), the result would be a no action decision. However, the feasibility study report evaluates landfill closure and capping alternatives. It is not apparent that the State requires closure or capping in its conditions. The closure and capping alternatives may have been considered because the cleanup goal (based on two times the arithmetic mean detected background concentration) is in excess of the risk-based Florida Soil Cleanup Goal (FSCG) for arsenic. The FS Report should discuss this issue further in Chapter 2.

Response: USEPA guidance indicates that a range of potential remedial alternatives be evaluated in the FS. The general response actions were selected based on USEPA guidance and the FDEP site-specific cleanup goal for arsenic (see Appendix B). The site-specific cleanup goal requires the implementation of LUCs to insure protection of human health and the environment. Based on this information, an evaluation of other potential response actions was performed in the FS. Furthermore, closure certification of the former disposal area has not been granted by FDEP, therefore, complete closure of the disposal area in accordance with State and Federal ARARs is required. Section 2.3 will be modified to include the following paragraph:

"These general response actions were selected based on the aforementioned guidance and the agreement with FDEP established for arsenic (Appendix B). The agreement with FDEP requires the use of LUCs to insure protection of human health and the environment. Because of this requirement, and CERCLA's preference for evaluation of a range of alternatives, an evaluation of other potential general response actions was performed in the FS."

Comment 5a. For the response to Comment No. 5, Section 2.3 should state that the agreement with FDEP requires the use of LUCs to restrict land use to nonresidential uses to insure protection of human health and the environment.

Response: Paragraph 2, of the above response will be revised as follows: "These general response actions were selected based on the aforementioned guidance and the agreement with FDEP established for arsenic (Appendix B). The agreement with FDEP requires the use of LUCs to **restrict land use to non residential uses to** insure protection of human health and the environment. Because of this requirement, and CERCLA's preference for evaluation of a range of alternatives, an evaluation of other potential general response actions was performed in the FS."

Comment 6. In several locations in Chapter 4, it is stated that the alternatives may provide some reduction in contaminant concentrations and toxicity through natural degradation processes. The FS Report should cite the relevant references in support of this statement for arsenic and beryllium in soil.

Response: Reduction of arsenic concentrations via natural degradation processes in soil are negligible. References to natural degradation will be removed for arsenic. The natural degradation of beryllium in soil is also negligible.

Specific Comments

7. **Page 2-2, Fourth Paragraph.** This section should discuss whether there are any endangered species, wetlands, or areas of historical or archeological significance in the area of the site. In addition, the FS Report should clearly state whether the site is located within the 100-year flood plain.

Response: Section 2.1.2 will be modified to include the following: "Observations made during the ecological survey of NAS Whiting Field indicate that no State or federally listed rare, threatened, or endangered species or species of concern are known to exist at Site 2 (Nature Conservancy, 1997). Site 2 does not contain wetland areas and no part of the site is located in a 100-year flood plain. In addition, because Site 2 was originally a borrow pit and then used as a landfill, the soils at the site are reworked. Therefore, no areas of historical or archeological significance exist at Site 2."

8. **Page 2-3 and 2-4, Table 2-1.** RCRA, 40 CFR Part 264, Subpart N is listed as relevant and appropriate in this table. According to Section 1.3, wastes were placed in the disposal area from 1976 until 1984. Since the RCRA Subtitle C regulations that established the hazardous waste management system first became effective on November 19, 1980, these regulations should be listed as applicable. The FS Report should substantiate whether hazardous wastes were placed in the disposal area after November 19, 1980.

   It should be determined whether RCRA 40 CFR 258 is relevant and appropriate (and if so, included in the table). In addition, federal and State regulations pertaining to air emissions should be included to address particulate emissions during cap construction. Location-specific ARARs should be included.

Response: As stated in the response to comment 4, waste disposed at Site 2 is non hazardous. For this reason, 40 CFR Part 264, Subpart N is considered relevant and appropriate.

Table 2-1 will be modified to include 40 CFR 258 as a relevant and appropriate requirement. Federal and state regulations pertaining to air emissions for landfill covers will be addressed in Table 2-1. No location-specific ARARs apply to the site (see

Response to comment #7).

9. **Page 2-5, Fourth Paragraph.** It is stated that "there are no current or future predicted exposure pathways for ecological receptors to groundwater". The potential for site-related groundwater discharge to surface water (e.g. the unnamed tributary to Clear Creek) as an ecological exposure pathway should be discussed in the text.

Response: As indicated in the ecological assessment of the RI, groundwater at Site 2 is approximately 70 feet below ground surface and is not expected to discharge to surface water within several thousand feet of the site. The unnamed tributary is to the west and southwest of Site 2. Although groundwater flows in the south-southwest direction, potentiometric contours show little evidence of potential discharge west of the site. If discharge were to occur, it would likely be farther south, in the vicinity of Clear Creek. Language to this effect will be added to the Site 2 FS to clarify the rationale for dismissal of the groundwater exposure pathway.

10. **Page 2-6, Table 2-2.** The range of detected concentrations of aluminum is presented as "82/248". It appears that this should be "82 to 248". The FS Report should clarify this notation.

Response: The correction from "82/248" to "82 to 248" will be made.

11. **Page 2-10, Fourth Paragraph.** The mean of the beryllium concentrations (0.24 mg/kg) was compared to the background screening value (0.36 mg/kg) and partly due to this comparison, it was determined that an additional Remedial Action Objective (RAO) would not be developed for beryllium. It is not appropriate to compare the mean detected concentration of a chemical to the background screening value. This comparison should be made based on the maximum detected concentrations in the screening process.

Response: As stated in the text, LUCs required for arsenic will be equally effective in protecting human health and the environment from exposure to beryllium. In addition, the residential SCTL for beryllium is 120 mg/kg, much greater than the maximum detected beryllium concentration (0.45 mg/kg) detected at Site 2.

11a. For the response to Comment No. 11, while it is agreed that the outcome will not change, future comparisons should be based on maximum detected concentrations.

Response: Agree

12. **Page 2-10, Fifth Paragraph.** It is stated in this paragraph that the subsurface soil concentrations were compared to the FSCGs for industrial sites and no exceedences were noted. The FS Report should clarify whether the Florida leachability-based cleanup goals were considered for the subsurface soil.

Response: See response to FDEP comment number 3.

12a. Please provide the complete response. Do not reference response to FDEP comments.

Response: Leachability criteria will be applied to surface and subsurface soil.

13. **Page 2-11, Second Paragraph.** It is not clear, based on the information provided in the FS Report, whether RCRA Subtitle C is applicable or relevant and appropriate. Disposal activities

occurred at the site from 1976 until 1984 (after the effective date, November 19, 1980, of the RCRA Subtitle C regulations); however, the report is not specific regarding the types of wastes that were disposed at the site after this effective date. As stated on Page 7 of the *Design and Construction of RCRA/CERCLA Final Covers*, EPA/625/4-91/025, the hybrid closure alternatives are "possible when RCRA requirements are relevant and appropriate, but not when closure requirements are applicable". Therefore, while a hybrid closure is possible if RCRA closure requirements are determined to be relevant and appropriate, hybrid closure is not possible if the RCRA closure requirements are determined to be applicable. The available information should be reviewed and a determination regarding the status of RCRA Subtitle C should be made.

Response: As stated in the response to comment number 4, wastes disposed at Site 2 are considered to be municipal in nature over its usage period (from 1976 to 1984). For this reason, RCRA closure requirements are considered to be relevant and appropriate making the hybrid-landfill possible.

14. **Page 2-12, First Paragraph.** The text of this paragraph seems to be referring to presumptive remedies; however, the appropriate presumptive remedy guidance is not discussed. The text should be clarified by citing the appropriate guidance.

Response: Presumptive remedies for Site 2 include containment technologies. This information will be inserted in the second paragraph on page 2-12 for clarification.

15. **Page 3-2, First Bullet.** The text states that the site characteristics considered during the identification and screening of alternatives included the presence of special site features including wetlands, flood plains, or endangered species. However, identification and discussion of these special site features is missing from the report. This information should be provided in the FS Report.

Response: Addressed in the response to Comment No. 7.

16. **Page 3-2, Fifth Paragraph.** With respect to the last sentence of this paragraph, it should be clarified that the period of 30 years for 5-year reviews was an assumption made for costing purposes only. Under CERCLA, 5-year reviews must continue as long as hazardous substances, pollutants, or contaminants remain at the site. The FS Report should clarify this issue.

Response: The following language will be added to paragraph 5, page 3-2 to clarify the use of a 30 year period for reviews.

"A period of 30 years for 5-year site reviews was chosen for costing purposes only. Under CERCLA, 5-year reviews must continue as long as hazardous substances, pollutants, or contaminants remain at the site."

17. **Page 3-4, Table 3-1.** Groundwater monitoring is listed as a General Response Action in this table, defined as applicable, and retained in the screening process. However, groundwater monitoring is not discussed further in the text nor is it included as a component in the presented remedial alternatives. This discrepancy should be corrected.

Response: Table 3-1 will be revised. Groundwater monitoring will be eliminated from further consideration in this FS. Groundwater monitoring will be addressed separately on a Facility wide basis (designated Site 40).

18. **Page 4-5, Fifth Paragraph.** The FS Report should cite the regulations to be followed, or the requirements to be met, in the preparation of the site closure and post-closure plan.

Response: Text will be added to include reference to the Florida landfill closure regulations (FAC 62-701) in preparation of the site closure and post-closure plan.

19. **Page 4-7, Table 4-3.** The information presented in this table should more closely correlate with the information in the text and the cost estimate in Appendix C. For example, the "Inspection/Reporting" costs in this table are referred to as "Annual Operation and Maintenance Costs" in Appendix C. Also, the "Land-use-controls" include Site Closure costs as shown in Appendix C. The same terminology should be used in both the table and the appendix.

Response: Table 4-3 will be revised for consistency with Appendix C, the detailed cost analysis.

20. **Page 4-7, First and Second Paragraphs.** The regulations to be followed, or the requirements to be met, in the preparation of the site closure and post-closure plan are not cited. In addition, the discussion of land use controls is missing from this alternative. The FS Report should address these discrepancies.

Response: The first sentence of the first paragraph will be revised as follows:

"Alternative 3 will consist of all of the activities detailed in Alternative 2 with the addition of the construction of an engineered soil cover at Site 2."

The discussion of LUCs is presented in section 4.2.1.

The requirements to be met in the preparation of the site closure and post-closure plan will be cited in the final FS. Text will be added to include reference to the Florida landfill closure regulations (FAC 62-701.600) and the hybrid-landfill closure requirements (in the proposed revisions to the NCP (53 FR 51446) discussed in the USEPA's *Design and Construction of RCRA/CERCLA Final Covers* (USEPA, 1991b).

21. **Page 4-7, Fourth Paragraph.** The text states that the landfill cover design was primarily based on the Florida landfill closure regulations. It appears that the State of Florida regulations being referred to in this sentence are Rule 62-701.600, F.A.C. However, this is not clear. The FS Report should provide the appropriate regulatory citation(s) and should also specify the criteria in the regulations that are governing the landfill cover design.

Response: Text will be added to include reference to the Florida landfill closure regulations (FAC 62-701.600 and 62-701.610) and the hybrid-landfill closure guidance in preparation of the landfill cover design (USEPA, 1991b).

22. **Page 4-8, Third Paragraph.** The text states that risks to ecological receptors based on exposure to groundwater were not identified. This statement needs to be supported in Section 2.2 with respect to the potential for groundwater discharge to surface water.

This paragraph also states that the permeability of the cover will be 6.9×10^{-3} cm/sec. The basis of this value should be provided.

Response: See response to comment # 9.

In accordance with Chapter 62-701.600, for Class III landfills, the barrier layer shall have a permeability of 1 x 10^{-5} cm/sec. This correction will be made.

23. **Page 4-8, Third and Fifth Paragraphs.** Borrow soil will be tested to ensure that it is "clean" fill. The FS Report should clarify how the soil will be tested (sampling method, analytical methods, number of samples, etc.) and include these costs in the cost estimate.

Response: One composite sample will be collected and analyzed for TAL metals and CLP volatiles to assure that the soil is "clean" fill. These costs will be added to the cost estimate.

24. **Page 4-9, First Paragraph.** The text states that the natural surface water drainage that exists at the site will be maintained to the extent possible. However, the site is described as being within a 25-ft surface depression. The text should explain how surface water can exit a 25-ft surface depression. The post-soil cover surface water drainage needs to be explained in greater detail and the calculations regarding the fill material volumes need to be provided in Appendix C.

Response: Site 2 currently allows infiltration of surface water. Because soil contaminant levels did not exceed leachability based SCTLs, land surface features will not be changed.

The calculations showing the fill material volumes will be provided in Appendix C.

25. **Page 4-9, Fifth Paragraph.** The text states that landfill closure requirements under RCRA Subtitles C and D, as well as Florida Solid Waste Disposal Facilities Regulations, were appropriately followed concerning the soil cover design. This statement should be re-evaluated and the appropriate regulatory citations (specific to the design criteria being met) should be provided.

Response: The landfill cover proposed is based on the Memorandum regarding the Applicability of Soil Cleanup Goals for Florida from John M. Ruddell, Director - Division of Waste Management, FDEP (dated January 19, 1996). Chapter 62-701.600 FAC was also used as a relevant and appropriate guidance.

26. **Page 4-9, Seventh Paragraph.** Groundwater sampling is mentioned in this paragraph. However, groundwater sampling is not mentioned anywhere else in the text or in the cost estimates. This discrepancy should be corrected.

Response: See response to Comment 17. Statements referring to groundwater sampling will be removed.

27. **Page 4-9, Eighth Paragraph.** It appears that the "monitoring data" in this paragraph refers to groundwater monitoring data. See the previous comment.

Response: The words "monitoring data" will be removed to avoid confusion.

28. **Page 5-3, Second Paragraph.** This paragraph should be re-phrased. The implementation of Alternative 2 would not "mitigate" impacts from Alternative 3. The FS Report should address this discrepancy.

Response: This paragraph will be revised accordingly.

29. **Page 5-3, Fourth Paragraph.** The assumptions which were used regarding the topography of the site (relevant to the construction of the cap and the calculated volumes of materials) should be included in Appendix C.

Response: Supporting calculations and assumptions will be included in Appendix C.

30. **Appendix C.** The supporting calculations for the cost estimates should be provided in this Appendix.

Response: See response to Comment 29.