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FINAL REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN FOR OPERABLE UNIT 2 (OU 2) MCCOY ANNEX LANDFILL NTC ORLANDO FL
1/20/1997
BROWN & ROOT ENVIRONMENTAL

Brown & Root Environmental

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January 20, 1997

Project Number 7457

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Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0024

Subject: Final Remedial Investigation and Feasibility Study Work Plan, Operable Unit 2, McCoy Annex Landfill, Naval Training Center, Orlando, Florida

Dear Ms. Nwokike:

Enclosed is the final RI/FS Work Plan for OU 2, McCoy Annex Landfill. This Work Plan incorporates the changes resulting from EPA and FDEP comments, and the associated responses issued on January 3, 1997, to the draft Work Plan issued by ABB Environmental Services in January 1995. As agreed upon at the November 1997 OPT meeting, any additional changes to the work plan will be incorporated by page substitution prior to release of the document or by addendum.

Please call me at (423) 483-9900 if you have any questions regarding the Work Plan.

Sincerely yours,

Steven B. McCoy

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN

for

OPERABLE UNIT 2 MCCOY ANNEX LANDFILL

Naval Training Center
Orlando, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order CTO-0024

JANUARY 1997

Rev. 0
1/20/97

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN

OPERABLE UNIT 2
MCCOY ANNEX LANDFILL

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
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North Charleston, South Carolina 29406

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ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
AEA	Atomic Energy Act
Air Force	U.S. Air Force
AOC	area of concern
ARARs	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
AWQC	ambient water quality criteria
BCP	BRAC Cleanup Plan
BCT	BRAC Cleanup Team
BEC	BRAC Environmental Coordinator
bgs	below ground surface
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CART	classification and regression trees
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CLP-RAS	CLP Routine Analytical Services
COC	chemical of concern
COPC	chemical of potential concern
CPT	cone penetrometer testing
CSM	conceptual site model
CWA	Clean Water Act
DMS	database management system
DOD	Department of Defense
dpm	disintegrations per minute
DPT	direct-push technology
DQO	data quality objective
ECAO	Environmental Criteria and Assessment Office
EP Tox	Extraction Procedure Toxicity
FDEP	Florida Department of Environmental Protection
FGFWFC	Florida Game and Fresh Water Fish Commission

ACRONYMS AND ABBREVIATIONS (continued)

FR	*Federal Register*
FS	Feasibility Study
FSA	field staging area
FSP	Field Sampling Plan
FWQS	Florida Water Quality Standard
GAC	granular activated carbon
GPR	ground-penetrating radar
GPS	Global Positioning System
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
ID	inner diameter
IDW	investigation-derived waste
IR	Installation Restoration
IRIS	Integrated Risk Information System
LDR	land disposal restriction
LFG	landfill gas
MAC	Military Airlift Command
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MHz	megahertz
ml	milliliter
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NACIP	Navy Assessment and Control of Installation Pollutants
Navy	U.S. Navy
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTC	Naval Training Center

ACRONYMS AND ABBREVIATIONS (continued)

OAFB	Orlando Air Force Base
OSHA	Occupational Safety and Health Administration
OU	operable unit
PA	Preliminary Assessment
PARCC	precision, accuracy, representativeness, comparability, and completeness
ppb	parts per billion
PCB	polychlorinated biphenyl
PCE	perchloroethene
pCi/g	piocuries per gram
PEL	permissible exposure level
POP	Project Operations Plan
POTW	publicly owned treatment works
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RA	Remedial Action
Ra	Radium
RAD	radiological
RAGs	Risk Assessment Guidance for Superfund
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SACM	Superfund Accelerated Cleanup Model
SARA	Superfund Amendments Reauthorization Act of 1986
SDW	Secondary Drinking Water
SDWA	Safe Drinking Water Act
SI	Site Inspection
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command

ACRONYMS AND ABBREVIATIONS (continued)

SPT	standard penetration test
SVOC	semivolatile organic compound
TAL	target analyte list
TBC	to be considered
TBEL	technology based effluent limit
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TD-MS	thermal desorption–mass spectrometry
Th	Thorium
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
U	Uranium
UCL	upper confidence limit
UMTRCA	Uranium Mill Tailings Radiation Control Act
USC	U.S. Code
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UV	ultraviolet
VOC	volatile organic compound
WQBEL	water quality based effluent limit
WQS	Water Quality Standard

FORWARD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks as well as conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's 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 its facilities.

One of these programs is the Base Realignment and Closure Cleanup Plan. This program complies with the Base Closure and Realignment Act of 1988 (Public Law 100-526, 102 Statute 2623) and the Defense Base Closure and Realignment Act of 1990 [Public Law 101-510, 104 Statute (1808)], which require the Department of Defense to observe pertinent environmental legal provisions of the Comprehensive Environmental Response, Compensation, and Liability Act and Executive Order 12580 as well as the statutory provisions of the Defense Environmental Restoration Program, the National Environmental Policy Act, and any other applicable statutes that protect natural and cultural resources.

Comprehensive Environmental Response, Compensation, and Liability Act requirements, in conjunction with corrective action requirements under Subtitle C of the Resource Conservation and Recovery Act, govern most environmental restoration activities. Requirements under Subtitles C, I, and D of the Resource Conservation and Recovery Act, as well as the Toxic Substances Control Act, the Clean Water Act, the Clean Air Act, the Safe Drinking Water Act, and other statutes, govern most environmental mission-, operational-, and closure-related compliance activities. These compliance laws may also be applicable or relevant and appropriate requirements for selecting and implementing remedial actions under the Comprehensive Environmental Response, Compensation, and Liability Act. The National Environmental Policy Act requirements govern the Environmental Impact Analysis and Environmental Impact Statement preparation for the disposal and reuse of Base Realignment and Closure installations.

EXECUTIVE SUMMARY

This Remedial Investigation and Feasibility Study Work Plan was developed by Brown & Root Environmental to enable proper conduct of work at Operable Unit 2, the McCoy Annex Landfill, at the Naval Training Center, Orlando. The Work Plan incorporates elements of the *Project Operations Plan for Site Investigations and Remedial Investigations, Naval Training Center, Orlando* prepared by ABB Environmental Services, Inc., in 1994, which contains a Quality Assurance Project Plan, Health and Safety Plan, and elements of a Field Sampling Plan related to sampling equipment, procedures, and sample handling and analysis. Other Field Sampling Plan elements specific to this site, including sampling objectives and sample location and frequency, will be addressed in this Work Plan.

This Work Plan is intended to be a dynamic document that permits flexibility during the implementation of this investigation at the Naval Training Center, Orlando. Central to this work is an understanding that complete site characterization is not possible, or even necessary. Furthermore, investigators must recognize that uncertainties will remain that will have to managed during the Remedial Investigation and Feasibility Study program. By managing these uncertainties and moving forward to developing and implementing remedies, the overall Remedial Investigation and Feasibility Study process will be streamlined and shortened. Such streamlining is the U. S. Environmental Protection Agency's major objective with the development of the Superfund Accelerated Cleanup Model, which permits earlier initiation of remedies thereby reducing existing risks to humans and the environment. The Superfund Accelerated Cleanup Model also results in significant savings in program costs.

As part of the Superfund Accelerated Cleanup Model process, presumptive remedies are encouraged that will enable the continued focusing of the program. In the Naval Training Center, Orlando investigation, the presumptive remedy of capping and containment will be applied because the site will remain a closed landfill. This presumptive remedy allows the introduction of potential technologies to achieve objectives stated in the Work Plan; it also promotes the collection of appropriate data during the field investigation. The overall objective of this Work Plan is to collect only those data that are supportive of the presumptive remedy and that are required by remedial technologies applied to reach the remedial objectives. Additionally, only data that will permit the evaluation of risks and exposures as related to the application of the presumptive remedy will be acquired.

The field program proposed in this document was developed to achieve the above goals. The field program will include the use of geophysics and direct-push technologies for site screening as well as the collection of soil, sediment, surface water, and groundwater samples for data evaluation and analysis. The resulting data should enable sufficient site characterization and risk evaluation for determination of the appropriate technologies to support the presumptive remedy for this site.

1.0 INTRODUCTION

1.1 REGULATORY BACKGROUND

To meet its mission objectives, the U.S. Navy (Navy) performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks as well as conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense (DOD) initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at its facilities. Two of these programs are the Installation Restoration (IR) program and the Base Realignment and Closure (BRAC) program.

The IR program complies with the Base Closure and Realignment Act of 1988 (Public Law 100-526,102 Statute 2623) and the Defense Base Closure and Realignment Act of 1990 [Public Law 101-510, 104 Statute (1808)], which require that DOD observe pertinent environmental legal provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Executive Order 12580 as well as the statutory provisions of the Defense Environmental Restoration Program, the National Environmental Policy Act (NEPA), and any other applicable statutes that protect natural and cultural resources.

Originally, the Navy's program was called the Navy 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 (IAS) under the NACIP program],
- Remedial Investigation (RI) and Feasibility Study (FS), and
- Remedial Design and Remedial Action.

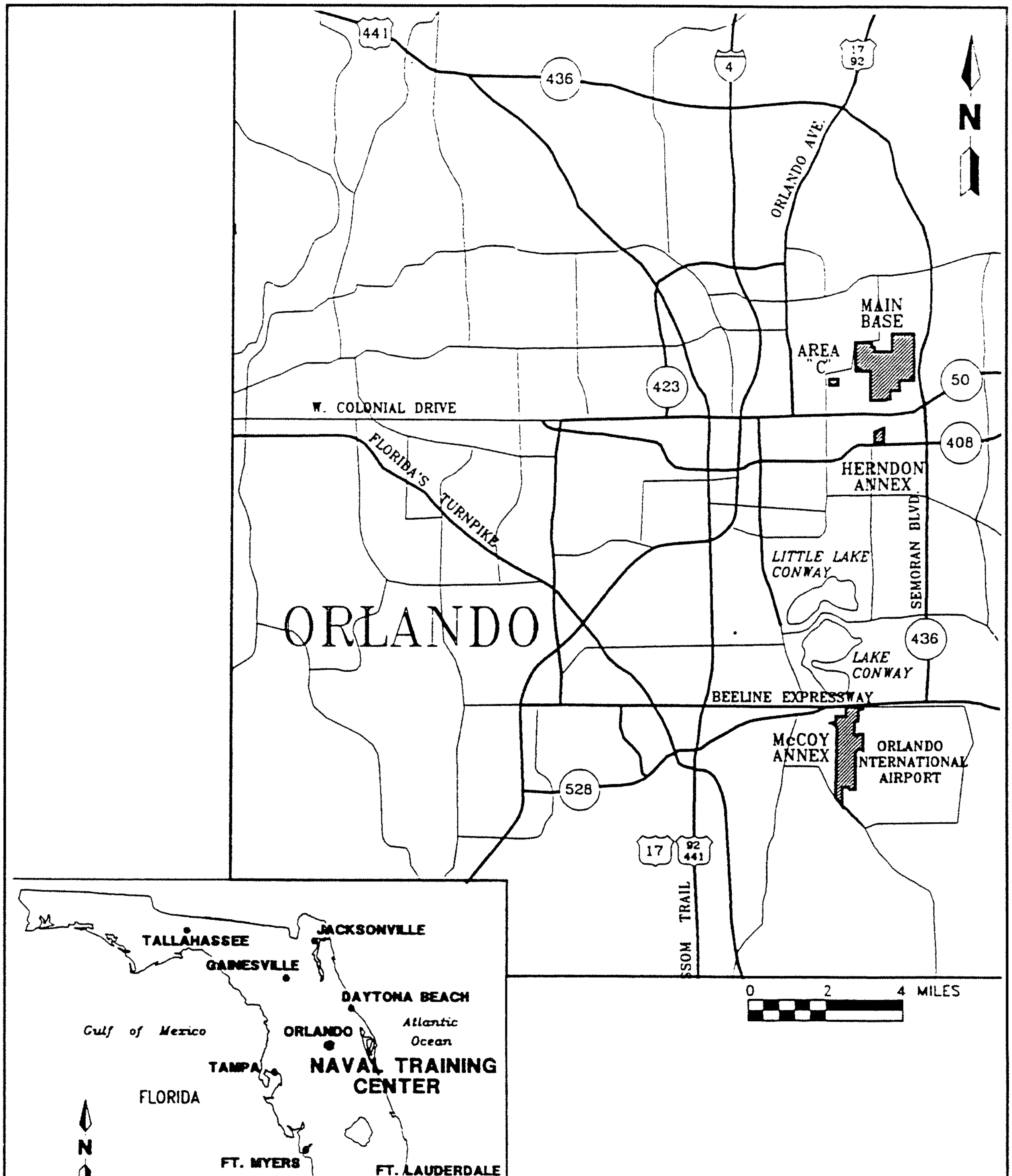
The goal of the BRAC program is to expedite and improve environmental response actions to facilitate the disposal and reuse of a BRAC installation while protecting human health and the environment.

1.2 FACILITY BACKGROUND

The Naval Training Center (NTC), Orlando encompasses 2,072 acres in Orange County, Florida, and consists of four discrete facilities: Main Base, Area "C," Herndon Annex, and McCoy Annex (Figure 1-1). McCoy Annex is located approximately 8 miles south of the Main Base, west of Orlando International Airport (Figure 1-2). The McCoy Annex is flanked to its west by industrially zoned property. The zoning allows heavy industry and aviation-related development although the area is not currently developed. The Beeline Expressway, a major highway running east and west through Orange County, forms the northern boundary of McCoy Annex. The property north of the Beeline Expressway and within 0.75 mile of the McCoy Annex is used primarily by businesses such as rental agencies, hotels, and restaurants that are directly related to the airport. Adjacent to the southern boundary are undeveloped woodlands. Further discussions of Main Base, Area "C," Herndon Annex, and McCoy Annex may be found in the Project Operations Plan (POP) [ABB Environmental Services, Inc. (ABB-ES) 1994a].

The history of McCoy Annex dates to 1941 with the construction of Orlando Municipal Airport No. 2 in Pinecastle, Florida. The new airport was needed because of the acquisition of the original municipal airport for construction of Orlando Air Base to the north. Before construction of the new airport, the property was undeveloped wetland. In 1942 the city leased the Pinecastle property to the Army Air Corps for construction of Pinecastle Army Air Field with acquired additional lands. The field was ready for operation in April 1943. At the end of World War II the base was deactivated and the property returned to the city. The terms of the property transfer included a "reverter for reactivation" clause in case of a national emergency. This clause was exercised in 1952 during the Korean Conflict, and the base was reopened as Pinecastle Air Force Base. The base was renamed McCoy Air Force Base in honor of Colonel Michael N.W. McCoy on May 7, 1958. The U.S. Air Force (Air Force) retained command of the base until its closure in 1973. At that time NTC, Orlando acquired title to part of the property and changed the name to McCoy Annex. McCoy Annex was acquired to serve as a community support annex for NTC, Orlando. The majority of the property, including runways, aircraft hangars, and maintenance facilities previously used by the Air Force, was never acquired by the Navy. Currently that property is owned and operated by the Orlando International Airport (ABB-ES 1994c).

The stated mission of NTC, Orlando is to exercise command over, and coordinate the efforts of, the assigned subordinate activities in recruit training of enlisted personnel; provide initial skill, advanced, and/or specialized



SOURCE:
MAP TAKEN FROM DRAWING PROVIDED
BY ABB ENVIRONMENTAL SERVICES, INC.

FIGURE 1-1

FACILITY LOCATIONS

RI/FS WORK PLAN, OPERABLE
UNIT 2, McCOY ANNEX LANDFILL

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

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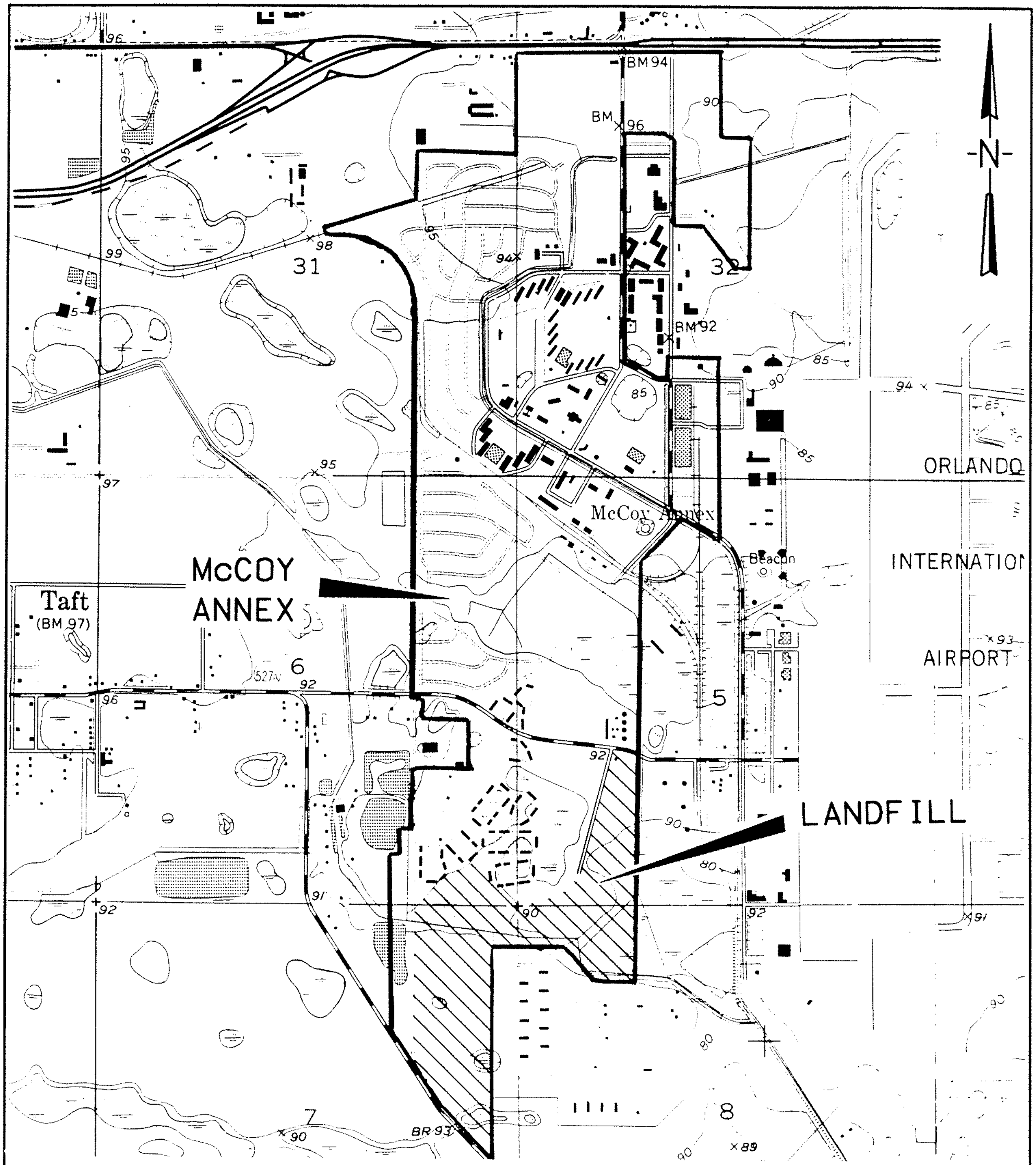

LEGEND:

INSTALLATION BOUNDARY

SOURCE: U.S.G.S. QUADRANGLE

APPROXIMATE SCALE IN FEET

2000 0 2000

FIGURE 1-2

McCOY ANNEX
SITE LOCATION MAP

SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND

RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

7457004.DGN

training for officer and enlisted personnel of the regular Navy and Naval Reserve; and support other activities as directed by a higher authority (ABB-ES 1994c). The Main Base is primarily comprised of operational and training facilities, while McCoy Annex is largely comprised of military housing units.

Previous NACIP investigative activities at NTC, Orlando included an IAS conducted by C.C. Johnson & Associates (1985) and a Verification Study conducted by Geraghty & Miller (1986).

Descriptions of IR and BRAC program investigative activities at NTC, Orlando can be found in the POP (ABB-ES 1994a), the BRAC Cleanup Plan (BCP) (ABB-ES 1994c), the Background Sampling Plan (ABB-ES 1994d), and the BRAC Environmental Baseline Survey (ABB-ES 1994b).

To facilitate the assessment of the IR program sites at NTC, Orlando they have been separated into groups known as operable units (OUs). An OU is composed of sites that

- are in close proximity to each other,
- have similar contaminant exposure histories, and/or
- will likely require similar remedial measures.

This Work Plan was prepared under a Comprehensive Long-Term Environmental Action Navy (CLEAN) contract with the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) for conducting an RI/FS at a former landfill located under the nine-hole golf course of McCoy Annex. The landfill will be referred to as the McCoy Annex Landfill and designated as OU 2.

The RI/FS will be conducted in accordance with the methods described in the U.S. Environmental Protection Agency's (USEPA's) *Conducting Remedial Investigations/Feasibility Studies for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Municipal Landfill Sites* (1991a); *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (1990); and *Superfund Accelerated Cleanup Model (SACM)* (1992b).

The objectives of the investigations are to

- determine the nature and distribution of contaminants at the site;

- identify potential threats to public health or the environment posed by the potential release of contaminants from the site; and

- evaluate potential remedial alternatives based on engineering factors (assuming the site will remain a closed landfill), implementability, environmental and public health concerns, and costs.

This Work Plan presents the technical scope of actions necessary to achieve these objectives and the schedule for conducting field activities, preparing reports, and developing and evaluating remedial alternatives. The program has been designed to be as efficient and streamlined as possible to support a rapid data acquisition and evaluation process during the RI/FS. To this end, investigators begin with the understanding that it will not be possible to **completely** characterize this site or any other similar site, even with a very large number of explorations and chemical analyses. Rather, the approach will be to **sufficiently** characterize the site with a limited number of explorations and analyses that will permit development and refinement of a conceptual model based on reasonable conclusions drawn from those data. Remedial alternatives will be selected such that planned contingencies may be invoked at any time during the investigation when it becomes apparent that probable conditions have given way to deviations in those assumptions; a working hypothesis will be formulated that will evolve and grow as knowledge of the site increases. In this way a balance between managed uncertainties and the implementation of remedial alternatives will be achieved, resulting in improved efficiencies.

The Work Plan consists of nine sections and one appendix. Section 1.0 provides an introduction to the process and a description of the components of the Work Plan. Section 2.0 summarizes the site background and setting and includes a description of the site, its history, and hydrogeologic setting, and a summary of the results of previous investigations. Also in Section 2.0 is an approach overview that presents and discusses the concepts of **streamlining** and **presumptive remedies** (USEPA 1990; 1993a) as they apply to municipal landfill sites, the value and applicability of the statistical sampling approach, and an evaluation of data needs. Section 3.0 provides the rationale and task-by-task approach for the field investigations at the McCoy Annex Landfill. Section 4.0 describes the laboratory analytical program. The risk assessment and waste management [investigation-derived waste (IDW)] tasks are described in Sections 5.0 and 6.0, respectively. Sections 7.0 and 8.0 describe the RI and FS reports. The project schedule is presented in Section 9.0. Appendix A contains a synopsis of potential federal and state applicable or relevant and appropriate requirements (ARARs) that may apply during the OU 2 RI/FS.

This Work Plan incorporates elements of the POP (ABB-ES 1994a), which contains a Quality Assurance Project Plan, Health and Safety Plan, and elements of a Field Sampling Plan (FSP) related to sampling equipment, procedures, and sample handling and analysis. Other FSP elements specific to this site, including sampling objectives and sample location and frequency, are also addressed in this Work Plan.

2.0 SITE BACKGROUND AND SETTING

2.1 SITE DESCRIPTION

The McCoy Annex Landfill is located at the southern end of McCoy Annex under an existing nine-hole golf course owned and maintained by the Navy. The gently rolling topography slopes from north to south. The golf course is bounded on the east, south, and west by manmade ditches that drain to Boggy Creek and Boggy Creek Swamp to the southeast. The golf course includes a number of water hazards and has several cypress swamps between fairways (Figure 2-1).

2.2 SITE HISTORY

The western portion of the landfill was reportedly used by the Air Force from about 1960 to 1972, while the eastern portion was used by the Air Force and the Navy from 1972 until about 1978.

Landfill operations consisted of excavating ditches (100 to 200 ft long by 20 to 25 ft wide by 10 to 15 ft deep) into which trucks disposed wastes. Occasional burning of the wastes took place in the ditches. Trenches were filled with waste to within 3 or 4 ft of the ground surface and then backfilled with topsoil and seeded.

2.3 HYDROGEOLOGIC SETTING

This section presents a discussion of the hydrogeologic framework for the area of NTC, Orlando. A general characterization of the major lithologic units and aquifers at NTC, Orlando is presented along with a summary of available documented information for OU 2, the McCoy Annex Landfill. The POP (ABB-ES 1994a) contains a detailed discussion of the regional physical characteristics (topography, geology, hydrogeology, soil, and surface water hydrology) of the NTC, Orlando area. This information is not reproduced in this Work Plan. Rather, a conceptual framework of the hydrogeologic setting, as it applies to the evaluation of contaminant migration in groundwater, is described.

Three major lithologic units underlie NTC, Orlando (Figure 2-2). These are (1) the undifferentiated surficial sand and clay of Holocene and Pleistocene age; (2) the clay, sand, and carbonates of the Hawthorn Group (Miocene age); and (3) the underlying Eocene carbonates of the Ocala, Avon Park, and Lake City Limestones. The principal aquifers correspond to these lithologic units. The aquifers are (1) the surficial

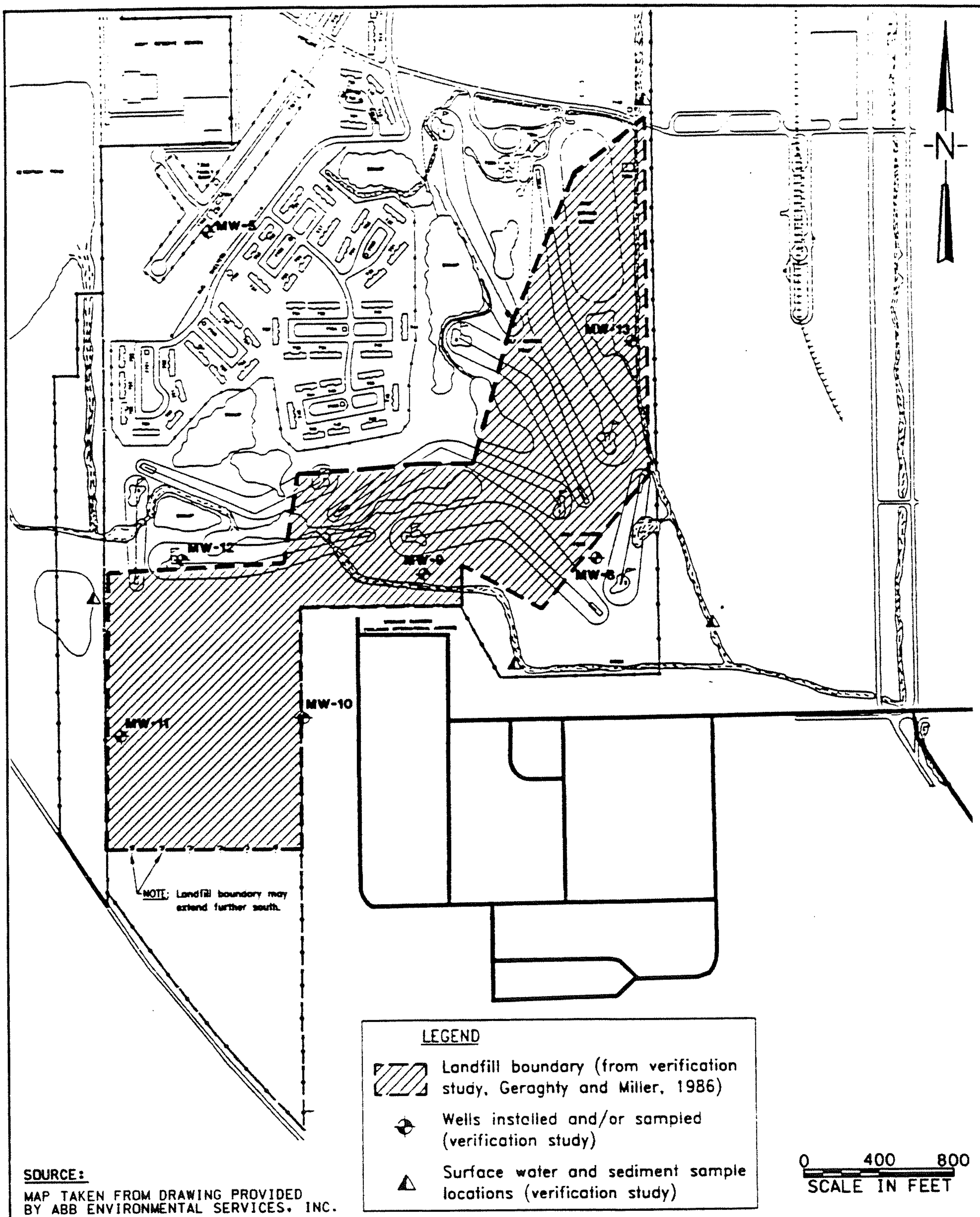

FIGURE 2-1

McCOY ANNEX LANDFILL LOCATION MAP

RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL

NAVAL TRAINING CENTER ORLANDO, FLORIDA

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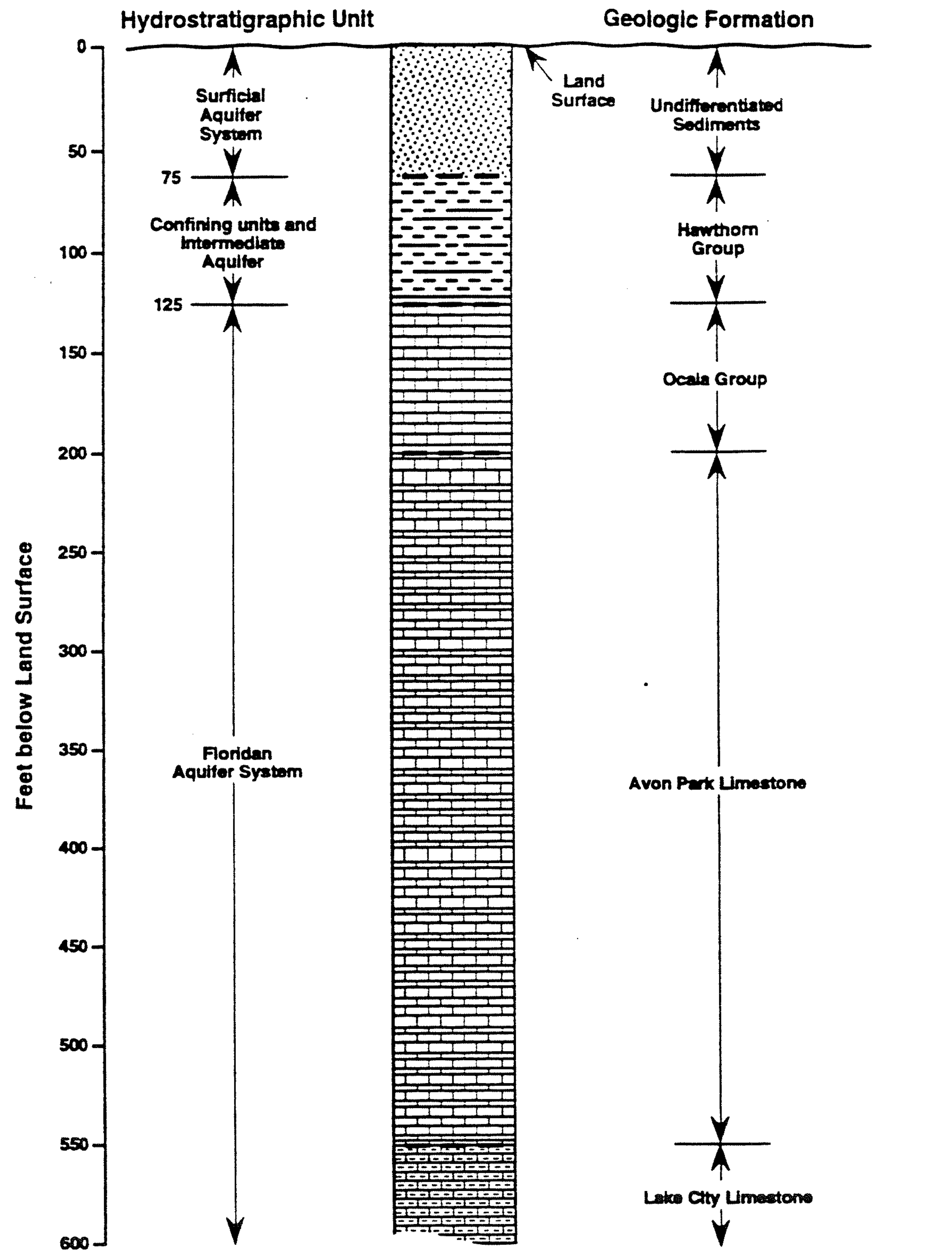


SOURCE: ABB-ES, 1994a

FIGURE 2-2

GENERALIZED GEOLOGIC CROSS SECTION, NTC ORLANDO

RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL

NAVAL TRAINING CENTER ORLANDO, FLORIDA

7457002.DGN

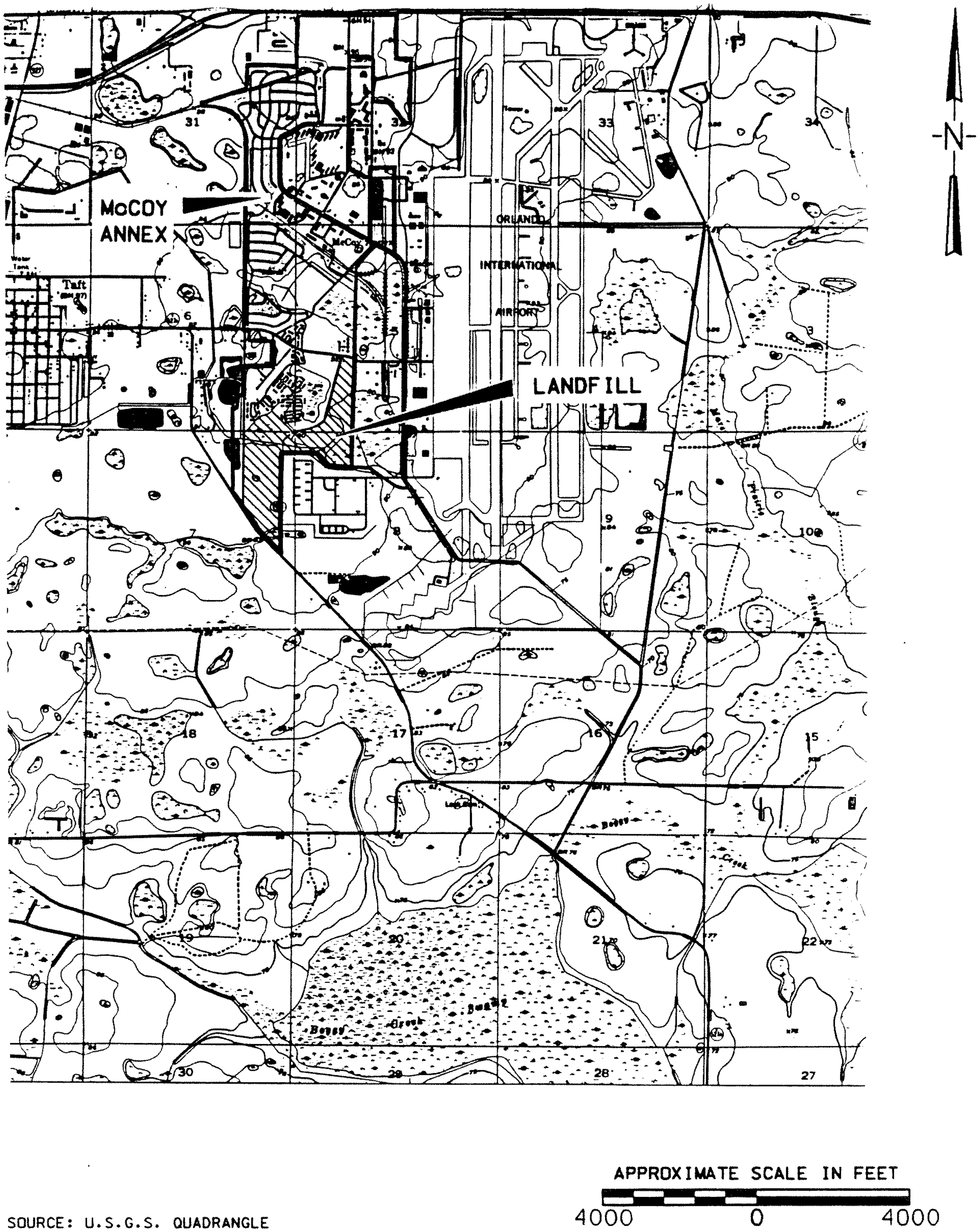
aquifer, (2) the intermediate aquifer and confining zone within the Hawthorn Group (formerly referred to as the secondary artesian aquifer), and (3) the Floridan aquifer system.

The sediments of the Hawthorn Group contain the intermediate aquifer (which may have more than one water-producing zone) and collectively act as a confining unit for both the surficial aquifer and the Floridan aquifer system. The Hawthorn Group acts as a lower aquitard for the surficial aquifer by impeding the downward migration of groundwater and as an upper aquitard for the Floridan aquifer system causing it to be confined or semiconfined. The Hawthorn Group is 80 to 100 ft thick on the eastern side of Orlando, as presented in geologic sections by Lichtler, Anderson, and Joyner (1968).

The net effect of the Hawthorn Group in the hydrogeologic framework for the NTC, Orlando area is to restrict the vertical flow of groundwater in the surficial aquifer and cause the primary direction of groundwater flow (in the surficial aquifer) to be horizontal, following the topography. This fact is important in the consideration of the potential transport of contaminants in groundwater. Horizontal flow in the surficial aquifer is a common occurrence in the northern and central parts of Florida where the Hawthorn Group is present. The potential does exist in the NTC, Orlando area for groundwater to migrate vertically into the intermediate aquifer and eventually into the Floridan aquifer system, depending on the elevation of the potentiometric surface for these two lower aquifers relative to the elevation of the water table. The low vertical permeability of the clayey Hawthorn Group sediment, however, would result in extremely slow vertical flow rates (i.e., long travel times) relative to horizontal flow rates in the surficial aquifer. The prevalence of karst activity and sinkhole development throughout the greater Orlando area will be considered in the hydrogeologic characterization.

For these reasons the primary unit of hydrogeologic interest to the investigation of potential groundwater contamination at OU 2 will be the surficial aquifer. The Holocene and Pleistocene sediments that contain the surficial aquifer are primarily sand with varying amounts of silt and clay. On the eastern side of Orlando the sediment ranges in thickness from approximately 60 to 90 ft, based on geologic sections presented by Lichtler, Anderson, and Joyner (1968). As discussed above, groundwater flow in the surficial aquifer is generally horizontal, following the topography to the nearest surface water body or drainage ditch intersecting the water table. A discussion of the conceptual understanding of groundwater flow in the surficial aquifer at OU 2 on which the groundwater investigation will be planned is provided below.

In contrast to the Main Base area of NTC, Orlando, the southern portion of the McCoy Annex area, where the OU 2 landfill is located, is relatively flat and has much lower overall topographic relief (Figure 2-3). Canals have been excavated in the area to compensate for this lack of topographic relief and to facilitate drainage of surface water. Several of these drainage canals are located on and adjacent to the OU 2 landfill.



SOURCE: U.S.G.S. QUADRANGLE

FIGURE 2-3 TOPOGRAPHIC MAP OF McCOY ANNEX LANDFILL AND SURROUNDING AREA	RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL NAVAL TRAINING CENTER ORLANDO, FLORIDA

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Field reconnaissance of the OU 2 landfill and evaluation of the potentiometric data presented in the Verification Study (Geraghty & Miller 1986) indicate that these drainage canals exert a controlling influence on the direction of groundwater flow in the upper portion of the surficial aquifer. This influence exists because the canals have been excavated to a depth sufficient to intersect the water table and provide a point of discharge for groundwater. No lithologic or potentiometric information is available concerning the lower portions of the surficial aquifer at OU 2.

Cypress swamps are located on and adjacent to the OU 2 landfill. Field reconnaissance has verified that these areas are indicative of locations at which permanent surface water bodies exist. Based on the size of the trees present, the swamps most probably predate the landfilling activities. These swamps are likely to be a surface expression of the water table and may be locally affecting the direction of groundwater flow in the surficial aquifer.

The conceptual understanding of the groundwater flow at OU 2 presented above is summarized below. This understanding will form the basis on which the groundwater investigation will be planned.

- The aquifer of primary interest to the groundwater investigation at OU 2 is the surficial aquifer.
- Groundwater flow in the surficial aquifer is horizontal, with the direction of flow influenced primarily by the presence of drainage canals.
- The drainage canals act as the primary point of discharge for water in the surficial aquifer. Cypress swamps located on and adjacent to the landfill may also act as points of groundwater discharge.
- The entire thickness of the surficial sand (from the water table to the top of the Hawthorn Group) is available for the potential transport of contaminants and will require assessment during the investigation.

If groundwater contamination from the landfill exists at the base of the surficial sand unit, the Hawthorn Group and potentially the Floridan aquifer system will be investigated to determine if contaminant migration has occurred.

2.4 LAND USE

The McCoy Annex Landfill is an inactive landfill located in the southern part of McCoy Annex, west of Orlando International Airport. A golf course now occupies much of the site. McCoy Annex, comprising approximately 877 acres, is located 12 miles south of the Main Base and serves primarily as a housing and community support activity for NTC, Orlando. The landfill occupies approximately 99 acres.

The golf course is used by about 2,500 to 3,000 people per month; approximately 676 enlisted personnel and 1,900 dependents reside at McCoy Annex; and there are two elementary schools within 1 mile west of McCoy Annex. Although zoned for industrial use and airport-related development, most of the area immediately west of the Annex is vacant wooded land. The Beeline Expressway, a major artery running east and west through Orange County, forms the northern boundary of McCoy Annex. The property north of this expressway is used primarily for airport-related industry. Adjacent to the southern boundary are undeveloped woodlands. The eastern boundary of McCoy Annex is adjacent to the Orlando International Airport.

McCoy Annex obtains its drinking water from the Orlando Utilities Commission and Winter Park Utilities (ABB-ES 1994a). Three irrigation wells are present at McCoy Annex.

Surface water from the McCoy Annex Landfill flows through drainage canals and retention ponds and then discharges to Boggy Creek and Boggy Creek Swamp, located south of the landfill. Surface water from Boggy Creek then flows into East Lake Tohopekaliga approximately 12.5 miles south of McCoy Annex.

All surface waters in the vicinity of NTC, Orlando are classified by the State of Florida as Class III waters suitable for fish and wildlife propagation and water-contact sports (ABB-ES 1994a). Groundwater in the surficial aquifer and the Floridan aquifer at NTC, Orlando is classified as G-II groundwater suitable for potable use.

2.5 REVIEW OF EXISTING DATA

2.5.1 Previous Investigations

The first phase of the NACIP program at NTC, Orlando was the IAS conducted in 1985 (C.C Johnson & Associates 1985). This program included an archival search and site walkovers at all four facilities of NTC, Orlando. Nine potentially contaminated sites were identified. The IR program sites were all located on three of the four NTC, Orlando facilities: Main Base, McCoy Annex, and Area "C." The sites included two trench-and-fill landfills (the North Grinder and McCoy Annex Landfills, IAS Sites 1 and 3, respectively).

The Verification Study was performed in 1986 (Geraghty & Miller 1986). This study recommended that the McCoy Annex Landfill (Site 3) be targeted for additional investigation. A brief Work Plan for the RI of the McCoy Annex Landfill (and three other IR program sites) was prepared in 1987; however, the Work Plan was not implemented (ABB-ES 1994c).

2.5.2 Types and Concentrations of Wastes

In the IAS (C.C. Johnson & Associates 1985) it was estimated that the volume of waste was more than 1,000,000 yds^3. Landfill wastes reportedly included the following:

- paint and paint thinner;
- asbestos;
- transformers [possibly with transformer oil containing polychlorinated biphenyls (PCBs)];
- hospital wastes (including syringes, dressings, blood and urine samples);
- low-level radiological waste (from Air Force operations);
- automobile batteries;
- steel cable, scrap metal, sections of pipe;
- airplane parts;
- bricks;
- fire hoses;
- parachutes;
- trees and leaves, scrap wood;
- paper, plastic; and
- possibly waste oil.

Five monitoring wells (MW-5, MW-8, MW-9, MW-10 and MW-13) (see Figure 2-1) were installed during the Verification Study performed by Geraghty & Miller (1986). Two existing wells from an earlier study (Conklin, Porter, and Holmes Engineers, Inc., 1983) were also incorporated into the Verification Study (MW-11 and MW-12, Figure 2-1). The wells were sampled for Secondary Drinking Water (SDW) standards, USEPA priority pollutants, and total radiological activity (gross alpha and gross beta). In addition, four surface water and sediment samples were collected (see Figure 2-1). Surface water samples were analyzed for USEPA priority pollutants. Sediment samples were analyzed for metals by Extraction Procedure Toxicity (EP Tox). Surface water and sediment samples at all four locations indicated elevated levels of phenols ranging from 1.0 to 3.4 parts per million (ppm). Arsenic was detected in the sediments at the southeasternmost location at 53 parts per billion (ppb).

A summary of the groundwater results is presented in Table 2-1. Elevated gross alpha values may be caused by naturally occurring radon and/or uranium. Without specific radionuclide activity values, a determination of the significance of these values cannot be made.

2.6 APPROACH OVERVIEW

The current system for Superfund cleanups is based on two programs: designated remediation and removal. The remedial program is traditionally structured toward long-term remedies that address risk as predicted under future scenarios. This traditional process has led to long study-based investigations to enable detailed alternative selection and evaluation of proposed remedies.

Recognizing that the process is both slow and expensive, USEPA sought to encourage flexibility in the program through the Superfund Accelerated Cleanup Model (SACM) program (USEPA 1992b). SACM encourages early action or development of ways to focus the RI/FS parts of an investigation, especially for certain types of sites with similar characteristics such as municipal landfills. The goal of SACM is to accelerate the entire remedial process.

Based on information collected from the types of sites previously investigated, presumptive remedies are considered a tool of acceleration within SACM that should be applied when appropriate. Presumptive remedies are preferred technologies for common categories of sites, based on historical RI/FS investigations within the Superfund program. Past experience can streamline or focus the site investigation and remedy selection, reducing the cost and time required to clean up the given type of site.

For this investigation of the McCoy Annex Landfill, the presumptive remedy of containment and capping is used within the approach of this Work Plan. The necessity of applying additional technologies to the presumptive remedy to meet overall remedial objectives for the site is anticipated.

To achieve the goals of SACM, uncertainties inherent in the RI/FS process must be recognized in the work-planning phase. A common misconception is that uncertainties can be reduced early in the life of the project. The reasoning is that time and resources invested during the investigation and study phases can yield a high degree of certainty in the expected results, thereby preventing large expenses later. As has been demonstrated in previous Superfund projects, however, major technical uncertainties exist in all of the key components of hazardous waste site characterization and remediation. There remains uncertainty in

Table 2-1
Summary of Results of Groundwater Analysis
Operable Unit 2, McCoy Annex Landfill

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
Orlando, Florida

Contaminant	MW-5	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	Federal MCL	State of Florida MCL
Iron (mg/L)	0.61	7.4	1.6	1.2	9.8	12	2.6	N/A	0.3[a]
Arsenic (mg/L)	--	0.02	--	--	--	--	--	0.05	0.05
Manganese (mg/L)	--	--	0.02	0.02	1.3	0.22	--	N/A	0.05[a]
Gross Alpha (pCi/L)	22±10	210±55	94±23	12±3	100±17	37±7	91±16	15 pCi/L	15 pCi/L
Gross Beta (pCi/L)	30±7	137±17	8±3	18±22	18±15	24±12	83±15	50 pCi/L[b]	50 pCi/L[b]
Benzene (µg/L)	--	--	--	--	--	31	--	5	1
Chloro-benzene (µg/L)	--	--	--	--	--	36	--	100	100
Ethylbenzene (µg/L)	--	--	--	--	--	10	--	700	700
Methylene Chloride (Dichloro-methane) (µg/L)	--	--	--	--	--	7.3 J	--	5	5
1,4-Dichlo-robenzene (µg/L)	--	--	--	--	--	8.3 J	--	75	75
Naphthalene (µg/L)	--	--	--	--	--	16	--	N/A	6.8[c]

[a] Secondary standard maximum contaminant level
[b] Gross beta screening level is referenced because specific nuclides are not known for conversion to dose (whole body or organ)
and comparison against 4 millirem per year federal and state level
[c] Organoleptic threshold guidance concentration (Florida Department of Environmental Protection)

Notes: J = estimated concentration; values are between the detection limit and one-half of that limit.
MCL = maximum contaminant level
mg/L = milligrams per liter
NA = not available
pCi/L = picocuries per liter
µg/L = micrograms per liter

characterizing the affected media, predicting contaminant fate and transport, assessing risk, and predicting technology performance. These uncertainties have the consequences described below for the traditional approach to site remediation.

- It is traditionally assumed that more study will progressively reduce uncertainty by meaningful amounts. For all but the simplest of waste sites, however, this has not been the case. The marginal value of collecting and analyzing more samples declines rapidly once general site conditions are ascertained because of the high degree of heterogeneity within the landfill and the problems inherent in dealing with karst geology.

- Traditionally the expectation for remedial design is that the constructed remedy will closely resemble the alternative selected in the Record of Decision (ROD). Engineers and scientists inevitably enter the implementation phase with many unresolved questions, however, because of the high degree of uncertainty associated with complex hazardous waste sites. Under the traditional approach, many of these unknowns are not acknowledged and, thus, are detected only as a result of a failure of the remedy.

- In the presence of uncertainty, individuals respond with different assumptions and interpretations. The traditional approach ultimately does not distinguish between these interpretations, and the implementation phase recognizes only one interpretation. Equally valid interpretations are not recognized.

Uncertainty need not handicap a project as long as it is recognized as a factor from the beginning and as long as it is possible to observe and continuously test the working model of the site as implementation proceeds. The suggested approach should address uncertainties common at hazardous waste sites, relying on flexible designs that can be modified during implementation to meet conditions as they are found. It is far safer to recognize uncertainty and plan for it than to assume that state-of-the-art technology will make highly accurate predictions and provide the necessary answers. This premise has spawned programs such as SACM and related concepts, including presumptive remedies and streamlining.

The steps presented below lead to the identification of the most probable conditions and account for reasonable deviations for the site in the form of a concept to be used during design and implementation. Monitoring and contingent actions to take if deviations are detected are also identified.

1. Planning sessions are conducted to sort through issues, review existing data, and screen possible remedial actions and technologies. A Work Plan is developed to give direction to the subsequent investigation and analyses.

2. Information is gathered and knowledge of general site conditions and of the nature and extent of contamination is refined. Investigations are complete when it is possible to determine probable conditions (including associated risk), differentiate among alternatives, set monitoring requirements, and identify reasonable deviations. Probable site conditions are those most likely to occur. Reasonable deviations are other potentially valid interpretations of site conditions.

3. The most probable site conditions and reasonable deviations are established. Based on this identification, conceptual designs incorporating both a base action and a contingent action can be developed and a ROD can be signed. The selected alternatives will identify probable technology performance and reasonable deviations from that performance.

4. Following remedy selection, remedial designs based on the most probable site conditions plus designs covering contingencies for the agreed-upon reasonable deviations are produced.

5. Parameters to observe during remediation to detect deviations during construction and operation are selected. Key indicators (chemical, physical, and others) are selected for observation during remediation for both expected and reasonable-deviation conditions. The selected parameters are measured, and necessary modifications (contingent action) are made if deviations occur. Decisions on changes to the remedial action are made on the basis of the detected deviations, then contingent actions are developed.

This proposed approach recognizes that complete site characterization is not possible or necessary and, therefore, the remaining uncertainties must be managed. This approach emphasizes the collection of data only to support decisions. At the McCoy Annex Landfill, because a presumptive remedy of containment and capping will be used, the primary decisions will be to determine (1) the type of cover that may be required to prevent exposure and (2) whether groundwater controls are needed to prevent groundwater migration. To make these decisions, data must be available to support a human health risk assessment, a qualitative ecological risk evaluation, and an FS.

Two different sampling strategies will be applied to the media within and surrounding the landfill to provide confidence that potential contamination has been identified and to verify the conceptual site model for groundwater, sediment, surface water, and surface soil (evaluation of soil quality).

- Hydrologic, gas generation and migration, and groundwater data will be collected on a purposeful basis because of the potential heterogeneity involved. Purposeful sampling is biased sampling; examples include characterizing areas of likely high concentrations or evaluating changes in concentrations with distance from the source. Surface soil data will be collected on a grid basis.

- In areas where contamination is considered to be either unlikely or more homogeneously distributed (off-site sediment and surface water), a statistically based sampling methodology will be applied.

The proposed statistical approach is based on a prescribed minimum sample size of 10, considered by USEPA to be a minimum for upper confidence limit (UCL) calculation based on the normal or lognormal distributions. Samples will be randomly located within areas that are likely to be relatively homogenous in terms of contamination or environmental conditions. If data are not distributed in normal or lognormal fashion, a nonparametric (distribution-free) statistic, the 95 percent UCL for the median, will be used.

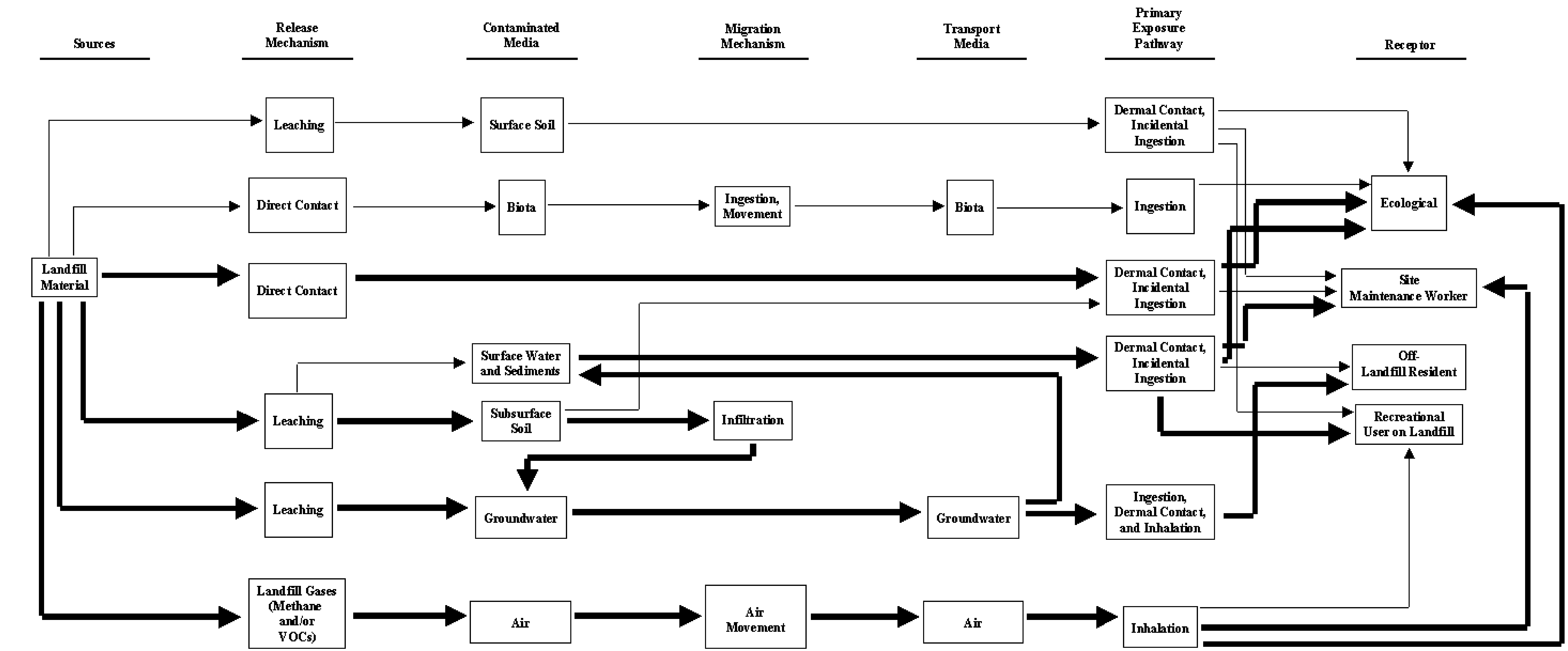
2.7 DATA NEEDS EVALUATION

2.7.1 Conceptual Site Model

The conceptual site model (CSM) is a framework within which the environmental pathways of potential concern are identified and illustrated. The media to be sampled to evaluate whether a release has occurred can be identified from the model. The CSM also serves as a framework for conceptualizing response actions. The CSM includes a set of hypotheses about the contaminated media and environmental pathways that are selected on the basis of existing data and site understanding. The source areas are identified as the areas of waste deposition. A contaminant release mechanism is defined as a process that results in migration of a contaminant from a source area into the immediate environment. Once in the environment, contaminants can be transferred between media and transported away from the source and/or site.

Figure 2-4 illustrates the various media, transport pathways, and exposure pathways that could be affected by release of the source material within the McCoy Annex Landfill. This model represents current and predicted future conditions at the site, assuming that the site, from a regulatory standpoint, will remain a closed landfill. In the CSM, a distinction has been made between probable conditions and reasonable deviations. For the most part, data collected will be used to characterize the current nature and extent of contamination to support the human and ecological risk assessments and the FS.

Contamination of subsurface soil underlying the landfill is probable as a result of the history and nature of the landfill. The probable contaminants are organics, inorganics, PCBs, and methane. Other potential contaminants (and, therefore, reasonable deviations from the CSM) would be hospital wastes, methane, and



Legend

Probable Condition

Potential Deviation

Assumption: Landfill soil cover is existing. No utilities exist that are in contact with landfill waste. This model represents current and future uses.

FIGURE 2-4

CONCEPTUAL SITE MODEL, McCOY ANNEX LANDFILL, OPERABLE UNIT 2

RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL

NAVAL TRAINING CENTER ORLANDO, FLORIDA

low-level radiological waste associated with Air Force operations. Low-level radiological waste would account for elevated gross alpha and beta activity in groundwater samples collected during the Verification Study (Geraghty & Miller 1986). Radon gas and gamma radiation might be present as a result of the low-level radiological waste but might also be the result of naturally occurring materials in the area.

The presumptive remedy of source containment, capping, and institutional controls will eliminate the need to remediate or remove the subsurface soil; therefore, no characterization of the subsurface soil is needed, and no sampling of this medium will be performed.

In the CSM, there are four probable release mechanisms for contaminants.

1. **Direct contact**. Ecological receptors may come in contact with the source material and be exposed by dermal contact or incidental ingestion, even if the presumptive remedy is properly implemented and maintained.

2. **Leaching to shallow groundwater**. Contaminants can leach from the source into the shallow groundwater. Groundwater may migrate into surface water and sediments so that subsequently ecological receptors, site maintenance workers, and recreational users may be exposed through dermal contact and incidental ingestion. Off-landfill residents may also be exposed through ingestion, dermal contact, and inhalation during residential use of the affected shallow groundwater.

3. **Leaching to subsurface soil**. Contaminants can leach from the source into the subsurface soil beneath and adjacent to the source. Infiltration of rainwater may result in secondary leaching from the subsurface soil to the shallow groundwater. Groundwater may migrate into surface water and sediments so that subsequently ecological receptors, site maintenance workers, and recreational users may be exposed through dermal contact and incidental ingestion. Off-landfill residents may also be exposed through ingestion, dermal contact, and inhalation during residential use of the affected shallow groundwater.

4. **Landfill gases**. Volatile organic compounds (VOCs) and methane can be generated from the source materials, potentially resulting in exposure of ecological receptors and site maintenance workers through inhalation.

Six potential deviations have been identified.

1. **Sediment and surface water**. It is possible that some landfill material is exposed at the surface that could result in leaching of contaminants to sediment and surface water. Ecological receptors, site maintenance workers, and recreational users could be exposed through dermal contact and incidental ingestion.

2. **Surface soil**. It is possible that some surface soil has been contaminated by the landfill material. Ecological receptors, site maintenance workers, and recreational users could be exposed through dermal contact and incidental ingestion.

3. **Biota food chain**. It is possible that biota exposed to contaminated materials (source material from the landfill or contaminated soil, sediment, or surface water) could be ingested by other biota, resulting in bioaccumulation risks to ecological receptors.

4. **Gases released from the landfill wastes**. Despite the age of the landfill, release of VOCs or methane and subsequent inhalation by recreational users are possible.

5. **Sediment and surface water**. It is possible that contaminants (leached from source material or contaminated soil) could migrate to off-landfill sediment and surface water. Off-landfill residents could be exposed through dermal contact or incidental ingestion.

6. **Landfill material and subsurface soil**. Intrusive activities could occur at the landfill, and site maintenance workers could be exposed through dermal contact or incidental ingestion.

Exposure to radon is not considered because of the short half-life (3.8 days) and consequent low potential for lateral migration. Explosion potential as a result of methane generation is considered unlikely because of the age of the landfill and, therefore, is also excluded from consideration.

Exposure through ingestion of groundwater within the Floridan aquifer system is not considered probable or potential because of the presence of the Hawthorn Group, the principal aquitard impeding vertical flow between the surficial aquifer and Floridan aquifer system (see Section 2.3, Hydrogeologic Setting). This assumption will be verified during the RI, however, as discussed in Section 2.3.

The exposure potential to these probable and potential contaminated media is discussed in Section 2.7.2, Preliminary Risk Evaluation.

2.7.2 Preliminary Risk Evaluation

2.7.2.1 Hazard Identification

Wastes reportedly disposed of in the McCoy Annex Landfill include paint, paint thinner, asbestos, transformers (possibly with transformer oil containing PCBs), autoclaved hospital wastes (syringes, dressings, blood, and urine), radioactive wastes, automobile batteries, steel cable, airplane parts, brick, fire hoses, parachutes, tree leaves, paper, plastic, scrap wood, scrap metal, sections of pipe, and waste oil (ABB-ES 1994a). Groundwater samples collected from seven monitoring wells in the area of the former landfill indicate the presence of iron; arsenic; zinc; manganese; benzene; chlorobenzene; ethylbenzene; 1,4-dichlorobenzene; naphthalene; and radionuclides (ABB-ES 1994a). Contaminants detected in surface water samples collected in the drainage canals include phenols, methylene chloride, and lead. Arsenic was detected in sediments from one area. An unconfirmed report of mercury in leachate has also been made (ABB-ES 1994a). Based on the waste disposal history and limited monitoring data, potential hazards at the site appear to be organics, inorganics, and radionuclides.

2.7.2.2 Human Health Preliminary Risk Evaluation

2.7.2.2.1 Potential Receptors

Potential receptors exposed to contamination associated with the McCoy Annex Landfill have been identified by considering present and future land and groundwater uses at the site. For purposes of this Work Plan the phrase “on site” refers to the area within the boundary of the landfill as defined by the geophysical summary and sampling programs.

McCoy Annex obtains its drinking water supply from the Orlando Utilities Commission and Winter Park Utilities (ABB-ES 1994a). In addition, there are three irrigation wells at McCoy Annex, none of which are used as potable water supplies (ABB-ES 1994a).

Surface water from the landfill flows through drainage canals and retention ponds and discharges to Boggy Creek and Boggy Creek Swamp, which are located south of the landfill. Surface water from Boggy Creek then flows into East Lake Tohopekaliga approximately 12.5 miles south of McCoy Annex (see Figure 2-3).

All surface waters in the vicinity of NTC, Orlando are classified by the State of Florida as Class III waters suitable for fish and wildlife propagation and water-contact sports (ABB-ES 1994a). Groundwater in the surficial aquifer and the Floridan aquifer at NTC, Orlando is classified as G-II groundwater suitable for potable use.

From a regulatory standpoint, the McCoy Annex Landfill will be treated as a closed landfill; however, future reuse scenarios include its continued use as a golf course, with residential areas outside of, but adjacent to, the closed landfill. For purposes of this RI/FS Work Plan it is assumed that no utilities pass through the former landfill and that no irrigation lines penetrate through the soil cover into landfill materials. If such utilities exist, therefore, they will be removed from service or replaced with utilities that do not penetrate the soil cover into landfill materials. This action will protect maintenance workers from potential exposure through direct contact with landfill wastes. In addition the presumptive remedy including capping would preclude the maintenance of existing utilities or installation of any future utilities.

Recognizing the current and anticipated future use of the landfill, the following potential receptors have been identified:

- a site maintenance worker who performs routine landfill and/or golf course maintenance activities (e.g., cap maintenance, sprinkler system repairs) that on occasion bring him in contact with landfill materials or contaminated media,

- a future recreational user of the site,

- a future off-landfill resident who extracts groundwater from beyond the landfill boundaries for potable use or who comes in contact with contaminated off-landfill surface water or sediments, and

- an ecological receptor such as a burrowing animal or a predator that might consume the burrowing animal.

2.7.2.2.2 <u>Potential Exposure Pathways</u>

An exposure pathway consists of four elements:

- a contaminant source,
- a transport mechanism,
- an exposure route (i.e., direct contact or ingestion), and
- a receptor.

The CSM for the McCoy Annex Landfill is presented in Section 2.7.1. The exposure pathways anticipated for the McCoy Annex Landfill are shown in the CSM. Under what are considered to be the most probable site conditions, the exposure pathways include:

- dermal contact with or ingestion of landfill materials by an ecological receptor;
- inhalation of landfill gases by an ecological receptor or a site maintenance worker;
- ingestion of landfill material by a burrowing ecological receptor;
- dermal contact with, ingestion of, or inhalation of landfill-derived contaminants that have migrated to shallow groundwater by an off-landfill resident; and
- dermal contact with or incidental ingestion of landfill-derived contaminants that have migrated to surface water and/or sediment by an ecological receptor, a site maintenance worker, or a recreational user.

Other potential pathways considered, although less likely to be completed pathways and therefore referred to as potential deviations, include the following:

- inhalation of landfill gases by a recreational user;
- dermal contact with or incidental ingestion of landfill-derived contaminants that have leached into surface soil by an ecological receptor, a site maintenance worker, or a recreational user;
- dermal contact with or incidental ingestion of landfill-derived contaminants that have leached into the subsurface soil by an ecological receptor or a site maintenance worker;
- ingestion of contaminated biota by an ecological receptor (resulting in possible bioaccumulation); and
- dermal contact with or incidental ingestion of landfill-derived contaminants that have migrated to surface water or sediment outside the landfill boundaries by an off-landfill resident.

Existing data suggest that exposure through ingestion of groundwater from within the Floridan aquifer is not probable or potential because of the presence of the Hawthorn Group, the principal aquitard impeding vertical flow between the surficial aquifer and the Floridan aquifer system; however, this assumption will be evaluated during the RI.

In addition to the above exposure pathways, a site maintenance worker potentially faces safety risks if ordnance was disposed of in the landfill. Although no documentation exists to indicate that ordnance was in fact disposed of at the McCoy Annex Landfill, the possibility cannot be ruled out. This possibility will be addressed before any intrusive work is undertaken at the landfill.

2.7.2.2.3 Exposure Pathways under the Presumptive Remedy

USEPA's directives on presumptive remedies for CERCLA municipal landfill sites (USEPA 1993a; 1993b) state that those exposure pathways addressed by the presumptive remedy need not be evaluated quantitatively in the RI/FS risk evaluation. The presumptive remedy of source containment and capping is assumed to adequately address or mitigate the potential risks associated with those exposure pathways. The presumptive remedy, as described in the directive, includes the following components:

- landfill cap,
- source area groundwater control,
- leachate collection and treatment,
- landfill gas collection and treatment, and
- institutional controls.

The remedy selected for OU 2 will be determined based on the results of the RI; some, all, or none of the above components may be selected.

According to USEPA's directives (USEPA 1993a; 1993b), a landfill cap is assumed to prevent human receptors from coming into direct contact with landfill material and contaminated surface soil, thereby eliminating this exposure pathway. During the RI the adequacy of the existing soil cover will be evaluated to determine if it is sufficient to prevent exposure. Source area groundwater control and/or leachate collection and treatment will prevent further migration of contaminants from the source to potential downgradient groundwater receptors and to surface water and sediment. Further investigation is needed to confirm the presence and/or extent of groundwater contamination, to determine if migration to surface water bodies has occurred, and to identify and investigate any potentially affected surface water bodies. Landfill gas collection and treatment, if necessary, will prevent the buildup and/or release of gases from the landfill, thereby eliminating this pathway. The RI will investigate the presence or absence of landfill gases. Institutional controls (e.g., deed restrictions) restricting site usage related to future excavation, construction, and/or groundwater extraction may also be selected as remedies to control future site use.

2.7.2.3 Ecological Preliminary Risk Evaluation

A preliminary risk evaluation was conducted to provide input for the development of this RI/FS Work Plan and the upcoming RI. This section presents the results of the evaluation and contains a brief discussion of the potential ecological receptors and exposure pathways present at OU 2 through which ecological receptors could be exposed to the chemicals of potential concern (COPCs) discussed in Section 2.7.2.1.

2.7.2.3.1 Potential Ecological Receptors.

Terrestrial Habitat and Receptors

Approximately 5 percent of the NTC, Orlando installation (roughly 100 acres basewide) is undeveloped, providing a limited amount of habitat for ecological receptors. A nine-hole golf course comprises the majority of the McCoy Annex Landfill. Most of the area immediately adjacent to McCoy Annex to the west and south is undeveloped and forested.

Three tree species provide the predominant vegetative cover at the base: live oak (*Quercus virginiana*), slash pine (*Pinus elliottii*), and cabbage palm (*Sabal palmetto*). Wetland habitat in the vicinity of McCoy Annex is dominated by bald cypress (*Taxodium distichum*)(C.C. Johnson & Associates 1985). Red maple (*Acer rubrum*) and pines (*Pinus* spp.) are additional dominant wetland tree species noted by ecologists during a brief reconnaissance of the installation. Additional information regarding vegetative cover types in the vicinity of the McCoy Annex Landfill is not currently available but will be obtained and incorporated into the habitat characterization of the RI, as discussed in Section 5.0.

Limited information is available regarding terrestrial fauna at NTC, Orlando. It is likely that the undeveloped areas surrounding the McCoy Annex Landfill provide habitat for a variety of wildlife species including various invertebrates, amphibians, reptiles, birds, and mammals.

Amphibians that may exist in the vicinity of McCoy Annex include several species of mole salamander (*Ambystoma* spp.) that spend at least part of the year in woodlands. Various species of lizards and colubrid snakes may also live in the pine forest communities at the installation. Several species of venomous snakes may be found in the area, including the eastern coral snake (*Micururus fulvius fulvius*), dusky pygmy rattlesnake (*Sistrurus miliarus barbouri*), and eastern diamondback rattlesnake (*Crotalus adamanteus*). The reptilian species mentioned above are among the top predators in the food chain at the installation. Rattlesnakes feed on rodents, birds, amphibians, and small reptiles. Coral snakes ingest other snakes, lizards, and amphibians.

Small mammals that may exist at the site include the eastern cottontail rabbit (*Sylvilagus floridanus*), hispid cotton rat (*Sigmodon hispidus*), and cotton mouse (*Peromyscus gossypinus*). Predatory mammals such as the red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*) may feed on small mammals at the base. In the wetland areas in the vicinity of McCoy Annex, omnivorous mammals such as the raccoon (*Procyon lotor*) may find habitat.

Birds of prey such as the black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), and red-shouldered hawk (*B. lineatus*) may forage for prey items in more open areas of the site. Granivorous birds such as the mourning dove (*Zenaida macroura*) are likely to be found in the grassy habitats at the site. Other bird species that may exist at NTC, Orlando include the brown-headed cowbird (*Molothrus ater*), brown thrasher (*Toxostoma rufum*), bobwhite quail (*Colinus virginianus*), mockingbird (*Mimus polyglottus*), common grackle (*Quiscalus quiscula*), killdeer (*Charadrius vovoferus*), northern cardinal (*Cardinalis cardinalis*), blue jay (*Cyanocitta cristata*), rufous-sided towhee (*Pipilo erythrophthalmus*), common flicker (*Colaptes auratus*), and red-bellied woodpecker (*Centurus carolinus*).

Birds that may use the forested wetland habitat near the McCoy Annex Landfill include the swamp sparrow (*Melospiza georgiana*), Carolina wren (*Thryothorus ludovicianus*), northern cardinal (*Cardinalis cardinalis*), common yellowthroat (*Geothlypis trichas*), wood duck (*Aix sponsa*), great blue heron (*Herodias ardea*), and possibly a number of egrets (*Egretta* spp.).

Aquatic Habitat and Receptors

All surface waters in the vicinity of NTC, Orlando are classified by the State of Florida as Class III waters suitable for fish and wildlife propagation and water-contact sports. Surface water runoff from the McCoy Annex Landfill drains via a series of drainage ditches along the perimeter and through the center of the golf course. Water flows through a drainage canal and retention ponds before discharging to Boggy Creek and Boggy Creek Swamp, a forested wetland dominated by bald cypress, located south of the landfill.

The drainage ditches and golf course water hazards may provide limited habitat for populations of aquatic invertebrates, amphibians, and small fish species. Great blue herons, which feed primarily on small fish and amphibians, are also likely to forage in these ditches. Other aquatic habitat, however, is available in the series of lakes, ponds, and swamps located throughout other portions of the base. The drainage ditches, golf course water hazards, lakes and ponds, and swamps with sufficient water provide habitat for a number of fish species, including largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), golden shiner (*Notemigonus crysoleucas*), yellow bullheads (*Ameiurus natalis*), and killifish (*Fundulus* spp.) as well as aquatic invertebrates (C.C. Johnson & Associates 1985). According to the NTC, Orlando *Master Plan Update* (SOUTHNAVFACENGCOM 1985), grass carp

(*Ctenopharyngodon idella*) have been introduced into several of the larger lakes to control Florida elodea *Hydrilla verticillata*, an invasive, rapidly growing aquatic weed that chokes waterways, rendering them impassable to boat traffic.

A number of other salamanders, frogs (including members of the genera *Hyla*, *Rana*, and *Pseudacris*), and toads (*Bufo* spp.) may occur in surface water bodies near the site. The Florida cottonmouth (*Agkistrodon piscivorus)*, a venomous aquatic snake inhabiting lakes, rivers, swamps, and ditches, also could occur in the ditches and golf course water hazards in the vicinity of the landfill. Cottonmouths feed on fish, amphibians (e.g., frogs and salamanders), small- to medium-sized reptiles (e.g., lizards, small turtles, baby alligators), and small birds and mammals. Other aquatic and semiaquatic reptiles (e.g., the American alligator, *Alligator mississippiensis*) probably occur in the ditches, golf course water hazards, lakes, and other water bodies at the installation.

Rare, Threatened, and Endangered Species

Limited information is currently available regarding rare, threatened, and endangered species at NTC, Orlando. Additional information regarding rare, threatened, and endangered plants and animals will be requested from state and federal authorities (i.e., Florida's Natural Heritage Program, the Florida Game and Fresh Water Fish Commission, and the U.S. Fish and Wildlife Service) during the RI. Table 2-2 presents the species that may currently (or did in the past) exist at NTC, Orlando based on the information available in the 1985 *Master Plan Update* (SOUTHNAVFACENGCOM 1985) and in the IAS of NTC, Orlando (C.C. Johnson & Associates 1985).

Table 2-2
Rare, Threatened, and Endangered Species

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
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Orlando, Florida

Common Name	Scientific Name	Status	
		Federal	State
Florida mouse	*Podomys floridanus*	NL	SSC
Southeastern kestrel	*Falco sparverius peulus*	NL	T
Short-tailed snake	*Stilosoma extenuatum*	NL	T
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Gopher tortoise	*Gopherus polyphemus*	NL	SSC
American alligator	*Alligator mississippiensis*	T(S/A)	SSC

Source: Florida Game and Fresh Water Fish Commission (1996).
Notes: NL = not listed
SSC = species of special concern
T = threatened
T(S/A) = threatened due to similarity of appearance

2.7.2.3.2 Potential Ecological Exposure Pathways

In this section, potential ecological exposure pathways are discussed for the McCoy Annex Landfill. A complete exposure pathway contains the following four components:

- contaminant source,
- transport mechanism to a medium of ecological exposure,
- exposure route (e.g., direct contact or ingestion), and
- receptor.

Potential exposure pathways for the McCoy Annex Landfill are summarized in a CSM shown in Figure 2-4. The contaminant source is considered to be the landfill material. Contaminants from the source may migrate into environmental media. The contaminated media providing potential exposure points for ecological receptors include soil, sediment, and surface water. Groundwater is not considered to be a medium for exposure except as it contributes to sediment and surface water contamination.

Exposure of ecological receptors to contaminants can occur directly through contact with contaminated media or indirectly by means of the food chain. Significant exposures through the food chain, however, are expected only for chemicals known to bioaccumulate (i.e., some inorganic chemicals such as mercury and lead, PCBs, and certain organochlorine pesticides).

The exposure pathways shown in Figure 2-4 are identified as either a probable condition (i.e., exposure pathways that are likely to exist) or a possible deviation (i.e., exposure pathways that are unlikely to exist based on currently available information).

<u>Terrestrial Exposure Pathways</u>

Probable ecological exposure pathways for terrestrial species in the vicinity of the McCoy Annex Landfill include the following:

- dermal contact with or incidental ingestion of landfill material by terrestrial wildlife,
- inhalation of landfill gases by terrestrial wildlife, and
- dermal contact with or incidental ingestion of contaminated surface water and sediment by terrestrial wildlife.

Additional ecological exposure pathways for terrestrial species that are identified as possible deviations in the CSM include:

- food chain exposure by terrestrial wildlife and

- dermal contact or incidental ingestion of contaminated surface soil by terrestrial wildlife.

Plants and soil invertebrates (e.g., earthworms) may be exposed to chemicals in surface soil through direct contact and uptake into tissue. Soil invertebrates also ingest soil and, therefore, may be exposed through ingestion of contaminated soil. Other terrestrial species are not in constant contact with soil, but they still may be exposed through direct contact and incidental ingestion of surface soil as a result of foraging or grooming activities. Higher-trophic-level species could be exposed by means of the food chain to chemicals known to bioaccumulate.

Significant contact with subsurface soil is considered unlikely for the majority of ecological receptors. Burrowing animals, however, such as the gopher tortoise and a number of small mammal species, could potentially burrow into landfill material and be exposed. At McCoy Annex the landfill is currently covered by a golf course. Exposure to landfill material or any contaminants from landfill materials is possible, however, because of the presence of exposed landfill material noted along some drainage ditches (C.C. Johnson & Associates 1985) or through contact with any water bodies within the landfill.

Aquatic Exposure Pathways

Based on site conditions and the CSM for the McCoy Annex Landfill, probable ecological exposure pathways for aquatic life include dermal contact and ingestion of surface water and sediment by aquatic life.

Ecological food chain exposure for aquatic species is identified as a possible deviation in the CSM.

Aquatic and semiaquatic organisms, including invertebrates, fish, amphibians, and some reptiles, could potentially be exposed to contaminants in surface water and sediments on or in the vicinity of the landfill. The available site data are currently insufficient to determine which surface water bodies have been or may be contaminated by landfill-related contaminants; this data gap has been identified and will be addressed during the RI. If these aquatic exposure pathways are determined to be complete for either on-site or off-site water bodies, potential food chain exposures and risks to predatory receptor species will be evaluated.

Exposure Pathways under the Presumptive Remedy

Following USEPA directives on presumptive remedies for CERCLA municipal landfill sites (USEPA 1993a; 1993b), those exposure pathways that are addressed by the presumptive remedy will not be evaluated in the RI/FS risk evaluation. The presumptive remedy of source containment and capping will be assumed to adequately address or mitigate the potential risks associated with those exposure pathways. The presumptive remedy includes the following components:

- landfill cap,
- source area groundwater control,
- leachate collection and treatment,
- landfill gas collection and treatment, and
- institutional controls.

The remedy selected for OU 2 will be determined based on the results of the RI; some, all, or none of the above components may be selected.

The landfill cap will prevent direct contact of ecological receptors with landfill material and contaminated surface soil, thereby eliminating this exposure pathway. The RI will investigate the existence and integrity of the current soil cover and determine if a soil cap exists that is sufficient to prevent exposure to contaminated soil and landfill materials. Source area groundwater control and/or leachate collection and treatment will prevent further migration of contaminants from the source to surface water and sediment. Migration of contaminants to surface water bodies may have already occurred; therefore, further investigation is needed to determine if migration to surface water has occurred and to identify and investigate any potentially affected surface water bodies. Landfill gas collection and treatment, if necessary, will prevent the buildup and/or release of gases from the landfill, thereby eliminating this pathway. The RI will investigate the presence or absence of landfill gases. Institutional controls (e.g., deed restrictions) are not an effective means of protecting ecological receptors from exposure to contaminated surficial media (surface water, surface soil, and sediment). Deed restrictions preventing excavation and construction, however, may protect ecological receptors against future exposure to subsurface contamination within the landfill.

2.7.3 Preliminary Identification of Remedial Action Technologies

The identification of preliminary remedial action technologies required the identification of ARARs, remedial action objectives (RAOs), and probable treatment technologies.

2.7.3.1 Applicable or Relevant and Appropriate Requirements

The ARARs are used to determine the appropriate extent of the required remedial action, develop remedial action alternatives, and direct the remedial action. Section 121 of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substances Contingency Plan (NCP) specify that remedial action for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws that are ARARs to the hazardous substances or particular circumstances at a site. NTC, Orlando is not classified as a National Priorities List (NPL) site; however, the identification of ARARs will follow CERCLA guidance to ensure strict conformance with regulatory criteria.

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 law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site" [55 *Federal Register* (FR) 8814, March 8, 1990 (NCP)]. Examples of applicable requirements include cleanup standards and standards of control for a hazardous substance. Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (55 FR 8814). For example, the Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act (SDWA) would be considered relevant and appropriate at a site where surface or groundwater contamination could affect a potential (not actual) drinking water source.

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both; however, requirements must be both relevant and appropriate for compliance to be required. For cases in which federal and state ARARs are available, or when there are two potential ARARs addressing the same issue, the more stringent requirements must be met.

In the absence of federal- or state-promulgated regulations, there are other criteria, advisories, guidance values, and proposed standards that are not legally binding but may serve as useful guidance for setting protective cleanup levels. These are not potential ARARs but are "to-be-considered" (TBC) guidance.

A table is presented in Appendix A of this Work Plan that represents a preliminary compilation of potential ARARs, of which subsets will be used or to which additional ARARs will be added as site-specific contaminants are identified and remedial actions are evaluated during the FS. This list is separated into the following three categories: chemical-, location-, and action-specific ARARs.

- "Chemical-specific requirements set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants" (55 FR 8814). These requirements generally set protective cleanup levels for the chemicals of concern (COCs) in the designated media or indicate a safe level of discharge that may be incorporated when considering a specific remedial activity.

- Location-specific requirements "are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats" (53 FR 51437, proposed NCP, 1988).

- Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste (55 FR 8814). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies as well as specific environmental levels for discharge or residual chemicals.

The list of ARARs in Appendix A was used for the development of the probable remedial actions required at the McCoy Annex Landfill.

2.7.3.2 Preliminary Remedial Action Objectives

Preliminary RAOs were identified through the development of the CSM and the preliminary list of ARARs for the McCoy Annex Landfill site. The intent of the RAOs is to determine the specific media, contaminants, and probable exposure pathways that must be addressed through a remedial action to protect the public and environment. These RAOs were developed to protect the public and environment for both existing and future site conditions as presented by the CSM. Under CERCLA guidance, RAOs required to protect the public health and environment are calculated based on the list of COPCs detected in the media, the corresponding acceptable exposure levels calculated on a cumulative basis, and the routes. During the RI evaluation these criteria will establish specific maximum allowable concentrations for each COPC detected at the McCoy Annex Landfill site.

The probable contaminated media are subsurface soil within and beneath the landfill material and groundwater beneath the landfill; potential contaminated media include air, surface soil, surface water, and sediment. The probable exposure pathways include direct contact or incidental ingestion of landfill material by a site maintenance worker or ecologist receptor; dermal contact, ingestion, or inhalation associated with residential use of groundwater; inhalation of landfill gases by an ecological receptor or a site maintenance worker; and dermal contact with or incidental ingestion of contaminated surface water and sediment by a site maintenance worker, a recreational user, or an ecological receptor. The only potential contaminated media requiring remedial action are the groundwater and landfill sediments and the surface water (ditches and golf course water hazards).

The likely COPCs at the McCoy Annex Landfill include organics, inorganics, chemicals derived from biomedical waste, and possibly radionuclides. Based on the list of ARARs, probable contaminated media, and exposure pathways, specific RAOs for each of the COPCs will be developed for the landfill site and presented within the FS; however, general RAOs will be assumed based on probable exposure pathways to support the development of the RI sampling requirements and contingent actions.

The RAOs for the McCoy Annex Landfill include the limitation of dermal contact for maintenance workers, ecological receptors, and future recreational users. Such limitation will be achieved through maintenance of the soil cover/cap and elimination of any utilities that pass through landfill wastes. RAOs also include the containment of landfill gases and radioactivity emissions; the containment/treatment of contaminated groundwater, surface water, and sediment, if found to exist; and the prevention of infiltration of rainwater into the landfill material (and subsequent leaching of contaminants into the shallow groundwater).

2.7.3.3 Preliminary Remedial Action Technologies

A limited evaluation of potential remedial action technologies was conducted to support the identification of data needs and development of RI requirements. The list of potential remedial technologies was developed based on the CSM prepared for the McCoy Annex Landfill presented in Figure 2-4. This site model identified the probable and potential contaminated media as well as the potential exposure pathways and receptors to these contaminated media.

Once the media and probable exposure pathways were identified, a list of treatment technologies was developed and evaluated based on site-specific characteristics at the landfill. The identification of remedial technologies included a review of USEPA's presumptive remedies for municipal landfill sites (USEPA 1993a; 1993b), historical FSs, and technical literature. Treatment technologies were also identified to address the potential deviations associated with the CSM (see Figure 2-4).

The USEPA guidance list of presumptive remedies was based on the evaluation of historical FSs and RODs for municipal landfills and identification of the most commonly implemented and effective remedial action technologies included in the RODs. The major components of the presumptive remedies included landfill caps, source area groundwater control, leachate collection and treatment, landfill gas collection and treatment, and institutional controls to maintain the integrity of the cap and treatment systems. The design of the cap materials and implementation of collection and treatment systems are based on site-specific requirements of the landfill.

2.7.3.3.1 Institutional Controls

These remedial actions include the implementation of land use restrictions for a specific land area and can include limitations on intrusive activities into the landfill cap material. Institutional controls may also include the development of monitoring and maintenance requirements at the sites. Other limited actions would have to be incorporated through deed restrictions such as the installation of fencing and warning signs around a specific area to ensure the safety of the public and environment.

2.7.3.3.2 Capping

Capping has been assumed as the probable remedial action for the McCoy Annex Landfill. It is possible that a sufficient soil cover exists in many areas at the landfill to eliminate the need for construction of a cap in these areas; however, it is likely that capping will be required in limited areas of the landfill because of thin or no cover material (ABB-ES 1994a). Evaluation of the existing soil cover will be performed during the RI field activities to fulfill primary data needs. If it is determined that additional capping materials are required to reduce the probable and/or potential exposure pathways, multiple alternatives exist for the modification of the existing soil cover material. These capping technologies include:

- multilayer cap,
- clay cap,
- asphalt cap,
- concrete cap,
- synthetic liner cover, and
- chemical seal.

All of these capping materials could be used at the McCoy Annex Landfill; however, only the multilayer cap, clay cap, and synthetic liner would be acceptable given the anticipated future recreational use of the landfill area at McCoy Annex (i.e., a golf course). Soil cover could then be installed over the capping material at the landfill to support the future recreational use of the site.

2.7.3.3.3 Containment

Vertical containment of the landfill material is considered a probable remedial action to contain the material within the boundaries of the landfill and to keep landfill material out of the surface water stream beds. Vertical containment can be accomplished by the use of the following methods:

- slurry wall,

- grout curtain,
- sheet piling,
- grout injection, and
- polywall barrier.

The ability to install an effective containment system around a portion of the landfill would be based on the evaluation of the subsurface lithology and location of a suitable impervious soil layer beneath the landfill to key into the containment system. It will be necessary to collect additional soil lithology data during the RI to support the use of these technologies for limited containment of the landfill material.

Potential remedial actions may also include the installation of a bottom seal under the landfill to reduce or eliminate the migration of contaminated leachate from the site. Additional data needs for this technology are identified in Section 2.8.

2.7.3.3.4 Collection and Treatment of Surface Water

Surface water at the McCoy Annex Landfill is considered a probable exposure pathway to the public and environment. The surface water in the golf course water hazards and drainage ditches is potentially contaminated and may require remediation. The surface water could be collected from the water hazards and drainage ditches and treated before being returned to the ditches. Treatment of the water could be accomplished by well-proven physical and chemical treatment technologies such as air stripping.

2.7.3.3.5 Treatment of Sediment

Sediments in the golf course water hazards and drainage ditches at the McCoy Annex Landfill are considered a probable exposure pathway to the public and environment. Treatment technologies to remediate sediments are well proven and readily available. It would be necessary to divert the water hazards and drainage ditches during remediation and to reconstruct them with the treated sediments or clean fill material.

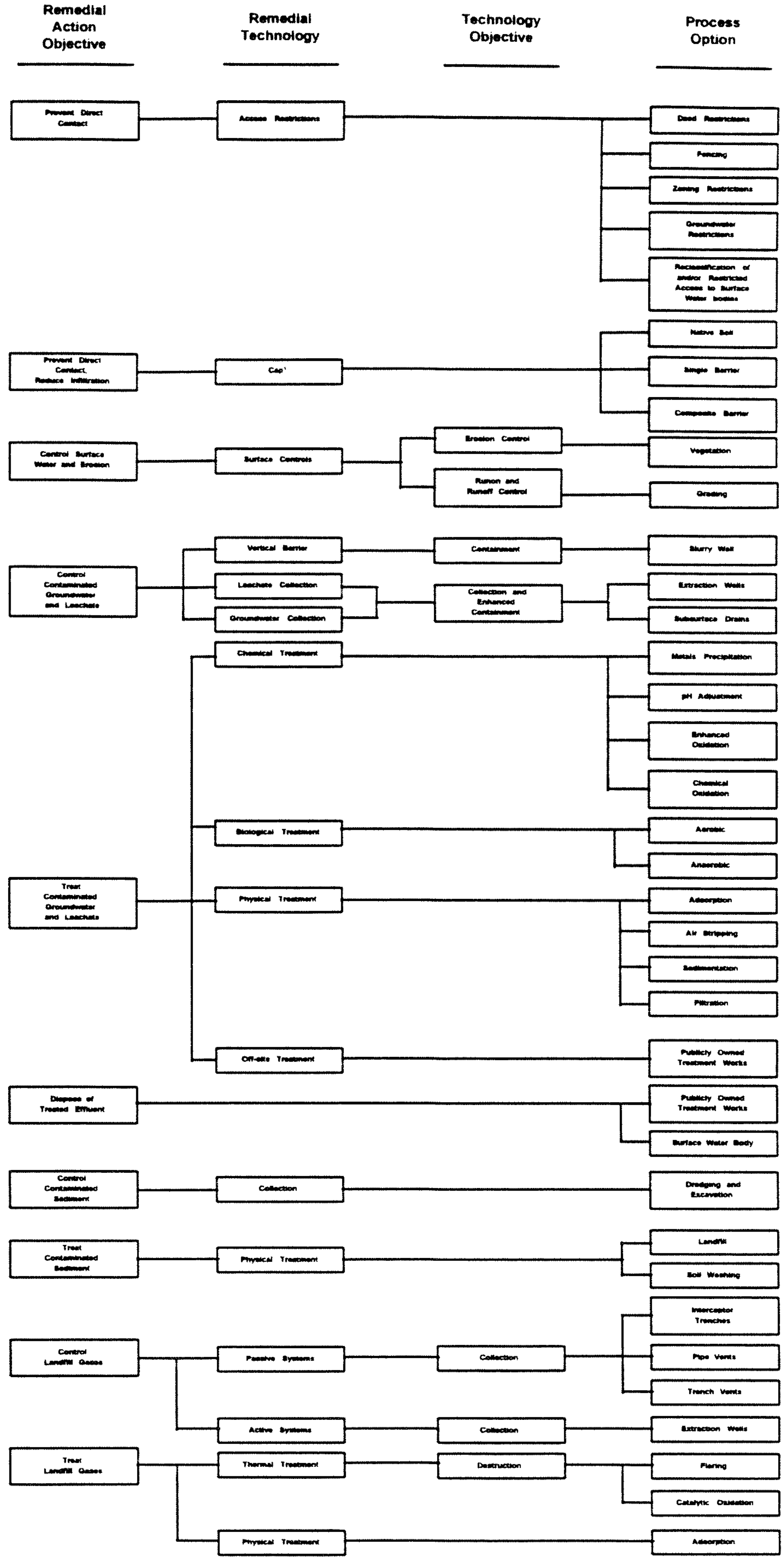
2.7.3.3.6 Collection and Treatment of Leachate and Groundwater

The release of contaminated leachate or groundwater from the landfill has been considered a probable exposure pathway. Collection of the leachate and shallow groundwater downgradient of the landfill can be successfully accomplished by subdrain trenches, horizontal wells, and existing drainage ditches. Once the leachate has been collected, it must be treated before being discharged. Treatment methods may include either physical (e.g., air stripping) or chemical [e.g., ultraviolet (UV)/oxidation] treatment technologies. Discharge options include injection/recirculation, discharge to a publicly owned treatment works (POTW), and surface water discharge. Data collection during the RI will determine the need for this remedial action and support the evaluation of multiple treatment alternatives.

2.7.3.3.7 Landfill Gas Collection and Treatment

It is anticipated that the potential emission of landfill gases will be addressed by the installation and maintenance of a landfill cap. If significant landfill gases are being produced within the landfill and emitted causing an exposure pathway to the public or the environment, however, it will be necessary to evaluate a collection and treatment system. This potential remedial action would require the installation of soil gas extraction wells (vertical or horizontal) and physical [e.g., vapor-phase granular activated carbon (GAC)] or thermal (e.g., incineration) treatment before release to the atmosphere. These technologies are well-proven for the remediation of landfill gases. Data collection during the RI will determine the need for this remedial action and support the evaluation of multiple treatment alternatives.

A preliminary list of remedial technologies and process options has been prepared to address the RAOs based on the type of contaminated media. Within each technology there may be several process options such as biological treatment (technology) of contaminated groundwater by aerobic and anaerobic processes. These remedial technologies and process options are presented in Figure 2-5. Additional technologies and process options may be identified following the RI. The screening of the remedial technologies and development of remedial alternatives is discussed in Section 8.0 of this Work Plan.



[1] Landfill cap will likely be implemented in conjunction with access restrictions, surface water controls, and erosion controls.

References:

U.S. Environmental Protection Agency, 1991a, p. 2-22

FIGURE 2-5 PRELIMINARY REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS	RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL NAVAL TRAINING CENTER ORLANDO, FLORIDA

2.8 SUMMARY OF DATA NEEDS

The three purposes for collecting data at the McCoy Annex landfill are to

- verify the probable conditions and reasonable deviations (i.e., verify the CSM),
- support the human health risk assessment and ecological evaluation, and
- support the FS.

Only those probable conditions and reasonable deviations that will affect the outcome of the risk assessment and evaluation or the FS will be identified.

To determine the data to be collected during the RI, uncertainties in terms of probable conditions and reasonable deviations have been identified with respect to technology performance (Table 2-3), site conditions (Table 2-4), and regulatory issues (Table 2-5). Preliminary base actions and contingent actions to address the deviations have also been identified. To resolve unacceptable uncertainties with respect to site conditions, technology performance, and regulatory issues, data needs are identified in Tables 2-3 through 2-5. These data needs are consolidated with existing information to identify what data should be collected during the RI. Some of the data must be collected off site, and for these data it is assumed that the Navy will provide any access that may be required.

The following information will be collected during the RI.

- **Soil gas**. Soil gas samples will be collected from within the landfill soil cover to determine if gases are being generated from the landfill waste. Soil gas samples will also be collected from areas immediately surrounding the landfill to evaluate horizontal migration of gases. Ambient air samples may also be collected to determine if soil gases are venting through the soil cover. This information will be used in the FS. Soil gas may also help to identify "hot spots."
- **Soil**. Soil samples will be randomly collected from the existing soil cover (0 to 2 ft) to evaluate the quality and thickness of cover material used.
- **Groundwater**. Groundwater quality data and hydrologic information will be collected through installation of monitoring wells and piezometers and through the use of other intrusive technologies [e.g., direct-push technologies (DPTs)] to evaluate the nature and extent of potential groundwater plumes, to evaluate the hydrogeologic environment surrounding the

Table 2-3
Technology Performance Uncertainties

RI/FS Work Plan, Operable Unit 2
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Technology	Probable Conditions	Data Needs	Potential Deviation	Contingent Action	Additional Data Needs
Institutional Controls	Implementation of zoning and deed restrictions for future land use and required maintenance of cap and containment alternatives.	Determine regulatory requirements for implementation of land use restrictions and future long-term liability for operations and maintenance.	Additional requirements for limitations on use of groundwater or adjacent surface water bodies. May also require Florida Department of Environmental Protection reclassification of surface water bodies.	Limit surface water body access and provide potable water supply if needed.	Collection of groundwater samples from the perimeter of the landfill area, characterization of both surface water flow and groundwater flow direction, and quantification of the surface water and sediment quality.
Capping	Cap provides sufficient barrier to reduce: direct contact exposure pathway to contaminated landfill material, infiltration of precipitation and resulting groundwater contamination, and leaching of contaminants into surface water bodies. Capping will also reduce air emissions of potential landfill gases and beta and gamma radionuclide emissions.	Verify existing soil cover integrity and construction for modification or upgrade of existing cap design. Obtain direct gamma survey results at ground surface and radionuclide concentration in shallow surface soil to determine barrier requirements. Determine surface water flow patterns of storm water runoff for containment of leachate. Determine groundwater flow characteristics into and out of the landfill for diversion of upgradient groundwater sources and containment of groundwater contamination and migration.	Emissions of landfill gases and/or radionuclides continue after containment.	Modify design and material of cap; implement soil gas collection and treatment.	Conduct soil gas survey and analyze content and concentrations of contaminants for risk and regulatory evaluation.
Containment	Physical containment around and beneath the landfill: reduces leachate migration from the landfill, provides additional structural stability of the cap, reduces potential leachate contamination of groundwater and flow of groundwater into the landfill material, and diverts groundwater flow around landfill area.	Assess soil lithology around the perimeter of the landfill area, structural and permeability characteristics of subsurface soil, and interaction of chemicals of potential concern with containment materials.	Mounding of groundwater upgradient of containment barriers overtopping surface cap. Contaminated leachate entering groundwater table beneath the landfill.	Collect groundwater upgradient of landfill area. Seal the bottom of the landfill above the existing groundwater table, implement hydraulic containment within the landfill, or implement leachate collection and treatment system.	Determine required influent rates, discharge options, and associated treatment criteria for treated groundwater and leachate collected upgradient and at perimeter of the landfill.

Table 2-4
Site Condition Uncertainties and Data Needs

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
Orlando, Florida

Media	Probable Conditions	Base Action	Data Needs	Reasonable Deviation	Contingent Action	Additional Data Needs
Soil cover and surface soil	Soil cover exists. Soil cover thickness is sufficient to prevent exposure from contaminants. Soil cover is maintained.	Institutional controls	Verify probable condition. Use ground-penetrating radar to evaluate soil cover thickness and distribution. Collect samples to evaluate composition of cap material. Evaluate existing soil cover as infiltration barrier. Data will support institutional controls evaluation.	Soil cover is sparse and insufficient to prevent exposure to receptors or to prevent infiltration.	Install proper cap.	Same as base action.
Sediment	Sediment in water bodies has not been adversely affected by leachate from landfill.	No action	Verify probable condition through sampling sediment and surface water.	Sediment and/or surface water has been contaminated by leachate from landfill.	Evaluate containment or source removal.	Estimate approximate area and depth of sediment and surface water contamination. Conduct ecological characterization of aquatic organisms. Evaluate risks and exposures associated with contamination.
Groundwater	Contaminated groundwater has not migrated off site.	Monitoring and containment	Collect hydrologic and groundwater data to design and evaluate hydraulic controls and/or containment.	Contaminated groundwater has migrated off site.	Provide source control or implement groundwater remedial system.	Conduct groundwater modeling to evaluate remedial systems. Conduct groundwater pumping test to calibrate model.
Air	Gases are not being generated by the landfill; therefore, no gas is migrating from the existing soil cover.	No action	Collect data to evaluate if soil gases are being generated and/or migrating through the soil cover.	Soil gas is migrating through soil cover.	Install proper cap and evaluate venting.	Same as base action.
Biota	Biota uptake does not pose a risk to human health or terrestrial fauna because of the soil cover and current and future land uses.	No action	Same as soil cover and surface soil.	Terrestrial fauna are being exposed to contaminated materials, thereby producing a possible risk to the food chain.	Install and maintain proper cap.	No additional data needed.

Note: off site = all areas beyond the boundaries of the landfill as defined by the geophysical survey and sampling programs.

Table 2-5
Regulatory Uncertainties and Data Needs

RI/FS Work Plan, Operable Unit 2
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Issue	Probable Conditions	Base Action	Data Needs	Reasonable Deviation	Contingent Action	Additional Data Needs
Disposal	Disposal locations available for low-level radiological waste.	Dispose of in identified locations.	Requirements of potential disposal location.	Waste is mixed or disposal locations are unavailable.	Provide temporary storage or contain in place.	Evaluate potential for waste to be mixed waste.
Wetlands	Wetland regulations are applicable or relevant and appropriate requirements (ARARs) because of the presence of wetlands.	Modify action to consider impact on wetlands. May include wetland restoration.	Verification of wetlands.	Wetlands are not present within affected study area.	No limitations.	None.
Floodplains	Floodplain restrictions limit feasible remediation but can be mitigated.	Modify actions to compensate for increase in flood risk.	Floodplain and riparian zone delineation.	Unique riparian characteristics prohibit disturbance.	Install sediment traps and institutional controls.	None.
Remedial action levels	Existing ARARs specify sufficient remedial action level.	Perform capping or removal and disposal.	Evaluation of regulations.	New regulations specify different remedial action levels or approval for existing regulation cannot be obtained.	Modify action.	None.

landfill, and to facilitate possible groundwater modeling. This information will be used to support the risk assessment and evaluation and the FS.

- **Geophysics**. Magnetics, terrain conductivity, ground penetrating radar, and possibly other geophysical techniques will be used to map the boundary of the landfill, determine the thickness and extent of the existing soil cover, and define any "hot spots" that may exist within the landfill. This information will support the FS.

- **Surface water and sediment**. On-landfill surface water and sediment samples will be collected purposefully from golf course water hazards, ditches, and other water bodies to evaluate possible contamination deposited as a result of leachate migration from the landfill. This information will support the risk assessment and evaluation as well as the FS. Off-landfill surface water and sediment may be sampled randomly to evaluate potential impact from contaminants that may have migrated from the landfill to support the risk assessment and evaluation as well as the FS.

- **Biota**. An ecological characterization will be conducted in areas impacted by and surrounding the landfill. This information will support the qualitative ecological risk evaluation.

The presumptive remedy of source containment, capping, and institutional controls will eliminate the need to remediate or remove the subsurface soil; therefore, no characterization of the subsurface soil is needed and no sampling of this medium will be performed.

To support the evaluation of the data, background values will be collected as part of this investigation and as part of a parallel background soil and groundwater investigation for the following media: site soil (surface and subsurface), off-site sediment and off-site surface water (if necessary), and off-site groundwater.

2.9 PROJECT DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are qualitative or quantitative statements developed by the data user to specify the quality of data needed from a particular data activity to support specific decisions. The DQOs are the starting point in the design of an investigation. The DQO development process matches sampling and analytical capabilities to the data targeted for specific uses and ensures that the quality of the data satisfies project requirements. USEPA has identified five general levels of analytical data quality as being potentially applicable to field investigations under CERCLA at potential hazardous waste sites. These levels are summarized below and discussed in the POP, Section 3.2, Data Quality Objectives (ABB-ES 1994a).

1. **Level I, Field Screening**. Characterized by use of portable field instruments that can provide real-time data both for personnel health and safety and to optimize locating sampling points.

2. **Level II, Field Analysis**. Characterized by use of portable analytical instruments for on-site use or in mobile laboratories near a site.

3. **Level III, Laboratory Analysis**. Characterized by use of methods other than the Contract Laboratory Program (CLP) Routine Analytical Services (CLP-RAS), but which may be equivalent without the CLP requirements for documentation.

4. **Level IV, Laboratory Analysis CLP-RAS**. Characterized by rigorous quality assurance (QA) and quality control (QC) protocols and documentation, providing qualitative and quantitative analytical data.

5. **Level V, Nonstandard Methods**. Includes analyses that may require modification and/or development.

The objectives of data collection are discussed below.

- Soil cover and soil gas information will be collected to evaluate the existing soil cover consistent with the presumptive remedy of containment and capping and to support the FS in the design of an appropriate cover.

- Hydrogeologic information will be collected to evaluate groundwater migration, flow gradients, and stratigraphy to evaluate if exposure potential from contaminant plumes exists and/or to predict if contaminant migration will likely occur in the future. As indicated in the CSM, a potential exists for ingestion, dermal contact, or inhalation by off-landfill residents.

- Sediment and surface water samples will be collected to support exposure and risk evaluations for human health and ecological receptors and to evaluate impacts from potential remediation.

- Biota and habitat in the landfill and surrounding areas will be characterized to identify potential receptors to contaminants and to determine impacts on the ecosystem from the landfill and from potential remediation.

3.0 TECHNICAL APPROACH

The technical approach to all of the individual tasks that constitute the field investigation is described below. Each of the field investigative tasks included in the approach is designed to support the CSM (see Figure 2-4) and the data needs identified in Tables 2-3, 2-4, and 2-5.

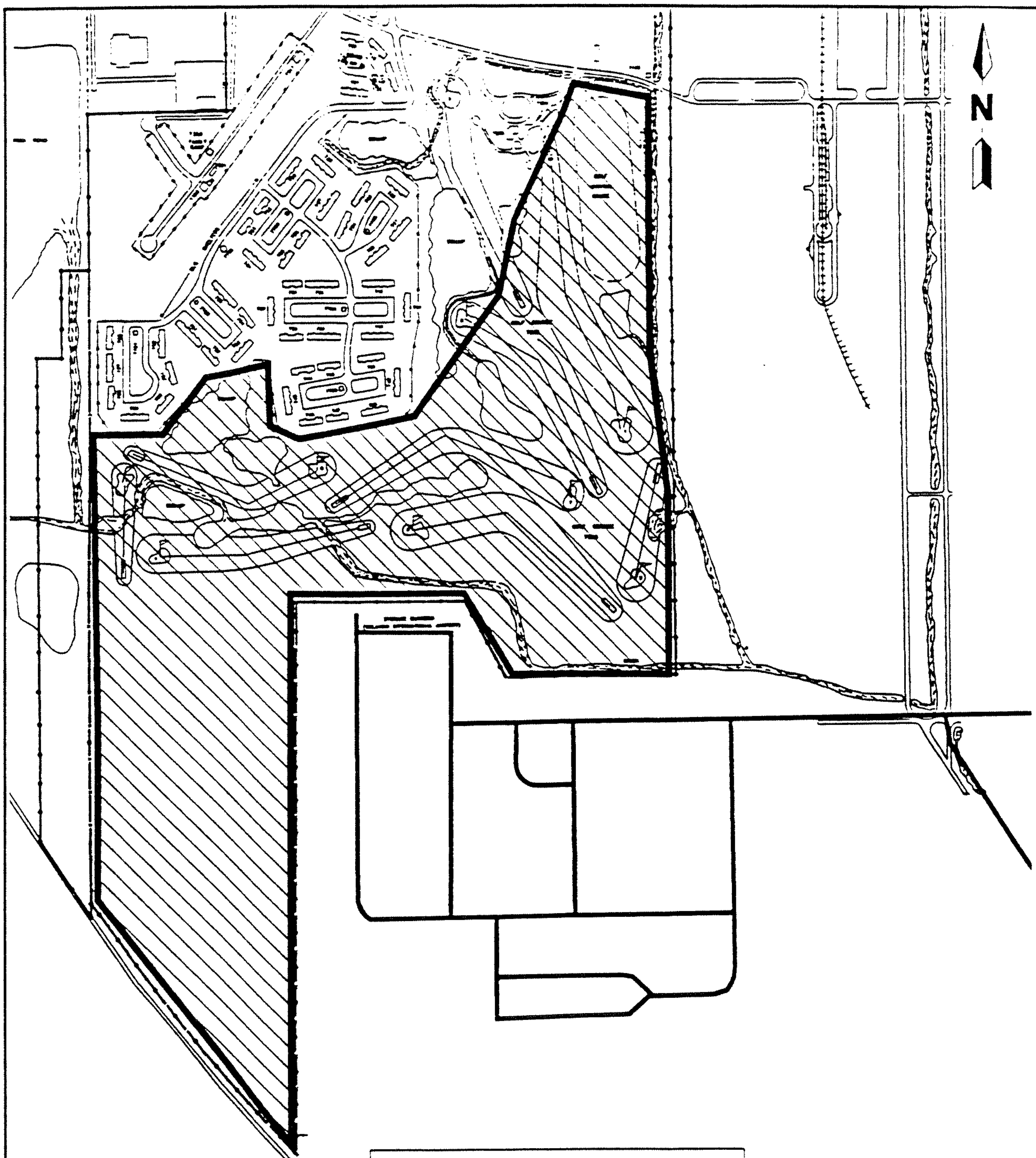
3.1 GEOPHYSICAL SURVEY PROGRAM

A geophysical survey program will be conducted to

- determine the boundaries of the McCoy Annex Landfill;
- locate "hot spots" in the McCoy Annex Landfill that might indicate concentrations of buried conductive and/or ferrous wastes, and, therefore, areas within the landfill that might warrant source removal to support the selected remedial alternative; and
- characterize, to the extent possible with remote sensing techniques, the landfill cover thickness and continuity.

The first objective will be completed with a magnetometer and terrain conductivity survey over the presumed location of the landfill (Figure 3-1). The magnetometer will include a vertical gradiometer capability for better resolution of buried ferrous debris, which is typically found in municipal landfills in sufficient quantities to clearly define landfill boundaries. Geophysical investigations will initially be performed on a 20-ft by 20-ft grid over an assumed area of approximately 110 acres (the reported 99 acres plus an additional 10 percent). Measurements will be adversely affected by the proximity of buildings and buried utilities, so magnetometer and terrain conductivity data will likely be compromised in residential areas abutting the landfill as well as adjacent to chain link fencing and in areas where wire mesh was used to reinforce concrete roads, sidewalks, and driveways. Following review of the preliminary data, the grid size may be reduced to 10 ft by 10 ft in selected areas. A location survey will be completed with a Global Positioning System (GPS) rover and base station system capable of submeter accuracy. Several semipermanent markers will be established to facilitate future investigations of any parts of the site at which geophysical anomalies are located.

The second objective will be fulfilled by the magnetometer and terrain conductivity survey at the McCoy Annex Landfill. "Hot spots" will be indicated on geophysical contour maps by zones at which the vertical gradient magnetic contours (in gammas per meter) or conductivity contours (in millimhos per meter) are of much higher amplitude than elsewhere within the landfill. Any "hot spots" will be confirmed with ground-penetrating radar (GPR) to better spatially define any potential source areas.



LEGEND

Geophysical survey coverage

0 400 800

SCALE: 1" = 800'

SOURCE:
MAP TAKEN FROM DRAWING PROVIDED BY ABB ENVIRONMENTAL SERVICES, INC.

FIGURE 3-1

McCOY ANNEX LANDFILL
GEOPHYSICAL SURVEYS

RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL

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The last objective will be met with a series of parallel GPR traverses (north to south) with a 500 megahertz (MHz) antenna to obtain detail in the first 5 ft or so of cover materials or landfill wastes. One hand-augered hole will be advanced along each GPR traverse. The thickness of the soil cover will be determined by a professional geologist to aid in the interpretation of the GPR data. GPR should define the interface between the cover material and waste, although the contact may be somewhat gradational as the waste may have mixed to some extent with the cover material. In the event that GPR is not successful in adequately defining the thickness of the landfill cover material, up to 180 hand-augered holes will be completed to acquire this information (see Section 3.2).

3.2 SOIL GAS PROGRAM

The objectives of the soil gas program are to

- characterize COPCs present in the soil cover so that a proper soil gas collection system (if needed) and cap can be designed;
- characterize volatile and semivolatile constituents that may have migrated into the landfill soil cover to locate "hot spots" that may need to be evaluated as potential source removals to support remedial objectives; and
- evaluate the presence of methane, which may still be problematic despite the age of the landfill.

The soil gas technique that will be used is a remote-sensing, near-surface screening method that directly collects and identifies a large range of organic constituents. The sampler is placed approximately 16 in. below the surface and left for a period of time ranging from a few days to a few weeks, depending on the anticipated soil conditions. Samplers are then retrieved and analyzed off site. Concentrations of identified compounds are regarded as qualitative.

For the OU 2 McCoy Annex Landfill, the soil gas program will assist in addressing exposure pathways presented on the CSM (see Figure 2-4). The soil gas results will contribute to the evaluation of the existing soil cover integrity and of COPCs as required by the uncertainties and data needs defined in Table 2-4.

DPTs will be used to install 175 soil vapor sampling implants along the western, southern, and eastern boundaries of the landfill (approximately 1 every 50 ft). Additional information regarding this program is presented in Section 3.3.1.

As part of the soil gas survey, a methane sampler will be used to evaluate whether the OU 2 McCoy Annex Landfill is producing methane. The survey will be conducted with a Neotronics Digiflame 2000 methane analyzer or equivalent. The sampling will be executed as the soil gas samplers are installed and repeated as they are retrieved. This information will be used to satisfy the data needs defined in Table 2-4.

3.3 DIRECT-PUSH TECHNOLOGIES

3.3.1 Direct-Push Technology Sampling Program

To better define any contaminant plume that may be present at the McCoy Annex Landfill, a DPT sampling survey will be conducted around the western, southern, and eastern boundaries of the McCoy Annex Landfill. The DPT sampling system consists of an hydraulic ram unit with the capability of driving 3/4-in.-diameter rods and stainless steel sampling probes into the subsurface for sample collection. Further details can be found in the POP, Section 4.4, Field Investigation Techniques and Procedures (ABB-ES 1994a).

Groundwater samples will be obtained at shallow and intermediate depths (at the water table and at refusal or 30 ft, whichever is shallower). A mobile field laboratory will be used to analyze the samples using gas chromatography for trace-level detection of selected VOCs. Samples will be collected in 40-milliliter (ml) Teflon™-sealed glass vials and analyzed on site using modified USEPA Method 3800.

QC analyses will consist of a three-point calibration of each analyte, method blank, matrix spike, and matrix spike duplicate and a continuing-check calibration standard of at least one per day.

The DPT sampling system can obtain 10 to 20 samples per day and will provide guidance for the DPT electric cone penetrometer program and monitoring well installations to follow. A total of 175 DPT sampling locations are proposed along the western southern, and eastern boundaries of the landfill (approximately 1 every 50 ft), with two groundwater samples at each location for a total of 350 samples. The data obtained during these activities are considered Level II data and will be used for siting DPT electric cone penetrometer explorations and monitoring wells and for characterizing hydrogeologic conditions at OU 2. For the purposes of this Work Plan, it is assumed that the shallow sample will be obtained at a depth of 8 ft and that the intermediate sample will be from approximately 30 ft.

It is likely that many DPT sampling locations will be located off base because of the proximity of the base boundary to the presumed landfill perimeter along the southern boundary of McCoy Annex and because of the (expected) southeast direction of groundwater flow. It is assumed that the Navy will provide any access to off-site locations that may be required.

Each DPT sampling location will be scanned with a gamma scintillation detector to determine the presence of gamma emissions. The ground surface will be scanned before each push, and the rods and sampling equipment will also be scanned after they are brought up. These data will be used for personnel protection and to qualitatively evaluate the presence and extent of radioactivity beneath the soil cover.

The DPT sampling will also be used to install 175 soil vapor sampling implants along the western, southern, and eastern boundaries of the landfill (approximately 1 every 50 ft). The implant will be lowered down the inside diameter of the probe rods, which have been pushed to the desired sampling depth. The sampler consists of a double-woven stainless steel wire screen that is 6 in. long and 1/4-in. in diameter with a flexible tubing riser to the surface. The screening size is 0.0057 in. After the probe rods are pulled, the probe hole will be backfilled and grouted to seal the subsurface from ambient air and will be sealed at the surface with a flush-mount protective cap. Repeated sampling will be performed at a frequency appropriate to the contaminants and concentrations found during the first sampling episode. For purposes of this Work Plan, a single sampling event has been scoped. Analyses will be performed with a mobile field laboratory using purge-and-trap gas chromatography capable of detecting trace-level concentrations of selected VOCs as described above.

A location survey for all DPT sampling explorations will be completed with a GPS rover and base station system capable of submeter accuracy.

3.3.2 <u>Cone Penetrometer Testing Program</u>

A cone pentrometer testing (CPT) investigation will be conducted to characterize the surficial aquifer because of the geologic conditions at the McCoy Annex Landfill.

CPT surveys are used to determine site stratigraphy, measure geotechnical and hydrogeological properties of subsurface soil strata, and obtain discrete groundwater samples for screening purposes. CPT surveys and the results of groundwater analyses will be used to assess contamination and optimize the location of soil borings and monitoring well installations.

Cone penetrometers are truck-mounted hydraulic units capable of pushing a cone-shaped measurement probe or sampling device to depths of 200 ft or more. Many units are capable of exerting downward pressures in excess of 50,000 lbs. Data from the measurement probe are monitored and recorded by a dedicated personal computer, permitting the crew chief to view data in real time and report results in a timely manner as CPT logs.

The measurement probe has several transducers that relay information on various soil and groundwater parameters as the cone penetrometer tip is pushed into the earth at a constant rate. Several parameters, including point stress (the stress exerted on the conical surface of the tip during penetration), sleeve friction (the stress generated on the cylindrical sleeve directly above the cone), and pore water pressure, are recorded simultaneously as a function of depth.

Sleeve friction, point stress, and the ratio between them allows the evaluation of:

- soil classifications based on the Unified Soil Classification System,
- relative soil density [direct comparison to standard penetration test (SPT) values, or blow counts],
- perched water table conditions,
- estimates of hydraulic conductivity, and
- effective thickness of confining units.

The pore pressure transducer measures:

- induced pore pressure,
- rate of pore pressure decay when testing is interrupted,
- hydrostatic pressure within the aquifer, and
- water table depth.

After analyzing the data from a "push," the rig can be repositioned over an adjacent entry point, and water can be sampled from discrete zones at selected depths. The sampler is connected to a porous tip that is exposed to the formation after the desired sampling depth is reached. The sampler is decontaminated between samples in accordance with the POP, Section 4.3.4.2, Cleaning Procedures for Downhole Equipment (ABB-ES 1994a)

Cone penetrometer holes are abandoned by removing the probe and tools from the hole and then using a tremie pipe to fill the open interval of the hole with grout from the bottom up to the ground surface. The grout is a mixture of approximately 5 percent bentonite powder to 95 percent Portland cement and with a consistency appropriate for its application. After the grout is allowed to set up (24 hours), the hole is checked for settlement and refilled with grout to within several inches of ground surface or to the base of asphalt or concrete where these materials are present. The hole is then finished to grade with appropriate materials (i.e., native soil, asphalt, or concrete).

For purposes of this Work Plan, 50 CPT locations have been scoped. Shallow groundwater samples will be obtained at each location. At six locations water samples will also be obtained at as many as five intervals to the top of the Hawthorn Group. All CPT locations will be selected based on DPT sampling results or decisions made in the field following on-site laboratory analysis. Water sampling intervals will be selected based on stratigraphy determined by evaluating the CPT logs.

It is likely that many CPT locations will be located off base because of the proximity of the base boundary to the presumed landfill perimeter along the southern boundary of the McCoy Annex and the (expected) southeast direction of groundwater flow. It is assumed that the Navy will provide any access to off-site locations that may be required.

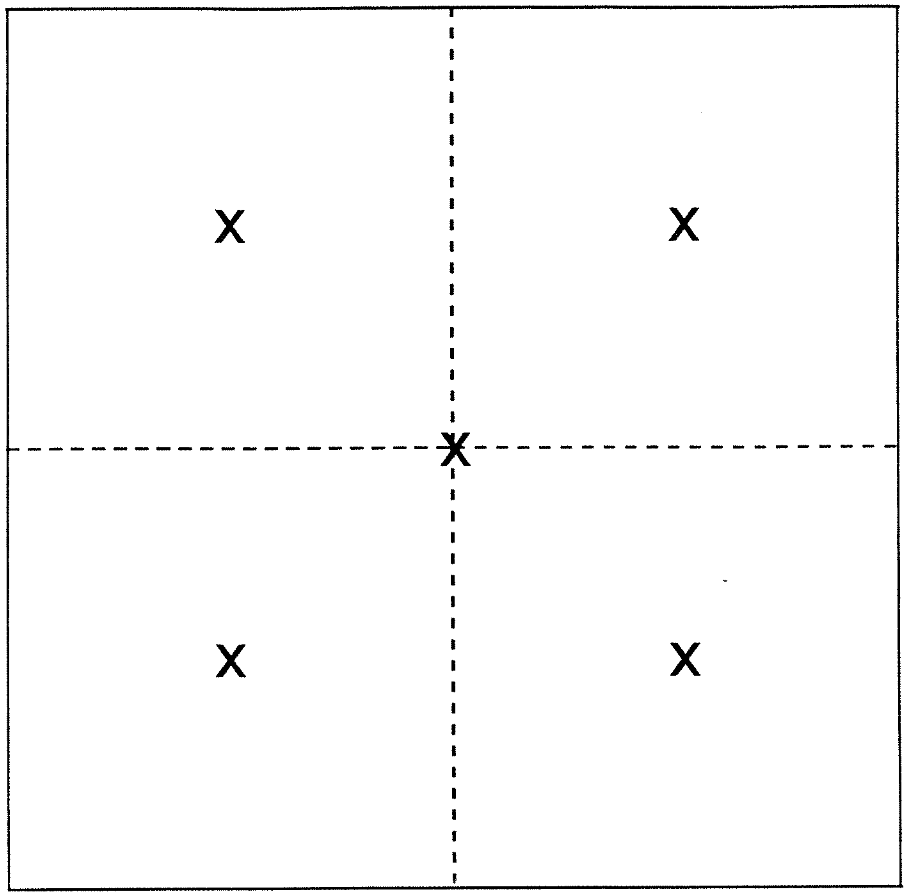
Analyses will be performed with a mobile field laboratory using gas chromatography for trace-level detection of selected VOCs as described above in Section 3.3.1. The data obtained during these activities are considered Level II data and will be used only for optimally siting monitoring wells and characterizing hydrogeologic conditions at OU 2. A location survey for all CPT explorations will be completed with a GPS rover and base station system capable of submeter accuracy.

3.4 SURFACE SOIL, SURFACE WATER, AND SEDIMENT SAMPLING PROGRAM

3.4.1 Surface Soil Sampling

The surface soil sampling program will be conducted based on the sampling methodology presented in Section 2.6. Although it is believed that the landfill cover was derived from a clean source and is not considered a contaminated medium, one surface soil sample of the existing cover will be collected for laboratory analysis from each acre (for a total of 99 samples). The objective of this sampling and analysis activity is to confirm that the existing soil cover is not contaminated. The samples will be collected from a depth range of 0 to 2 ft. Samples for semivolatile organic compound (SVOC) and metals analyses will be composited from five sample locations within each acre (Figure 3-2). Samples for VOC analysis will not be composited but will be collected from the central node of the composite pattern. Statistical evaluation of the results will be performed, and additional sampling will be conducted if outliers are found.

Within the McCoy Annex Landfill, 1 geotechnical soil sample will be collected per 4 acres (for a total of approximately 25). At each location a Shelby tube sample will be collected for determination of undisturbed vertical permeability [American Society for Testing and Materials (ASTM) D5084/EPA 9100], moisture content (ASTM D2216), in place density (ASTM D2937), and Atterberg Limits (ASTM D4318). A standard



Note: Area enclosed is approximately one acre.

FIGURE 3-2 SURFACE SOIL SAMPLING PATTERN	RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL NAVAL TRAINING CENTER ORLANDO, FLORIDA

proctor test (ASTM D698) will also be performed at each sampling location to determine the degree of compaction of the existing soil cover. These samples will be collected above landfill trenches within each 4-acre block if possible.

Primary parameters to be analyzed for include CLP target analyte list (TAL) metals; total petroleum hydrocarbons (TPH); and target compound list (TCL) organics including pesticides, herbicides, and, for 10 percent of the samples, PCBs and total organic carbon. Dioxins will be analyzed for only if PCBs are detected (see Table 3-1). The levels of pesticides and herbicides will be compared to those measured in samples collected from areas of the golf course that are outside the boundaries of the former landfill. This comparison will help in the evaluation of the contribution of pesticides and herbicides that results from normal golf course maintenance (i.e., not associated with past landfilling activities). Analyses for primary parameters will be completed in accordance with USEPA Level IV DQOs. The surface soil sampling data will be compared to the base background data as described in the Background Sampling Plan (ABB-ES 1994d).

3.4.2 <u>Surface Water and Sediment Sampling</u>

Surface water and sediment sampling will be completed in the water bodies and drainage ditches within and adjacent to the McCoy Annex Landfill (Figure 3-3). A total of 10 surface water and 10 sediment samples will be taken to characterize potential contamination from the landfill materials. Upgradient locations are included to determine the contribution of any contaminants from outside the landfill. The locations indicated on Figure 3-3 are included for conceptual reasons only. Actual locations will be selected in the field by the project team.

In the event that contamination in the on-site surface water and sediment is confirmed, then off-site surface water and sediment sampling in downgradient surface water bodies will be required.

At the time this Work Plan was developed, the available groundwater flow data indicated that groundwater flow is southeasterly (Geraghty & Miller 1986); therefore, the most likely surface water bodies for off-site surface water and sediment sampling are the ditches leading from the landfill to Boggy Creek and Boggy Creek Swamp located 2½ miles south of the landfill. From Boggy Creek Swamp, surface water then flows into East Lake Tohopekaliga approximately 12½ miles south of McCoy Annex.

If surface water and sediment sampling is required in off-site surface water bodies, then surface water sample locations will be randomly selected from areas within the ditches leading from the landfill to Boggy Creek and from areas along Boggy Creek and Boggy Creek Swamp downgradient from the landfill. Surface

TABLE 3-1
ANALYTICAL PROGRAM SUMMARY
OU 2, MCCOY ANNEX LANDFILL
PAGE 1 OF 2

RI/FS Work Plan, Operable Unit 2
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Sample Identification	Quantity	CLP/TCL VOCs	CLP/TCL SVOCs	CLP/TAL Inorganics	CLP/TCL Pesticides/PCBs[a]	Herbicides	TPH	Radionuclides[b]	Other Secondary Parameters[c]
Surface Soil (from landfill cover)	109	109	99	99	109	109	99	99	25
Sediment[d]	25	25	25	25	25	25	25	25	25
QC Samples									
Duplicate	14	14	13	13	13	13	13	3	6
Matrix Spike	7	7	7	7	7	7	7	0	4
Matrix Spike Duplicate	7	7	7	7	7	7	7	0	4
Other QC Samples									
Trip Blanks	17	17							
Equipment Blanks	14	14	13	13	14	14	13	0	6
Field Banks	3	3	3	3	3	3	3	0	3
Total Soil and Sediment	196	196	167	167	178	178	167	28	73
Groundwater	49	49	49	49	49	49	49	49	46
Surface water[d]	25	25	25	25	25	25	25	25	25
QC Samples									
Duplicate	8	8	8	8	8	8	8	8	8
Matrix Spike	5	5	5	5	5	5	5	0	5
Matrix Spike Duplicate	5	5	5	5	5	5	5	0	5
Other QC Samples									
Trip Blanks	24	24							
Equipment Blank	8	8	8	8	8	8	8	0	8
Field Blank	3	3	3	3	3	3	3	0	3
Total Water	127	127	103	103	103	103	103	82	100

TABLE 3-1
ANALYTICAL PROGRAM SUMMARY
OU 2, MCCOY ANNEX LANDFILL
PAGE 2 OF 2

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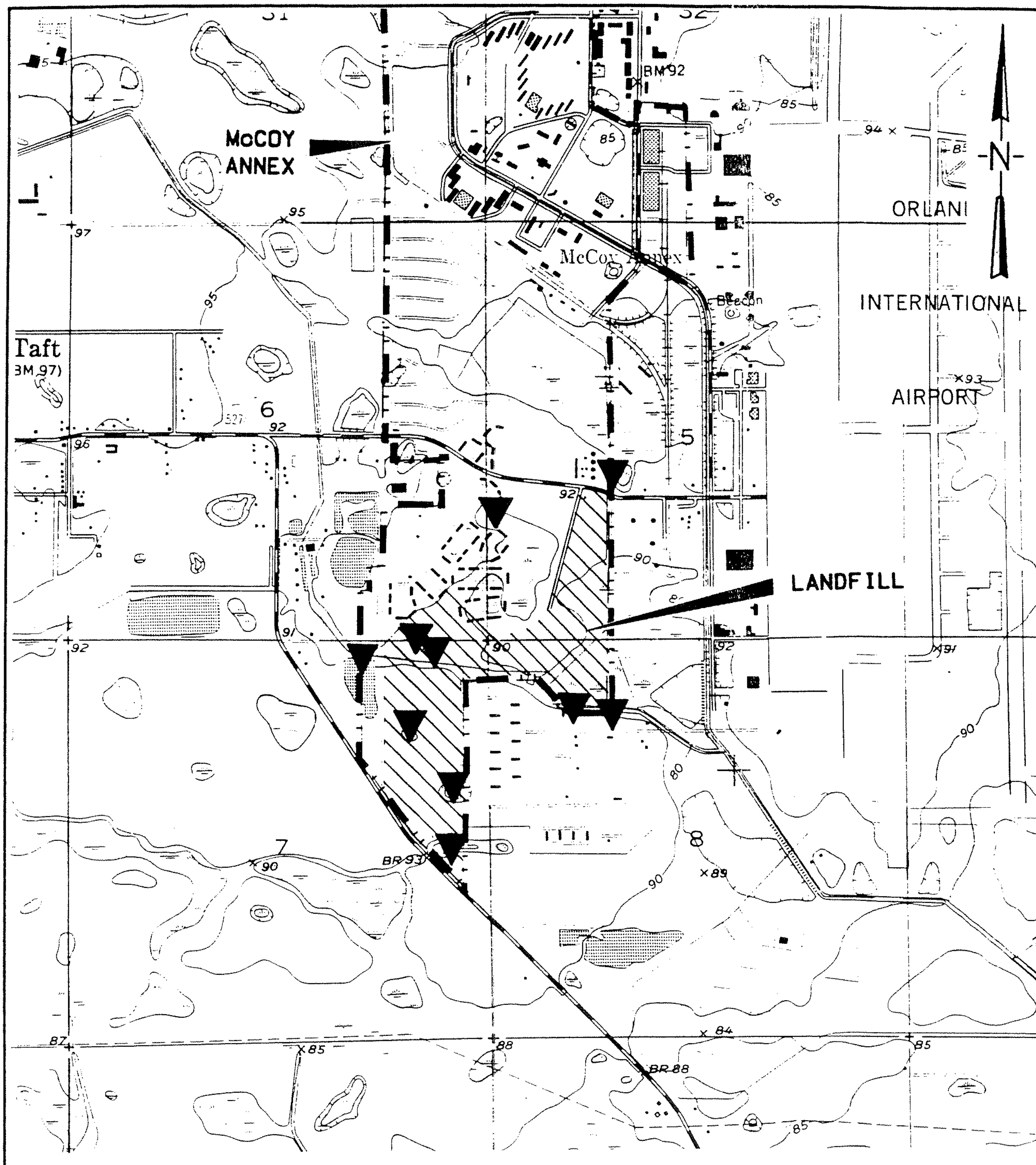
[a] Dioxins analysis will be performed only if PCBs are detected. Ten percent of samples in each medium will be submitted for PCB analysis.

[b] Radionuclides analysis includes gross alpha, gross beta (USEPA Method 9310), and a Gamma Scan (USEPA Method 101.1). U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, Ra-228, and radon may also be analyzed for, but only if gross alpha and gross beta values are above the referenced gross alpha Maximum Contaminant Level and gross beta screening level.

[c] Other secondary parameters for water may include: pH (SW846 Method 9040B), hardness (USEPA Method 130.2), total dissolved solids (USEPA Method 160.1), total suspended solids (USEPA Method 160.2), ferrous iron (Standard Method 315B), phosphate (USEPA Method 300 or SW846 Method 9056), total alkalinity (USEPA Method 310.1), nitrate (USEPA Method 352.1), nitrite (USEPA Method 354.1), sulfate (USEPA Method 375.4), sulfide (USEPA Method 376.1), chloride (SW846 Method 9056), microbial plate count (USEPA Method MICROBIO), biochemical oxygen demand (USEPA Method 405.1), chemical oxygen demand (USEPA Method 410.4), oxidation/reduction potential, dissolved methane (Standard Method 502A) and total organic carbon (USEPA Method 415.1). For surface soil samples, secondary parameters may include vertical permeability (ASTM D5084/USEPA 9100), moisture content (ASTM D2216), in-place density (ASTM D2937), Atterberg Limits (ASTM D4318), speciation of specific metals, total organic carbon (USEPA Method A004), cation exchange capacity (SW846 Method 9081), grain size (hydrometer method), and a standard proctor test (ASTM D698).

[d] Ten samples will be collected on site. If contaminants are detected, an additional 15 samples will be collected off site.

Notes:
ASTM = American Society for Testing and Materials
CLP = contract laboratory program
PCB = polychlorinated biphenyls
QC = quality control
Ra = Radium
SVOC = semivolatile organic compound
TAL = target analyte list
TCL = target compound list
Th = Thorium
TPH = total petroleum hydrocarbons
U = Uranium
USEPA = U.S. Environmental Protection Agency
VOCs = volatile organic compound



LEGEND:

▼ SURFACE WATER AND SEDIMENT SAMPLE LOCATION (PRELIMINARY)

SOURCE: U.S.G.S. QUADRANGLE

APPROXIMATE SCALE IN FEET

2000 0 2000

FIGURE 3-3

SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS, McCOY ANNEX LANDFILL

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water and sediment samples will be analyzed in the field for pH for risk and treatability evaluations. More information on the details of field procedures for surface water sampling is available in the POP (ABB-ES 1994a).

Surface water parameters analyzed for will include TAL metals; TCL organics including pesticides, herbicides, and for 10 percent of the samples, PCBs; TPH; and radionuclides [uranium (U)-234, U-238, thorium (Th)-227, Th-228, Th-230, Th-232, radium (Ra)-226, and Ra-228]. Specific radionuclides will only be analyzed for if elevated gross alpha and beta levels are above the referenced alpha MCL and beta screening levels (see Table 2-1). In addition, total dissolved solids, total suspended solids, hardness, and total alkalinity will be obtained for risk and treatability evaluations. Fifteen surface water samples are planned (from the drainage ditch leading southeast away from the landfill, Boggy Creek, and Boggy Creek Swamp in a presumed downgradient direction from the McCoy Annex Landfill).

Sediment sampling will also be completed in shallow water in the same areas as those selected for surface water sampling (i.e., along the ditches leading to Boggy Creek or in zones of groundwater recharge). Fifteen sediment samples are planned (from the drainage ditch leading southeast away from the landfill, Boggy Creek, and Boggy Creek Swamp in a downgradient direction from the McCoy Annex Landfill). If laboratory results indicate significant contamination in the sediments, additional samples will be collected to determine if (1) the sediments are hazardous wastes by characteristic [Toxicity Characteristic Leaching Procedure (TCLP), ignitability, corrosivity, and reactivity] and (2) pretreatment (e.g., stabilization) will be required before disposal.

Sediment parameters analyzed will include TAL metals; TCL organics including pesticides, herbicides, and, for 10 percent of the samples, PCBs; TPH; and radionuclides (U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, and Ra-228). Dioxins will be analyzed for only if PCBs are detected. As with the surface water analyses, the specific parameters to be analyzed for will be tailored to contaminants detected in groundwater samples collected. In addition, total organic carbon may be obtained for risk and treatability evaluations.

A survey for all surface water and sediment sample locations will be completed with a GPS rover and base station system capable of submeter accuracy. More information on the details of field procedures for sediment sampling is available in the POP (ABB-ES 1994a).

3.5 MONITORING WELL INSTALLATIONS

The objectives of the monitoring well installation program for OU 2, McCoy Annex Landfill, are

- the characterization of the vertical and horizontal extent of potential groundwater contamination and
- the development of sufficient information to complete the risk assessment and the FS.

The monitoring well installation program will be designed not only to characterize the potential groundwater contamination but also to establish locations suitable for future groundwater monitoring at the landfill, if required.

As discussed in Section 3.3, a direct-push screening program will be completed to evaluate the subsurface at the landfill and identify the extent of potential groundwater contamination. This evaluation will be completed by using a combination of DPT and CPT. The DPT sampling will be used for groundwater sampling to assess and characterize any contaminant plume that may be present, whereas the CPT program will be used to characterize the lithologies present in the vicinity of the landfill and to characterize the vertical distribution of any contamination throughout the surficial aquifer. This direct-push program is included in the investigative approach for the OU 2 landfill because of uncertainties in (1) the presence and location of groundwater contamination and (2) the presence and depths of water-bearing intervals and potential confining units in the site's subsurface. A detailed discussion of the monitoring well installation program cannot be completed with the available information because of these uncertainties. The following paragraphs will, therefore, only outline the approach to be used for the installation of groundwater monitoring wells.

The locations and depths for monitoring well installations at OU 2 will be based on an evaluation of the data provided by the direct-push screening program. Data from the screening program will be compiled and evaluated to develop a model of the site's aquifers (there may be more than one in the surficial material above the Hawthorn Group), confining layers, and extent to which potential contaminants from the landfill have migrated horizontally and vertically in the groundwater. Following this evaluation and model development, a proposed monitoring well installation program will be designed.

The results of the screening program, the model of site conditions, and the proposed monitoring well installation program will be presented to the BRAC Cleanup Team (BCT) in the form of a brief letter report to be followed by a meeting. The meeting will be a working session at which the final monitoring well locations and depths will be agreed upon. This approach, a screening program followed by a working session to finalize monitoring well locations, will expedite the completion of the RI.

The following scenario is considered likely. A series of well clusters (shallow, intermediate, and deep) within the surficial aquifer system will be required to characterize groundwater and any contaminant plume emanating from the McCoy Annex Landfill. The clusters will consist of one upgradient, six lateral (to define both sides of the plume), two downgradient (off the nose of the plume), and three characterization (within the plume) sets of wells.

Upgradient refers to any point in the direction from which groundwater flows relative to the site. Downgradient refers to any point in the direction toward which groundwater flows relative to the site. The term lateral refers to any downgradient location that is also offset laterally from the direction of groundwater flow. Implicit in all three terms is their spatial relationship to a point of interest, in this case the McCoy Annex Landfill. Characterization is a term that refers to the placement of monitoring wells within a contaminant plume such that they characterize the plume sufficiently to predict contaminant concentrations and migration pathways. The ultimate goal of the placement of characterization wells and wells outside of a contaminant plume is to enable evaluation of risks, remedial alternatives, and further monitoring to support potential remedial actions.

The well clusters will be designed to support data requirements only for the risk assessment and FS. The probable condition is that there is only one major contamination plume emanating from the McCoy Annex Landfill. Discrete sources of contamination could create separate contamination plumes because of the length of the site in a northeast–southwest direction (approximately 5,000 ft) and the assumed direction of shallow groundwater flow toward the nearest drainage canals (south to southeast). A reasonable deviation, therefore, is that additional contamination plumes exist that will require characterization during the RI. As it is impossible to plan for this contingency, however, it has not been scoped.

As defined in this Work Plan, shallow wells will be screened from approximately 5 to 15 ft below ground surface (bgs), intermediate wells from 40 to 50 ft bgs, and deep wells from 70 to 80 ft bgs. The exact placement of well screens will depend on results from the screening survey (DPT and/or CPT). Perched water zones and multiple secondary aquifers within the surficial aquifer may be present and will require assessment.

For this program, 6¼-in. inner diameter (ID) hollow-stem augers (HSAs) will be used to advance the hole to the desired depth. This approach will provide an ample sand pack around the 2-in. diameter well screen. Split-spoon samples will be collected every 5 ft and may be analyzed for grain size, confirmation of CPT lithology, aquifer matrix characterization (total organic carbon and speciation of specific metals) to evaluate intrinsic remediation, and other hydrologic parameters. All wells will be installed with 2-in. polyvinyl chloride (PVC) screen and riser, and well installation details will be in accordance with the POP, Section 4.4.6, Exploratory Drilling (ABB-ES 1994a).

In the event that a contaminant plume is detected at the base of the surficial aquifer, the installation of monitoring wells into the Hawthorn Group will be required as follows: one upgradient, four lateral, one downgradient, and one characterization. For purposes of this Work Plan, each of these deep wells will be screened 120 to 130 ft bgs. A horizontal location survey for all monitoring wells will be completed with a GPS rover and base station system capable of sub-meter accuracy. Vertical surveys will be required for all monitoring wells and will be completed with traditional leveling techniques as described in the POP, Section 4.9, Elevation Survey (ABB-ES 1994a).

In the same manner, if the contaminant plume extends into the Hawthorn Group, additional monitoring wells will be needed in the Floridan aquifer system. There may be adequate existing downgradient wells that can be sampled for this assessment; however, for the purposes of this Work Plan, three deep wells into the Floridan aquifer system have been scoped as follows: one upgradient, one downgradient, and one characterization). The wells will be screened approximately 200 ft bgs. To prevent any cross contamination between the surficial aquifer, the Hawthorn Group, and the Floridan aquifer system, the deep wells will be double cased.

Groundwater will be analyzed for TAL metals; TCL organics including pesticides, herbicides, and for 10 percent of the samples, PCBs; TPH; and gross alpha and gross beta. Radionuclides (U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, Ra-228, and radon) may also be analyzed for, but only if gross alpha and gross beta values are above the referenced gross alpha MCL and gross beta screening level (see Table 2-1). Dioxins will be analyzed for only if PCBs are detected. Dissolved oxygen, dissolved carbon dioxide, temperature, conductivity, methane, and pH will be measured in the field.

For monitoring well installations that may pass through zones of contamination, an outer casing will be installed before well installation to prevent cross contamination of deeper aquifers. Either the mud-rotary or the air-percussion-casing-advance technique (or equivalent) may be used to install the outer casing instead of HSA. Mud-rotary drilling is discussed in Section 4.4.6.2 of the POP (ABB-ES 1994a).

The air-percussion-casing-advance technique is a reverse-circulation technique that removes cuttings through the annulus of the casing, thereby minimizing IDW and contact with overlying contaminated strata. The technique features a reamer that swings around an eccentric shaft on the pilot bit. In the open position, the reamer drills a hole slightly larger than the outside diameter of the casing. The casing is permitted to advance behind the drill bit, preventing the hole from collapsing. Cuttings are eliminated through the casing annulus and contained at the surface. When the desired depth is reached, the reamer is closed by reversing the direction of rotation. In the closed position, the reamer may be retracted inside the casing.

The primary advantage of this technique is the ability to case off part of the surficial aquifer to prevent cross contamination of the lower part of the aquifer. This casing-off is accomplished by starting the hole at ground surface with a casing sufficiently large to accommodate a second casing (or multiple casings, if necessary). When the appropriate depth has been achieved, the pilot bit is removed and PVC Schedule 40 casing is installed inside the steel casing to the depth of the hole. The steel casing is retracted, and the PVC casing is grouted in place with neat cement grout (with 5 percent bentonite powder by volume). The grout is left to cure for a minimum of 24 hours, then a smaller-diameter pilot bit is advanced through the grout at the base of the PVC casing to the desired depth of the well. The tools are removed, and the well is installed as described in Section 4.4.6.3 of the POP (ABB-ES 1994a).

The technique is similar for deeper drilling through a second aquifer, except that the hole must be cased off not only at the base of the upper aquifer but also at the base of the second aquifer. In this case the borehole starts out at a larger diameter, sleeves down to an intermediate diameter at the top of the second aquifer, and is completed into the deeper aquifer, where the well screen is installed as described in Section 4.4.6.3 of the POP (ABB-ES 1994a).

Advantages of the air-percussion-casing-advance technique include the following:

- greater depths can be achieved than with HSA;
- less IDW is generated;
- better monitoring wells can be installed because there is less disturbance to the formation outside the sand pack;
- critical layers can be cased off to prevent cross contamination;
- continuous sampling (cuttings only) can take place with no loss in production; and
- problems encountered in artesian conditions with running sands, which can cause significant delays with other drilling methods, can be reduced or avoided.

The disadvantages of the technique are the following:

- the initial cost is greater and mobilization fees are higher,
- it is less suitable for installing shallow wells,
- it is less versatile, and
- soil samples (e.g., split spoon) cannot be collected economically.

3.6 AQUIFER TESTING

The objective of the aquifer testing program for the OU 2 landfill is to develop data on the nature of the aquifer (e.g., hydraulic conductivity, transmissivity) to (1) complete the characterization of groundwater flow, (2) evaluate fate and transport of detected contaminants, and (3) support the evaluation of groundwater remedial alternatives.

Aquifer testing for OU 2 will consist of completing slug tests at 30 percent of the newly installed monitoring wells to characterize the hydraulic conductivity in the vicinity of the screened interval. As there are 36 proposed wells in 12 clusters within the surficial aquifer (12 shallow, 12 intermediate, and 12 deep), 7 proposed wells in the Hawthorn Group, and 3 proposed wells in the Floridan for a total of 46 wells, approximately 14 slug tests will be completed. Locations for slug tests will be chosen so that all sides of the site (and groundwater plume, if detected) are characterized. It is anticipated that monitoring wells will be installed in more than one horizon (vertically) within the surficial aquifer. Slug tests will be completed at the same frequency (30 percent) for each of the specific intervals in which monitoring wells are completed. Slug tests are described in the POP, Section 4.8.2, Hydraulic Conductivity Testing (ABB-ES 1994a).

As discussed in Section 3.5, several uncertainties exist regarding both the presence of contamination in the surficial aquifer and the groundwater flow at the site. More intensive efforts, such as a pumping test, may be required depending on the conditions encountered. For this reason it may be necessary to reevaluate the proposed aquifer testing program upon completion of the monitoring well installation program.

4.0 SAMPLE ANALYSES AND VALIDATION

4.1 DATA VALIDATION

The approach to providing reliable data that meet the DQOs will include QA/QC requirements for each of the analytical data types generated during the field investigation. The QA/QC efforts for laboratory analyses will include collection and submittal of QC samples and the assessment and validation of data from the subcontract laboratories. Analytical data will be subjected to independent data validation by a subcontractor as described in the POP, Section 8.2, Validation (ABB-ES 1994a).

Data quality indicators include the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters. These parameters will be used within the data validation process to evaluate data quality. The achievable limits for these parameters vary with the DQO level of the data. The limits used for laboratory analytical data in this program will be those set by the CLP for Level IV DQOs and as specified in the USEPA methods for Level III DQOs. PARCC parameters are described in the POP, Section 12.0, Data Assessment (ABB-ES 1994a).

4.2 DATA EVALUATION

The purpose of this task is to assess usability of validated data results based upon data comparisons to non-site-related conditions. Results that meet the DQO requirements and are considered usable will be compared to background sampling results from a recent investigation (ABB-ES 1994d). Results of the data evaluation will be documented in the RI report. The following data evaluations and comparisons will be made:

- evaluation of detection limits,
- evaluation of counting errors,
- evaluation of equilibrium data,
- evaluation of qualified data,
- comparison of laboratory and field blanks to sample results, and
- comparison of laboratory and field duplicate results.

COCs will be identified through evaluation of the following criteria:

- background sampling results,
- frequency of detection, and
- extent of contamination.

COCs will be used throughout the data evaluation, fate and transport assessment, risk assessment, and FS.

Statistical analyses will be used in the data evaluation process and will involve a variety of analytical methods including exploratory analyses and the use of the standard *t* test and/or the Mann-Whitney test. The following paragraphs briefly describe each of the methods along with its application.

Exploratory analyses include evaluation of tables and graphs, including histograms, probability plots, and boxplots. Histograms and probability plots are used to understand and classify data distributions. In addition, tables of descriptive statistics (e.g., frequency of detection, minimum, quartiles, mean, maximum) will be evaluated. These tables alone may provide an adequate understanding of the distributions of some analytes, particularly those with few detected concentrations. Boxplots are used for side-by-side comparisons of different data sets (e.g., background versus potentially contaminated media); they graphically indicate quartiles, means, potential outliers, and properties such as skew in distributions.

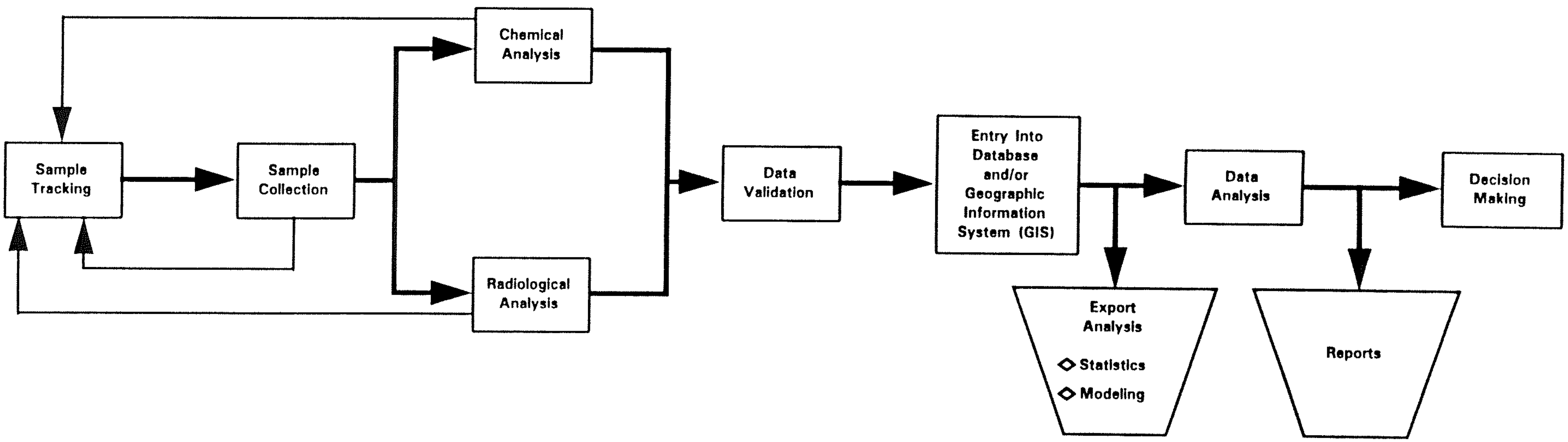
Background will be compared to site data using several numerical approaches in addition to the graphical techniques described above. Site data will be compared to two times the background mean as well as the background maximum and other descriptive statistics. If necessary, statistical testing will be performed using the *t* test, Mann-Whitney test, or both. Results of the *t* test will be used when the data have a normal distribution or can be made to approximate the normal through transformation (e.g., taking the logarithm of each datum transforms a lognormal distribution to the normal). Results of the Mann-Whitney test will be used when at lease one of the distributions being compared cannot be classified. Although not required to draw conclusions about the difference between background and site data, performing both tests simultaneously can provide a better understanding of the distributional patterns affecting test results.

4.3 DATA MANAGEMENT

The purpose of this task is to track and manage environmental and QC data collected during the field investigation from the time the data are obtained through data analysis and report evaluation. Coordination and management of the contracted laboratories is also part of this task. RI activities generate data including sample locations, measurements of field parameters, and the results of laboratory analyses. Reports regarding the collection and analyses of sample data will also be generated. The RI process entails the flow of data collected in the field and generated by the analytical laboratory work to those involved in project evaluation and decision making. Figure 4-1 illustrates the data management life cycle and project information flow. Management of data collected during RI activities will ensure accessibility of data to support environmental data analysis, risk assessments, and the evaluation of remedial action alternatives.

Samples will be tracked from field collection activities to analytical laboratories through return of sample residuals from the laboratories (if not disposed of by the laboratory) following standard chain-of-custody procedures, which may include bar coding. These procedures are described in the POP, Section 5.0, Sample Handling and Custody Procedures (ABB-ES 1994a). Sample information recorded from bar coding or the chain-of-custody forms will be transferred (electronically or manually) into the sample tracking portion of the database management system (DMS), thereby enabling the samples to be tracked through final disposition.

Analytical results, applicable QA/QC data, validation flags, chain-of-custody information, and any other attributed information will be incorporated into the DMS. All data will be verified after uploading to ensure completeness and accuracy.



Legend

- Flow Path (thick line)
- Tracking Routine (thin line)

FIGURE 4-1

DATA MANAGEMENT LIFE CYCLE

RI/FS WORK PLAN, OPERABLE UNIT 2, McCOY ANNEX LANDFILL

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

5.0 RISK EVALUATION

5.1 HUMAN HEALTH EVALUATION

The purpose of the human health risk evaluation at the McCoy Annex Landfill is to provide an evaluation of the potential risks to human receptors posed by landfill-derived contaminants. The evaluation will be conducted under the presumed remedy of source containment and capping. This presumptive remedy addresses exposures and risks within the source area but does not address exposures and risks outside of it.

The results of the preliminary risk evaluation presented in Section 2.7.2.2 were used to develop an approach for the human health risk evaluation. In this evaluation the adequacy of the various components of the presumptive remedy will be scrutinized to determine if they are sufficient to prevent exposure in the landfill source area as well as in off-landfill areas. The human health risk evaluation will qualitatively evaluate and discuss the adequacy of the presumptive remedy components as they relate to exposure. Provided the presumptive remedy addresses all potential source area exposure pathways, a quantitative risk evaluation for the landfill source area will not be conducted. If contaminants have migrated to off-site locations at which human exposure is possible, then a quantitative risk evaluation may be necessary. The focus of the quantitative risk evaluation will be on potential exposure pathways outside the source area.

The quantitative risk evaluation will consist of the following components, which are discussed below: hazard identification, toxicity assessment, exposure assessment, risk characterization, comparison to health standards and guidelines, and uncertainty assessment.

The approach used in the human health risk evaluation will be consistent with the following guidance:

- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A),* Interim Final (USEPA 1989a);

- *Baseline Risk Assessment Guidance Based on the National Contingency Plan and Directed to Federal Facilities: USEPA Region IV* (USEPA 1991b); and

- *Presumptive Remedy for CERCLA Municipal Landfill Sites* (USEPA 1993a) and *Presumptive Remedy for CERCLA Municipal Landfill Sites: Quick Reference Fact Sheet* (USEPA 1993b).

5.1.1 Hazard Identification

This section will present an overview of the type and extent of contamination present at the McCoy Annex Landfill and will identify COPCs. COPCs will be selected based on factors such as comparison to background concentrations, frequency of detection, DQOs, inherent toxicity of the chemical, ARARs, and physical and chemical properties of the chemical.

5.1.2 Toxicity Assessment

If a quantitative risk evaluation is necessary, the most recent toxicity constants or dose-response values will be obtained from the USEPA Integrated Risk Information System (IRIS) database and the Health Effects Assessment Summary Tables (HEAST). If neither IRIS nor HEAST contains a toxicity constant for a particular COPC, then the USEPA Environmental Criteria and Assessment Office (ECAO) will be contacted to determine if an ECAO–derived value is available.

5.1.3 Exposure Assessment

The exposure assessment will evaluate the potential for human exposure to landfill-derived contaminants. It will consist of the identification of potential human receptors and potential pathways of exposure as well as an estimation of exposure intakes.

In accordance with USEPA's directives on presumptive remedies for CERCLA municipal landfill sites (USEPA 1993a; 1993b), the following exposure pathways associated with the source (i.e., the landfill) are assumed to be addressed by a particular component of the remedy:

- direct contact with soil and/or debris is prevented by the landfill cap;
- exposure to contaminated groundwater within the landfill area is prevented by groundwater control;
- exposure to contaminated leachate is prevented by leachate collection and treatment; and
- exposure to landfill gas is addressed by gas collection and treatment, as appropriate.

In the human health risk evaluation, the adequacy of the various components of the presumptive remedy will be evaluated to determine if they are sufficient to prevent exposure. The human health risk evaluation will qualitatively evaluate and discuss the adequacy of the presumptive remedy components as they relate to exposure.

If contaminants have migrated to off-site locations at which human exposure is possible, then a quantitative risk evaluation may be necessary. The results of field investigations and chemical analyses will be used to determine if potential exposure pathways need to be evaluated quantitatively. As discussed in the Human Health Preliminary Risk Evaluation (Section 2.7.2.2), under what are considered to be the most probable site conditions, human exposure pathways include the following:

- dermal contact, ingestion, or inhalation of contaminated shallow groundwater by off-landfill residents is possible;
- inhalation of landfill gases by site maintenance workers is possible; and
- dermal contact or incidental ingestion of contaminated surface water and sediments by both site maintenance workers and recreational users is possible.

Exposure point concentrations will be represented as the 95 percent UCL of the arithmetic average (with those contaminants not detected set equal to one-half their sample quantitation limit). If, however, the UCL exceeds the maximum detected concentration, then the exposure point concentration will be set at the maximum.

To minimize revisions to the draft human health risk evaluation, a preliminary exposure memorandum will be prepared and circulated to the regulatory risk assessors before completion of the draft risk evaluation. The purpose of the memorandum will be to inform the regulators of the exposure pathways and parameter values being evaluated and to provide them with the opportunity to comment on the proposed approach to the risk evaluation.

5.1.4 Risk Characterization

The purpose of the risk characterization will be to combine the findings of the toxicity and exposure assessments to characterize the human health risks associated with off-site contamination (i.e., contaminants that have migrated beyond the boundaries of the landfill).

Both cancer and noncancer risks will be estimated following the procedures established in the Risk Assessment Guidance for Superfund (RAGS) (USEPA 1989a). Excess lifetime cancer risks and Hazard

Indices (HIs) will be calculated for the COPCs. These risk estimates will be compared to the Superfund target risk range for carcinogens of 10^{-4} to 10^{-6} and the noncancer HI of one. The State of Florida does not accept a cancer risk greater than $1x10^{-6}$.

5.1.5 Comparison to Health Standards and Guidelines

Exposure point concentrations will be compared to available federal and state health standards and guidelines. These may include, but are not limited to, drinking water, surface water, and/or air standards and guidelines such as federal and state MCLs, ambient water quality criteria (AWQC), and Occupational Safety and Health Administration (OSHA) permissible exposure levels (PELs).

5.1.6 Uncertainty Analysis

The prediction of human health risk involves a number of assumptions and uncertainties. The uncertainties in the risk evaluation will be identified and their potential effects upon the results of the risk evaluation will be discussed. Both site-specific and general risk assessment uncertainties and limitations will be included.

5.2 ECOLOGICAL EVALUATION

The purpose of the ecological evaluation at the McCoy Annex Landfill is to provide an evaluation of the potential risk to ecological receptors posed by chemicals in environmental media under current conditions and conditions expected under the presumed remedy of source containment and capping. This presumptive remedy addresses exposure and risk within the source area but does not address exposure pathways outside of it.

The results of the preliminary risk evaluation presented in Section 2.7.2.3 were used in the development of the approach for the ecological evaluation. The ecological evaluation will be based on data obtained during RI field activities, and its objectives will be twofold: (1) to determine if the existing soil cover on the McCoy Annex Landfill is sufficient to prevent exposure and risk to ecological receptors on the landfill and (2) to determine if contaminants within the landfill have migrated to off-site locations at which other ecological exposure could occur.

The ecological evaluation will consist of the following elements, which are discussed below in greater detail: problem formulation, exposure assessment, ecological effects characterization, and risk characterization. An uncertainty analysis will also be performed.

The approach used in this ecological evaluation will be consistent with the following guidance:

- *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA. 1996a);
- *Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment* (USEPA 1995);
- *Framework for Ecological Risk Assessment* (USEPA 1996b);
- *Tri-Service Procedural Guidelines for Ecological Risk Assessments* (Wentsel et al. 1996);
- *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (USEPA 1991a); and
- *Presumptive Remedy for CERCLA Municipal Landfill Sites* (USEPA 1993a) and *Presumptive Remedy for CERCLA Municipal Landfill Sites: Quick Reference Fact Sheet* (USEPA 1993b).

Ecological risk assessments are often performed using a tiered approach. The initial investigation normally employs a generalized, conservative approach. If necessary, additional investigations, or tiers, may be conducted using a more focused approach. This ecological risk evaluation can be considered a "screening level" assessment because it will be based on a screening of exposure point concentrations against benchmark values. If it is determined that risk is potentially present but has not been adequately characterized, additional investigations (tiers) may be necessary. These investigations may involve toxicity testing, community surveys, or detailed modeling.

5.2.1 Problem Formulation

This section will present an overview of the type and extent of contamination present at the McCoy Annex Landfill and will identify ecological COPCs. COPCs will be selected from available site data based on factors such as the applicability of the data for ecological assessment, the DQOs, the classification of chemicals (e.g., inorganics, VOCs, SVOCs, and pesticides), comparison of chemical concentrations to naturally occurring background concentrations, the physical and chemical properties of contaminants, the frequency of detection, and the inherent toxicity of the chemicals and their potential to bioaccumulate.

The ecological characterization will serve as the basis for identifying potential ecological receptors at the McCoy Annex Landfill. Flora and fauna located at or potentially affected by the site will be qualitatively characterized.

The characterization will be based on a limited site reconnaissance. In addition, background information on the McCoy Annex Landfill and surrounding area, including literature on the range and distribution of wildlife species and interviews with local, state, and federal wildlife officials, will be reviewed. Emphasis will be placed on assessing habitat suitability for aquatic and terrestrial organisms; assessing the potential occurrence of rare, threatened, or endangered species; and identifying wetland or other aquatic habitats that may potentially be affected by site-related contaminants. The U.S. Fish and Wildlife Service, Florida Natural Heritage Program, and Florida Game and Fresh water Fish Commission will be contacted regarding the presence of potential receptors. Additional information will be obtained, if available, from other subcontractors conducting the basewide Environmental Impact Statement. The results of the receptor analyses will be used to further develop exposure scenarios for the ecological exposure assessment.

The ecological exposure assessment will evaluate the potential for receptor exposure to COPCs at the McCoy Annex Landfill. This evaluation will involve the identification of potential exposure routes and an evaluation of the magnitude of exposure of identified ecological receptors. Exposure concentrations and/or doses will be estimated for each exposure pathway. If appropriate, indicator species will be selected for ecological exposure modeling.

Exposure pathways describe how ecological receptors can come into contact with contaminated media and are based on identifying (1) the contaminant source, (2) the environmental transport medium, (3) the point of receptor contact, and (4) the exposure route (e.g., incidental soil ingestion, drinking of contaminated surface water, or ingestion of contaminated prey items).

A CSM that identifies exposure pathways under probable conditions as well as possible deviations from those site conditions is presented in the preliminary risk evaluation section (Section 2.7.1) of this Work Plan. As discussed in that section, the ecological exposure pathways most likely to be complete at the McCoy Annex Landfill are:

- dermal contact with or ingestion of soil or landfill material,
- inhalation of landfill gas, and
- dermal contact with or ingestion of surface water and sediment.

Additional exposure pathways for ecological receptors that are possible deviations in the CSM include:

- food chain exposure and

- dermal contact with or ingestion of surface soil contaminated by landfill materials.

In selecting ecological exposure pathways for the ecological evaluation, these and other potential exposure pathways will be considered in light of the additional information obtained during the field investigative efforts.

5.2.2 Exposure Assessment

Based on COPC concentration data, exposure point concentrations will be determined for the selected ecological exposure pathways and receptors. Exposure point concentrations will be the maximum and mean detected contaminant concentrations in all applicable media.

The process of assessing exposure for terrestrial receptors will involve estimating the likely dosage for each relevant exposure route and summing these estimates to derive an expected total body dosage for each receptor type. The extent of exposure will depend upon various factors such as the type of food consumed, feeding rates, habitat preference, and home range.

5.2.3 Ecological Effects Assessment

The ecological effects assessment will contain a description of the ecotoxicological effects associated with the COPCs as well as a discussion of the relationship between the exposure concentration and the potential for adverse effects in ecological populations. Toxicological effects will be evaluated using concentration- or dose-response data regarding acute and chronic toxicity to the identified potential ecological receptors.

Contaminant doses known to cause adverse effects in the representative receptor species will be obtained from the literature. No-observed-adverse-effects-level and lowest-observed-adverse-effects-level data will be used if available. Toxicity data are lacking on the adverse effects of contaminants on many wildlife species, so toxicity data from surrogate species in laboratory studies may be obtained. If needed, uncertainty factors will be applied to laboratory toxicity data (intake doses) to extrapolate to receptor species. These doses, referred to as reference doses, will be compared to modeled contaminant intake doses in the risk characterization.

Benchmark concentrations or doses will be identified for use in the ecological risk characterization section. Sources that will be considered to obtain benchmark values for surface water include State of Florida Water Quality Standards (FDEP 1995), USEPA Region IV screening levels (USEPA 1995), and federal AWQC (USEPA 1996c). Benchmark values for sediment will be obtained from Florida Sediment Quality Guidelines (FDEP 1994), USEPA Region IV screening levels (USEPA 1995), and National Oceanographic and Atmospheric Administration sediment screening levels (Long et al. 1995). Benchmark values for surface soil and terrestrial plants will be obtained from Will and Suter 1994.

5.2.4 Risk Characterization

The purpose of the ecological risk characterization will be to combine the results of the exposure and effects assessments to characterize the ecological risks at the McCoy Annex Landfill. This section will identify ecological receptors that might be at risk from site-related contamination. Potential risks will be described using the HI approach described below.

The estimated doses or exposure concentrations will be compared to benchmark values identified in the toxicity assessment. Hazard Quotients (HQs) will be calculated for each chemical by dividing the exposure concentration by the benchmark value. These HQs will be summed into a cumulative HI. As the HI increases in magnitude, the likelihood for adverse ecological effects also increases. The ecological risk characterization will include a discussion of the chemicals and pathways that may pose a risk to ecological receptors under the presumed remedy. It will also contain a discussion of visual observations of any ecosystem degradation or other symptoms of environmental stress observed during the site visit.

The findings of the ecological risk characterization will be used in evaluating the need (if any) for addressing specific ecological concerns in the presumed remedy of source containment and capping for the McCoy Annex Landfill.

5.2.5 Uncertainty Analysis

The prediction of ecological risks involves a number of assumptions. The uncertainties associated with these risk assessment assumptions will be identified, and their potential effects upon the results of the risk assessment will be discussed.

6.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

The purpose of this task is the management of IDW generated during studies conducted at the McCoy Annex Landfill and surrounding areas. Also considered will be the management of sample residuals of any radiologically contaminated samples returned from the laboratories.

This section contains definitions and identifies waste categories and classification methods, packaging requirements, and preferred management options. The approach outlined in this section emphasizes the following objectives:

- management of IDW in a manner that is protective of human health and the environment;
- minimization of IDW, thereby reducing costs and the use of the limited storage facility capacity; and
- compliance, to the extent practical, with federal and state requirements that are ARARs.

6.1 DEFINITIONS

An **area of concern (AOC)** is an area delineated by the areal extent of potential contamination on the project site. This boundary may contain varying concentrations and types of hazardous substances and may also contain areas free of contamination. For the purpose of this Work Plan, the AOC will be considered the area within the landfill boundaries as defined by the geophysical survey and sampling programs.

USEPA's "Contained-In" Policy requires any mixture of a nonsolid waste (environmental media) and a Resource Conservation and Recovery Act (RCRA)–listed hazardous waste to be managed as a hazardous waste as long as the material contains the listed hazardous waste above health-based standards.

A **field staging area (FSA)** is an area within the project site where drums and other containers or IDW are stored until the site investigation activities are completed or a final disposal option is selected in a ROD. This area will be posted as the FSA and will be checked for leaking containers weekly during field activities. This area will remain active until all containers have been disposed of appropriately. Additional empty drums, overpack, and absorbent materials will be kept at the FSA in the event of a leak or spill. The FSA is not considered a RCRA 90-day storage area.

Hazardous constituents are those constituents listed in 40 Code of Federal Regulations (CFR) Part 261, Appendix VIII.

Hazardous substances, for the purposes of this Work Plan, shall have the meaning set forth by Section 101(14) of CERCLA, 42 U.S. Code (USC) 9601(14).

IDW is discarded material resulting from site investigation activities, such as drilling or decontamination, that possesses no inherent value or additional usefulness without treatment. Such waste may be:

- solid, semisolid, liquid, or gaseous material that may or may not be hazardous as defined in 40 CFR 261;
- radioactive because of the presence of radionuclides regulated by the Atomic Energy Act (AEA) of 1954, as amended; or
- mixed, which is a waste that contains both radioactive and hazardous components.

IDW may include materials such as used personal protective equipment (PPE), decontamination fluids (wash and rinse), drilling muds and cuttings, pumped monitoring well fluids, purge water, soil, other materials from collection of samples, and spill-contaminated materials.

IDW will be classified as RCRA hazardous waste if it meets one of the following criteria:

- it contains a USEPA–listed hazardous waste identified in 40 CFR 261 or
- it exhibits characteristics of hazardous waste, including ignitability, corrosivity, reactivity, or toxicity (fails the TCLP test), as described in 40 CFR 261.

Land disposal means placement in or on the land and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, underground mine or cave, or concrete vault or bunker intended for disposal.

Land disposal restrictions (LDRs) are restrictions that prohibit the land disposal of certain RCRA hazardous wastes unless specific treatment standards are met. USEPA has established standards for specific hazardous wastes that are protective of human health and the environment when the wastes are land-disposed.

Radioactive waste is waste that contains radioactivity above background or referenced levels.

Mixed waste is material that has been classified as hazardous or toxic waste and is also classified as radioactive.

Movement (nonplacement) is an activity that consists of moving soil, whether excavated or surface soil, within the site along with RCRA hazardous wastes and CERCLA hazardous constituents contained in the soil to consolidate the material within the AOC. Movement of soil with CERCLA constituents or radioactive constituents that do not contain RCRA hazardous waste would not trigger RCRA LDRs, even if moved outside the AOC.

Placement is an activity that consists of moving soil contaminated with RCRA hazardous wastes off site or outside the AOC.

Wastewater is liquid waste consisting primarily of water without other liquid phases present that may result from groundwater well installation, development, and sampling activities or from the cleaning of well installation or sampling equipment.

6.2 GENERAL MANAGEMENT APPROACH

The intent of this approach is to manage all IDW in an environmentally responsible manner consistent with the CERCLA program, RCRA requirements, and the base's standard procedures.

Wastewater, cuttings, soil, spill-contaminated materials, and PPE generated during investigation activities will be containerized, centralized, and managed in accordance with this Work Plan.

6.3 AREA OF CONCERN

Before development of this Work Plan, management of IDW was evaluated regarding compliance with applicable regulations. The most significant ARARs considered included the LDRs under RCRA. For LDRs to be applicable, the action must constitute placement of a restricted RCRA hazardous waste in a land disposal unit. To clarify whether placement occurs, the concept of the AOC has been adopted.

IDW that is generated, moved, consolidated, stored, or redeposited within the boundaries of the AOC will not constitute placement or trigger LDRs (USEPA 1992d). Placement will occur, however, as a result of either of the two following activities: (1) IDW is consolidated from different AOCs into a single AOC and redeposited, or (2) IDW is moved outside of an AOC (e.g., for treatment or storage) and returned to the same or a different AOC.

6.4 WASTE HANDLING, SEGREGATION, AND PACKAGING

IDW will be containerized for characterization and classification. PPE will be composited into plastic-lined, open-top, 55-gal steel 17C U.S. Department of Transportation (USDOT)–approved drums. Wastewater generated will be collected in either 55-gal drums or a bulk polypropylene-type container mounted to a transportable trailer or vehicle.

Filled waste containers will be securely closed, cleaned, and labeled. All labeling will include the date, the specific location (boring or well) from which the material came, waste type, and any field observations that may be appropriate. Labels will be completed with permanent markers and will be attached to the container when it is full or when sampling activities are complete.

6.5 WASTE TRANSPORTATION AND STORAGE

Materials generated at the job site will be packaged before movement to the FSA. Packaged material will be surveyed for loose surface contamination and radiation dose rates on the package exterior. If necessary the package will be decontaminated to levels that are below 1,000 disintegrations per minute (dpm) per 100 square centimeters (cm^2) before movement.

Packages with an exterior dose rate on contact with the package surface in excess of 5 millirem per hour will be transported in accordance with guidance provided by the Site Safety Officer. Once the drums and/or containers are securely sealed and labeled, they will be moved to the FSA.

At the FSA the drums will be unloaded onto pallets, not to exceed four drums per pallet. Drums will be positioned on the pallets such that the container labels are visible and readable. Wastewater from the decontamination activities will be sampled for CLP TAL metals and TCL organics (excluding PCBs, dioxins, and pesticides). Radionuclides (U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, Ra-228, and radon) may also be analyzed for, but only if gross alpha and gross beta values are above the referenced gross alpha MCL and gross beta screening level (see Table 2-1).

IDW will temporarily be stored at the FSA pending the analytical results of the samples collected. Following receipt of the environmental and IDW sample results and comparison of these data to regulatory levels, disposal options and/or additional classification criteria will be determined with the Navy. Additional information on the handling and temporary storage of IDW is contained in the POP, Section 4.1, Control and Disposal of IDW (ABB-ES 1994a).

6.6 WASTE CLASSIFICATION CRITERIA

If needed for final disposal, the Navy will classify the IDW into four categories:

1. nonhazardous waste,
2. radiological waste,
3. mixed waste, and
4. RCRA hazardous waste.

These categories are as defined in Section 6.1. IDW will be classified on the basis of environmental and IDW sample results.

To determine if a waste is a listed waste under RCRA, the source must be identified. Site information such as disposal records and investigation analyses will be used to determine source identity. When such documentation is not available, it will be assumed that the wastes are not RCRA–listed hazardous wastes. If documentation does confirm that IDW waste contains RCRA–listed waste resulting from disposal activities that occurred after the effective date of RCRA regulations (November 19, 1980), however, the IDW will be managed as a hazardous waste in accordance with USEPA's "Contained-In" Policy. A review of historical information indicates that no RCRA–listed wastes were disposed of in the McCoy Annex Landfill. Similarly there are no records indicating releases of RCRA–listed wastes at this site after November 1980.

IDW classification (non–PPE) will be evaluated on the basis of comparison of analytical results obtained during the RI to promulgated and regulatory guidance values for water, soil, and sediment. Soil and sediment results will be evaluated for hazardous characteristics, as determined by RCRA. 40 CFR 261, Appendix II, Method 1311, TCLP, Item 1.2, states, "If a total analysis of the waste demonstrates that the individual contaminants are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory thresholds could not possibly be exceeded, the TCLP need not be run." If, however, the sample analytical results meet or exceed the total extraction limit for a constituent, then the IDW may require sampling and analysis for TCLP parameters.

6.7 SAMPLE MANAGEMENT

Laboratory sample residuals that have radioactive concentrations in excess of 2,000 picocuries per gram (pCi/g) may be returned to the site only if accompanied by chain-of-custody documentation relating the residue to the sample source material. These samples will then be stored with the appropriate source material in the FSA until final disposition of that source material. Samples suspected of having radioactive contamination in excess of the 2,000 pCi/g USDOT limit, but less than 1 x 10^{-3} times the A_2 value (isotope-specific values from 49 CFR 173.435) for each isotope, and no dose rate on any portion of the package exterior in excess of 0.5 millirem per hour may be shipped in accordance with the limited-quantity criteria. Samples that have laboratory documentation showing that the concentration of radioactive materials is below 2,000 pCi/g are exempted from USDOT radioactive materials shipping requirements.

6.8 DISPOSAL OPTIONS

The types of IDW expected to be generated during the site investigation are wastewater, PPE, soil cuttings, and drilling mud and fluids.

Wastewater. Wastewater generated from decontamination activities and well installations will temporarily be stored at the FSA. Samples collected for characterization of this IDW will be evaluated for acceptability for disposal at the NTC, Orlando POTW. If the IDW wastewater contamination is at a level that cannot be disposed of at the POTW, then the IDW wastewater will be disposed of off site at an approved treatment, storage, and disposal facility or stored at the FSA until discharge limits can be achieved through treatment.

Soils and Drilling Fluids. Analyses of collected samples that are representative of the applicable IDW will be evaluated to determine the proper disposal options. If constituents are detected at concentrations that will not affect human health or the environment, then the IDW will be used as clean fill material in areas identified by the Navy. If concentrations are such that on-site disposal is not permitted, then the IDW will be disposed of off site at an approved treatment, storage, and disposal facility.

The incidental contact with waste or contaminated media by PPE typical of CERCLA site investigations does not warrant management of PPE as hazardous solid waste. If exposure to radioactive materials occurs, however, PPE will be regarded as hazardous only if radiological contamination levels are greater than 10,000 dpm/100 cm^2 for beta-gamma radioactivity or greater than 1,000 dpm/100 cm^2 for alpha radioactivity. Isotope-specific criteria will be established by the project's health physicist.

7.0 REMEDIAL INVESTIGATION REPORT

The draft RI report will be prepared in accordance with the guidance contained in *Conducting Remedial Investigations/Feasibility Studies under CERCLA* (USEPA 1988). The report will include appropriate sections concerning site background, investigation activities, physical characteristics, nature and extent of contamination, aquifer characterization, fate and transport, and risk evaluations (both human health and ecological assessments). Numerical modeling may be used to evaluate the nature and extent as well as the fate and transport of contaminants detected within OU 2. Probable conditions and reasonable deviations, as depicted in the current CSM, will be verified and/or revised and presented in the report.

After internal review the document will be prepared for submission to the NTC, Orlando BCT and the NTC Restoration Advisory Board for review. A final RI document will include a list of comments received and the responses.

8.0 FEASIBILITY STUDY

The purpose of the FS is to identify and evaluate remedial action alternatives to minimize or eliminate exposure to contaminants from the landfill (USEPA 1991a). The FS report for the McCoy Annex Landfill will include a summary of RI results for each medium; a summary of site risks; identification of ARARs; identification of RAOs and general response actions; and identification, screening, and analysis of remedial technologies and alternatives. Preliminary ARARs, preliminary RAOs, and several potentially applicable technologies are identified in Section 2.7.3 based on what is currently known about the landfill. These will be refined in the FS based on the findings of the RI.

The approach for screening remedial technologies, developing and screening remedial alternatives, and evaluating alternatives in the FS is presented in the following sections.

8.1 ALTERNATIVE TECHNOLOGY SCREENING

USEPA has reviewed a number of FS reports and RODs for CERCLA municipal landfill sites and has evaluated the types of technologies that are typically selected for implementation (USEPA 1991a). Generally these landfills contain a large volume of heterogeneous waste, as does the McCoy Annex Landfill. This fact often makes technologies such as excavation and treatment of landfilled materials impractical and costly. The presumptive remedy for CERCLA landfill sites, therefore, is containment and capping with other components (e.g., leachate or groundwater collection and treatment, “hot spot” remediation, institutional controls, or landfill gas control) to supplement the containment technologies, depending on site-specific conditions (USEPA 1993a).

Preliminary remedial technologies have been identified within the general response action categories to assist in focusing the scope of the RI/FS. These categories include institutional controls; capping; containment; and collection and treatment of surface water, sediment, leachate, groundwater, and landfill gases. The technologies have been identified for probable and potential contaminated media and exposure pathways (Table 8-1). The physical and chemical characteristics of the site may require consideration of certain technologies while making others infeasible. The purpose of the technology screening step in the FS process is to eliminate technologies that are infeasible or ineffective for the conditions and contaminants found at the landfill, as identified in the RI.

Technologies will be screened on the basis of effectiveness, implementability, and cost, as described below. The technology screening step will be conducted in tabular form.

TABLE 8-1
PRELIMINARY REMEDIAL ACTIONS
PAGE 1 OF 5

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
Orlando, Florida

Environmental Media	General Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Soil and Landfill Contents	Limited action	Access restrictions	Deed restrictions	All deeds for property within potentially contaminated areas would include restrictions on property's use.	Potentially viable.
			Fencing	Security fences would be installed around potentially contaminated areas to limit access.	Potentially viable.
			Zoning restrictions	Municipal zoning regulations would be revised to limit access, development, and use of the land.	Potentially viable.
			Groundwater restric-tions	All deeds for property within potentially contaminated areas would include restrictions on development and use of groundwater.	Potentially viable.
			Reclassification of and/or restricted access to surface water bodies	State reclassification of surface water bodies would limit use and access.	Potentially viable.
	Containment	Surface controls	Vegetation	Seeding, fertilizing, and watering would be performed until a stand of vegetation has been established.	Potentially viable.
			Grading	Topography would be reshaped to manage runoff to control erosion and infiltration.	Potentially viable.
		Capping	Native soil	Uncontaminated native soil would be placed over landfill.	Viable in cases in which direct con-tact is prime threat. Also may be viable in cases in which majority of source is below water table and leaching is not a significant release mechanism. Unless engineered to do so, will not result in reduction of infiltration.

TABLE 8-1
PRELIMINARY REMEDIAL ACTIONS
PAGE 2 OF 5

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
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Environmental Media	General Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Soil and Landfill Contents (continued)	Containment (continued)	Capping (continued)	Single barrier	Cap of compacted clay would be placed over site. Cap is usually protected with additional fill above and topsoil. Clay cap is normally 2 ft thick.	Potentially viable in situations in which it is not necessary to comply with RCRA Subtitle C.
			Composite barrier	Compacted clay covered with a synthetic membrane (0.020 in. minimum) followed by 1 ft of sand and 1.5 ft of fill and 6 in. of topsoil would be installed to provide erosion and moisture control as well as freeze/thaw protection.	Potentially viable. Provides maximum protection from exposure through direct contact. This is also the most effective capping option for reducing infiltration in compliance with RCRA guidance.
Groundwater and Leachate	No action			No action.	Required by NCP to be carried through detailed analyses of alternatives for groundwater usage outside landfill when applying presumptive remedy.
	Containment	Vertical barriers	Slurry wall	Trench around site or "hot spot" would be excavated and filled with a bentonite slurry. Trench would be backfilled with a soil- (or cement-)bentonite mixture.	Potentially viable. Effectiveness depends on site characteristics. Slurry wall should be keyed into aquitard or bedrock.
	Collection	Extraction	Extraction wells	Series of wells would be installed to extract contaminated groundwater.	Potentially viable. May include perimeter wells to collect leachate as well as downgradient wells to capture migration of contaminated groundwater.
		Leachate collection	Subsurface drains	System of perforated pipe would be laid in trenches to collect contaminated groundwater and to lower the water table.	Potentially viable.
	Treatment	Biological treatment	Aerobic	Aerobic microbes would be used to biodegrade organic wastes.	Potentially viable for organics. Sludge produced.
			Anaerobic	Anaerobic microbes would be used to biodegrade organic wastes.	Potentially viable for organics. Sludge produced.

TABLE 8-1
PRELIMINARY REMEDIAL ACTIONS
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RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
Orlando, Florida

Environmental Media	General Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Groundwater and Leachate (continued)	Treatment (continued)	Chemical treatment	Chemical oxidation	Oxidizing agents would be added to waste for oxidation of heavy metals, unsaturated organics, sulfides, phenolics, and aromatic hydrocarbons to less toxic oxidation states.	Potentially viable.
			Enhanced oxidation	Destruction of organic contaminants would be accomplished using oxidizing agents enhanced with, for example, ultraviolet light.	Potentially viable.
			Metals precipitation	Inorganic constituents would be altered to reduce the solubility of heavy metals through the addition of a substance that reacts with the metals or changes the pH.	Potentially viable.
			pH adjustment	Neutralizing agents (such as lime) would be added to adjust the pH. May be done to neutralize a waste stream or to reduce the solubility of inorganic constituents as part of the metals precipitation process.	Potentially viable.
		Physical treatment	GAC adsorption	Contaminated water would be passed through a bed of adsorbent so contaminants would adsorb on the surface.	Potentially viable.
			Air stripping	Large volumes of air would be mixed with water in a packed column or through diffused aeration to promote transfer of VOCs from liquid to air.	Potentially viable.
			Sedimentation	Suspended particles would be settled out as a pretreatment or primary treatment step.	Potentially viable.
			Filtration	Process would be used to filter out suspended particles. May be preceded be a coagulation and flocculation step to increase the effectiveness of sand filtration.	Potentially viable.
	Disposal	Off-site discharge	POTW	Extracted groundwater would be discharged to local POTW for further treatment.	Potentially viable. Requires extensive negotiations with POTW.

TABLE 8-1
PRELIMINARY REMEDIAL ACTIONS
PAGE 4 OF 5

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
Orlando, Florida

Environmental Media	General Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Groundwater and Leachate (continued)	Disposal (continued)	On-site discharge	Surface water discharge	Treated effluent would be discharged to an adjacent surface water body. A federal and state NPDES permit would likely be required.	Potentially viable.
Sediments	Removal	Excavation	Mechanical excavation	Mechanical excavation equipment would be used to remove and load contaminated sediment for disposal.	Potentially viable. Potential for secondary migration of contaminants through surface water during excavation.
	Disposal	Off-site disposal or discharge	RCRA landfill	Excavated sediment would be transported to an RCRA–permitted landfill.	Potentially viable. Treatment may be based on land disposal restrictions.
	Treatment	Physical	Stabilization	Soil would be mixed with stabilizing reagents (e.g., lime or fly ash) that can stabilize contaminants.	Potentially viable for sediment contaminated with inorganics and low concentrations of organics.
			Thermal treatment	Contaminants would be thermally destroyed in a controlled oxygen-sufficient environment.	Potentially viable. Ash may require additional treatment for inorganics.
Landfill Gases	Collection	Passive systems	Pipe vents	Atmospheric vents would be used for venting LFG at points at which it is collecting and pressure is building up. Vents are often used in conjunction with flares.	Potentially viable.
			Trench vents/interceptor trenches	Vents would be constructed by excavating a deep narrow trench surrounding the waste site or spanning a section of the area's perimeter. The trench would be backfilled with gravel, forming a path of least resistance through which gases would migrate upward to the atmosphere. Trenches are most successfully used where the depth of LFG migration is limited by groundwater or an impervious formation.	Potentially viable.

TABLE 8-1
PRELIMINARY REMEDIAL ACTIONS
PAGE 5 OF 5

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
Orlando, Florida

Environmental Media	General Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Landfill Gases (continued)	Collection (continued)	Active systems	Extraction wells	Applied vacuum extraction would serve to withdraw LFG in both the horizontal and vertical directions. Wells would be connected by a collection header leading to a blower and burner facility. Vacuum blowers would serve to extract the LFG from the wells and push the collected gas through a free vent or waste gas burner.	Potentially viable.
	Treatment	Thermal destruction	Flaring	Enclosed ground flare systems would consist of a refractory-lined flame enclosure. Waste might sometimes be mixed with a supplemental fuel and fed through a vertical, open-ended pipe. Pilot burners next to the end of the pipe would ignite the waste.	Potentially viable but could produce secondary air pollutants from the process.
			Catalytic oxidation	Organic compounds would be destroyed by combustion, facilitated by catalyst media, thereby decreasing the operating temperature from traditional incineration.	Potentially viable.
		Physical treatment	GAC adsorption	LFG would be passed through a bed of adsorbent material so contaminants would absorb to the GAC surface.	Potentially viable.

Source: U.S. Environmental Protection Agency (USEPA), 1991a.

Notes: GAC = granular activated carbon
LFG = landfill gases
NCP = National Oil and Hazardous Substances Contingency Plan
NPDES = National Pollution Discharge Elimination System
POTW = publicly owned treatment works
RCRA = Resource Conservation and Recovery Act
VOC = volatile organic compounds

Effectiveness considers the effect that physical and chemical properties of a medium, individual compounds, and compound mixtures would have on a given technology or process. It also considers the technology's reliability over time, its ability to meet chemical-specific ARARs or guidance values, and the impacts to the community or environment during implementation.

Implementability focuses on the construction, operation, and performance of a technology as well as on its institutional feasibility. The evaluation of technologies against this criterion considers site-specific features such as topography, buildings, utilities, and available space in determining feasibility. A technology that has not been demonstrated or is not widely available may also be eliminated under this criterion.

Cost affects the practicality of certain technologies at a site. A technology can be eliminated on the basis of cost if it can be shown that the higher-cost technology provides little or no advantage in effectiveness or implementability over another lower-cost, but otherwise equal, technology. At this stage, costs will be presented on an order-of-magnitude, unit-cost basis (e.g., per acre or per gallon).

8.2 ALTERNATIVE DEVELOPMENT AND SCREENING

The technologies remaining following technology screening will be assembled into remedial alternatives that address each response objective established for the site. In addition to the No Action alternative (only for off-landfill exposure), which is required under CERCLA to establish a baseline for comparison of alternatives, a number of other alternatives may be developed that focus on containment of the landfilled material and address other media of concern (e.g., groundwater migrating from the site or landfill gas emissions). A brief description of the components of each alternative developed will be provided in the FS report.

Few options may be available to adequately address the RAOs because of the nature of the site. If few alternatives (i.e., fewer than six) are developed, it may not be necessary to conduct further screening to limit the number of alternatives to be evaluated. If the complexity of the site indicates that several options are potentially feasible, however, a second screening step may be required. The alternative screening will be conducted under the same criteria used for technology screening, but will consider how the alternative components function together to meet the RAOs.

8.3 ALTERNATIVE EVALUATION

Remedial alternatives will be evaluated in the FS to provide information that will help decision makers select an appropriate remedial action for the McCoy Annex Landfill. The evaluation process will consist of (1) a detailed description of the alternative components, sufficient to support a conceptual design and a cost estimate accurate to +50/-30 percent; (2) an evaluation of each alternative against seven of USEPA's nine evaluation criteria (USEPA 1191a) (state and community acceptance will be addressed in the Proposed Plan and ROD); and (3) a comparison of the alternatives relative to one another, with respect to the evaluation criteria.

Where appropriate the description of alternatives may present preliminary design calculations, process flow diagrams, sizing of key components, and preliminary layouts and cross sections. The description may also include a discussion of limitations, assumptions, and uncertainties associated with each alternative.

The seven criteria that will be used to evaluate each alternative are described below.

Overall protection of human health and the environment considers how risks identified in the CSM are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs identifies how the alternative meets the federal and state requirements regulating the chemical constituents, location of the site, and type of action to be implemented.

Long-term effectiveness and permanence considers the integrity of the system or component over time, long-term management of waste, and magnitude of risk associated with waste remaining in place.

Reduction of toxicity, mobility, or volume through treatment does not apply to the containment or other nontreatment components, but does apply to treatment components for “hot spots”, groundwater, leachate, sediment, or landfill gas. This criterion considers the amount of material destroyed or treated and the degree of expected contaminant reduction. It also includes an evaluation of the irreversibility of the treatment technology.

Short-term effectiveness considers the impact on the surrounding community during construction and operation of the alternative. It also evaluates the amount of time required to achieve the response objectives.

Implementability includes several factors such as technical feasibility (i.e., the ability to construct and operate the alternative, the reliability of the technology, and the ability to monitor the effectiveness of the remedy), availability of materials and services, and administrative feasibility (i.e., the ease or difficulty of coordinating with or obtaining approvals from other agencies as well as the enforceability of deed restrictions).

Cost includes a line-item cost estimate for construction as well as operation and maintenance costs and a total-present-worth cost for the purpose of comparison with other alternatives. These cost estimates may be presented as a range of values with an accuracy of +50/-30 percent. The cost estimates will include a reasonable contingency factor to cover details and unforeseen circumstances. The estimates may be suitable for budgeting but should not be considered the final construction cost estimates for the remedial action.

The comparative analysis of alternatives highlights the relative advantages and disadvantages of the alternatives for each of the seven evaluation criteria. This analysis will be presented as a written discussion for each alternative and will be summarized in tabular format for ease of comparison.

8.4 FINAL FEASIBILITY STUDY

The final FS will be signed, sealed, and dated by the Florida Registered Professional Engineer with responsible charge for its preparation.

9.0 PROJECT SCHEDULE

The anticipated schedule for all tasks related to the OU 2 RI/FS Work Plan is presented in Figure 9-1. The probable (early start point to early finish point) and potential (early start point to late finish point) durations of each task are indicated in the figure. The total float bars represent uncertainty regarding the duration of certain field tasks because of variables that may be implemented during the field investigation such as multiple aquifer evaluations.

Figure 9-1 Project Schedule

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APPENDIX A

SYNOPSIS OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Appendix A
Synopsis of Potential Federal and State ARARs

RI/FS Work Plan, Operable Unit 2
McCoy Annex Landfill
Naval Training Center
Orlando, Florida

Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Atomic Energy Act (AEA) Regulations, Protection of Individuals in Unrestricted Areas for Radiation Exposure [10 CFR Part 20.105]	Establishes radiation exposure limits for members of the public.	Action-specific	The exposure limits established in this rule are potential relevant and appropriate requirements for radioactively contaminated sites.
AEA Regulations, Discharge of Radionuclides to Unrestricted Areas (Air and Water) [10 CFR Part 20.106]	Establishes maximum concentration limits for radionuclide discharges to air and water.	Chemical-specific	The exposure limits established in this rule are potential relevant and appropriate requirements for radioactively contaminated sites.
AEA Regulations, Protection of Individuals in Restricted Areas for Radiation Exposure [10 CFR Part 20.106]	Establishes radiation exposure limits for individuals in restricted areas.	Action-specific	This regulation is potential relevant and appropriate requirement for worker exposure to radioactive material during remedial activities.
CAA, National Ambient Air Quality Standards (NAAQs) [40 CFR Part 50]	Establishes primary (health based) and secondary (welfare based) air quality standards for carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides emitted from a major source of air emissions.	Action-specific	NAAQs are potential relevant and appropriate requirements for cleanup activities. The principal application of these standards is during remedial activities resulting in exposures through dust and vapors.
Clean Water Act (CWA) Regulations, Ambient Water Quality Criteria [40 CFR Part 131]	Federal Ambient Water Quality Criteria (AWQC) are non-enforceable, health-based criteria for surface water. AWQC provide levels of exposure from drinking the water and consuming aquatic life which are protective of public health. AWQC also provide acute and chronic concentrations for protection of freshwater and marine organisms.	Chemical-specific	In the absence of any Florida Surface Water Quality Standard (FWQS) specific to the pollutant and water body of concern, AWQC may be ARARs for surface-water bodies when protection of aquatic life is a concern or if human exposure from consumption of contaminated fish is a concern.
CWA Regulations, National Pollutant Discharge Elimination System (NPDES) [40 CFR Parts 122 and 125]	Requires permits specifying the permissible concentration or level of contaminants in the effluent for the discharge of pollutants from any point source into waters of the United States.	Action-specific	Offsite discharge from a site to surface waters may require that an NPDES permit be obtained and that both the substantive and administrative NPDES requirements be met.
CWA Regulations, National Pretreatment Standards [40 CFR Part 403]	Sets pretreatment standards through the National Categorical Standards or the General Pretreatment Regulations, for the introduction of pollutants from nondomestic sources into publicly owned treatment works (POTWs) to control pollutants which pass through, cause interference, or are otherwise incompatible with treatment processes at a POTW.	Action-specific	If groundwater is discharged to a POTW, the discharge must meet local limits imposed by the POTW. A discharge from a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site must meet the POTW's pretreatment standards in the effluent to the POTW. Discharge to a POTW is considered an offsite activity and is, therefore, subject to both the substantive and administrative requirements of this rule.
CWA Regulations, Discharge of Radioactive Pollutants to Surface Waters [40 CFR Part 440]	Requires that the concentration of pollutants discharged in drainage from mines that produce uranium not exceed specified standards.	Chemical-specific	This regulation should be used for guidance in the evaluation of radium and uranium in drainage and surface water runoff into surface waters.

Appendix A
Synopsis of Potential Federal and State ARARs

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Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
CWA Regulations, Toxic Pollutant Effluent Standards [40 CFR Part 129]	This rule regulates the concentration of a toxic pollutant in navigable waters that shall not result in adverse impacts to aquatic life or to consumers of aquatic life.	Chemical-specific	This rule is a potential ARAR for sites which may potentially discharge regulated pollutants to surface water. These standards may be incorporated into NPDES permits where applicable for offsite discharge of surface water.
Fish and Wildlife Coordination Act [40 CFR Part 302]	Requires that the Fish and Wildlife Services (USFWS), National Marine Fisheries Service (NMFS), and other related State agencies be consulted when a Federal department or agency proposes or authorizes any control or structural modification of any stream or other water body. Also requires adequate provision for protection of fish and wildlife resources.	Location-specific	Should a remedial alternative involve the alteration of a stream or other body of water, the USFWS, NMFS, and other related agencies must be consulted before that body of water is altered.
National Environmental Policy Act Regulations [40 CFR Part 6.302 and 40 CFR Part 6, Appendix A and Executive Orders 11990 and 11988]	Requires that Federal agencies minimize the degradation, loss, or destruction of wetlands, and preserve and enhance natural and beneficial values of wetlands and floodplains.	Location-specific	For remedies which may impact wetlands or floodplains, the intent of NEPA (i.e., that degradation, loss, or destruction of wetlands should be minimized) is a potential ARAR.
Occupational Health and Safety Act (OSHA) Regulations, General Industry Standards [29 CFR Part 1910]	Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements.	Action-specific	Under 40 CFR 300.38, requirements apply to all response activities under the National Contingency Plan.
OSHA Regulations [29 CFR Part 1910, Subpart Z]	Establishes permissible exposure limits for work place exposure to a specific listing of chemicals.	Chemical-specific	Standards applicable for worker exposure to OSHA hazardous chemicals during remediation activities.
OSHA Regulations, Recordkeeping, Reporting, and Related Regulations [29 CFR Part 1904]	Provides recordkeeping and reporting requirements applicable to remediation activities.	Action-specific	These requirements apply to all site contractors and subcontractors and must be followed during all site work.
OSHA Regulations, Health and Safety Standards [29 CFR Part 1926]	Specifies the type of safety training, equipment, and procedures to be used during site investigation and remediation.	Action-specific	All phases of the remedial response project should be executed in compliance with this regulation.
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Waste [40 CFR Part 261]	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265.	Action-specific	These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes which should be incorporated into the characterization and remediation elements of remedial response projects.
RCRA Regulations, Contingency Plan and Emergency Procedures [40 CFR Part 264, Subpart D]	Outlines requirements for emergency procedures to be used following explosions, fires, etc.	Action-specific	These requirements are relevant and appropriate for remedial actions involving the management of hazardous waste.

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RCRA Regulations, Closure and Post-Closure [40 CFR Part 264, Subpart G]	Details general requirements for closure and post-closure of hazardous waste facilities, including installation of a groundwater monitoring program.	Action-specific	This requirement is a potential ARAR for remedial alternatives that involve the closure of a hazardous waste site.
RCRA Regulations, Use and Management of Containers [40 CFR Part 264, Subpart I]	Sets standards for the storage of containers of hazardous waste.	Action-specific	This requirement would apply if a remedial alternative involves the storage of containers of RCRA hazardous waste. Additionally, the staging of study-generated RCRA-wastes should meet the intent of the regulation.
RCRA Regulations, Landfills [40 CFR Part 264, Subpart N]	Provides requirements for design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for RCRA regulated landfills. As part of a RCRA closure, a final cover must be designed and constructed that prevents migration of liquids, requires minimum maintenance, promotes drainage, minimizes erosion, accommodates settling, and has a permeability less than or equal to that of any bottom liner or natural subsoils present.	Action-specific	These requirements should be considered during the development and implementation of remedial alternatives for landfills which contain hazardous waste.
RCRA Regulations, Land Disposal Restrictions [40 CFR Part 268]	Establishes restrictions on land disposal of untreated hazardous wastes, and provides treatment standards for hazardous wastes.	Action-specific	Under the LDRs, treatment standards have been established for all listed wastes. If it is determined that hazardous wastes are considered subject to LDRs, the material must be handled and treated in compliance with these regulations. Universal Treatment Standards (UTSs) for organic constituents of hazardous wastes have been promulgated under this rule. The UTSs became effective on December 19, 1994.
Safe Drinking Water Act (SDWA) Regulations, Maximum Contaminant Level Goals (MCLGs) [40 CFR Part 141]	Establishes drinking water quality goals at levels of no known or anticipated adverse health effects with an adequate margin of safety. These criteria do not consider treatment feasibility or cost elements.	Chemical-specific	MCLGs greater than zero are relevant and appropriate standards for ground or surface waters that are current or potential sources of drinking water.
SDWA Regulations, National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) [40 CFR Part 141]	Establishes enforceable standards for specific contaminants which have been determined to adversely effect human health. These standards, MCLs, are protective of human health for individual chemicals and are developed using MCLGs, available treatment technologies, and cost data.	Chemical-specific	MCLs established by the SDWA are relevant and appropriate standards where the MCLGs are not determined to be ARARs. MCLs apply to ground or surface waters that are current or potential drinking water sources.
SDWA Regulations, National Secondary Drinking Water Standards (SMLCs) [40 CFR Part 143]	Establishes welfare-based standards for public water systems for specific contaminants or water characteristics that may affect the aesthetic qualities of drinking water.	Chemical-specific	SMCLs are non-enforceable limits intended as guidelines for use by States in regulating water supplies.

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Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Solid Waste Disposal Act Regulations Criteria for Municipal Solid Waste Landfills (40 CFR Part 258).	Establishes minimum standards for municipal solid waste landfills	Action-Specific	Requirements of this regulation are implemented by the State of Florida under Chapter 62-701, Florida Administrative Code. Florida received full final determination to implement requirements in July 1994.
Uranium Mill Tailings Radiation Control Act (UMTRCA) Regulations, Control of Uranium or Thorium Mill Tailings [40 CFR Part 192]	Establishes health and environmental protection standards for uranium and thorium mill tailings.	Chemical-specific	May be relevant and appropriate for CERCLA sites that contain materials other than, but sufficiently similar to, uranium and thorium mill tailings (i.e., contaminated soil or any other waste containing more than 5 pCi/g).
USEPA Region III Soil Risk Based Concentrations (RBCs) (USEPA Region III Office of RCRA, Technical Memo June 1996)	Established health based screening criteria for contaminants of concern in soils.	Chemical-specific TBC	Used in screening process to determine COPCs.
USEPA Region IV Sediment Screening Values (SSVs) (USEPA Region IV Table 3, Bulletin 2, Ecological Screening Value Memo, November 1995)	Establishes ecological protection based screening criteria for sediments.	Chemical-specific TBC	Used in ecological risk analysis for preliminary sensitivity screening.

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Synopsis of Potential Federal and State ARARs

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State Citations[a]	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Chapter 62-2, FAC Florida Air Pollution Rules - October 1992	Establishes permitting requirements for owners or operators of any source which emits any air pollutant. This rules also establishes ambient air quality standards for sulfur dioxide, PM_{10}, carbon monoxide, and ozone.	Action-specific	Where remedial action could result in release of regulated contaminants to the atmosphere, such as may occur during air stripping, this regulation would be a potential ARAR.
Chapter 62-4, FAC Florida Rules on Permits - February 1994	Establishes procedures for obtaining permits for sources of pollution.	Action-specific	The substantive permitting requirements must be met during a CERCLA remediation. Both substantive and administrative requirements must be met for non-CERCLA activities.
Chapter 62-301, FAC Florida Surface Waters of the State - May 1990	Provides criteria for determination of the line demarcating the landward extent of surface waters.	Location-specific	This rule would be considered to differentiate soils from sediments during the determination of preliminary remediation goals.
Chapter 62-302, FAC Florida Surface Water Standards - August 1994	Defines classifications of surface waters, and establishes water quality standards (WQS) for surface water within the classifications. The State's antidegradation policy is also established in this rule.	Chemical-specific Location-specific	Remedial actions which potentially impact surface waters of the State will consider surface water quality standards (WQS). WQC may also be relevant and appropriate ARARs for groundwater if no MCL exists, groundwater discharges to surface water and contaminants are affecting aquatic organisms, or other health-based standards are not available.
Chapter 62-520, FAC Florida Water Quality Standards - April 1994	Establishes the groundwater classification system for the State and provides qualitative minimum criteria for groundwater based on the classification.	Chemical-specific Location-specific	Drinking water standards are established in Rule 62-550 for current or potential sources of potable water. The classification system established in this rule defines potable water sources (F-I, G-I and G-II waters).
Chapter 62-522, FAC Groundwater Permitting and Monitoring Requirements - April 1994	Establishes permitting and monitoring requirements for installations discharging to groundwater.	Action-specific	This rule should be considered when discharge to groundwater is a possible remedial action.
Chapter 62-532, FAC Florida Water Well Permitting and Construction Requirements - March 1992	Establishes the minimum standards for the location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established.	Action-specific	The substantive requirements for permitting may be potential ARARs for remedial actions involving the construction, repair, or abandonment of monitoring, extraction, or injection wells.
Chapter 62-550, FAC Florida Drinking Water Standards - September 1994	Established to implement the Federal Safe Drinking Water Act by adopting the national primary and secondary drinking water standards and by creating additional rules to fulfill State and Federal requirements.	Chemical-specific Location-specific	MCLs are commonly considered applicable regulations for aquifers and related groundwater classified as a current or potential potable water supply source. MCLs should be considered ARARs during a cleanup of ground or surface waters that are current or potential sources of drinking water.