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U.S. DEPARTMENT OF THE NAVY

NAVAL AIR STATION, BRUNSWICK

BRUNSWICK, MAINE

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN

RI/FS PROGRAM CONTRACT: N62472-84-C-1108

E.C. JORDAN PROJECT NO. 4607-05

APRIL 1988

E.C.JORDAN

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RI/FS WORK PLAN

NAVAL AIR STATION BRUNSWICK

Prepared for:

U.S. DEPARTMENT OF THE NAVY
CONTRACT: N62472-84-C-1108

Prepared by:

E.C. JORDAN CO.
PORTLAND, MAINE

JOB NO. 4607-05

APRIL 1988

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1.0 INTRODUCTION

Naval Air Station Brunswick (NASB) is included in the U.S. Department of the Navy (Navy) Installation Restoration (IR) Program. The IR Program was established to identify potential contamination at Navy and Marine Corps facilities resulting from past operations and, if needed, to institute corrective remedial measures. Initial investigations conducted at NASB identified 10 sites for further study to confirm the presence or absence of contamination and to provide data for Feasibility Studies.

The Navy chose E.C. Jordan Co. (Jordan) of Portland, Maine, to develop this Remedial Investigation/Feasibility Study (RI/FS) Work Plan and to initiate an RI/FS study at NASB. This RI/FS Work Plan, which describes the scope of work and methodology that will be used by Jordan to conduct the RI/FS, consists of 13 sections and three documents incorporated by reference. Section 1.0 provides an introduction to the Navy IR Program and a summary of previous studies conducted at the site. Section 2.0 summarizes the RI/FS Work Plan, including Task R2 components of the Navy Statement of Work (SOW). Project logistics, including security, communications, and field operations, are discussed in Section 3.0. Section 4.0 addresses the RI field program. Section 5.0 outlines the analytical program and describes data quality objectives (DQOs) and the data validation process. The Data Evaluation task, including preparation of three technical memoranda and reevaluation of Sites 5 and 6, is discussed in Section 6.0. Section 7.0 defines and discusses ARARs, and Section 8.0 describes the proposed Risk Assessment (RA). Section 9.0 discusses monthly progress reporting and the RI report. The FS and post-RI/FS support are presented in Sections 10.0 and 11.0, respectively. Three documents incorporated by reference include a Community Relations Plan (CRP), a Health and Safety Plan (HASP), and a Quality Assurance Project Plan (QAPP). The HASP and QAPP were submitted previously to the Navy, and the CRP will be developed and submitted separately.

1.1 THE NAVY INSTALLATION RESTORATION PROGRAM

The current IR Program used by the Navy (see Appendix A of the SOW) is implemented in four phases: (1) preliminary assessment, (2) site inspection, (3) RI/FS, and (4) remedial action plan. This program essentially parallels the U.S. Environmental Protection Agency (USEPA) RI/FS process.

USEPA, in accordance with the National Contingency Plan (NCP), placed NASB on the Superfund National Priorities List (NPL). In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the 1986 Superfund Amendments and Reauthorization Act (SARA), work for this project will use USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (1988). Jordan's contractual tasks outlined in the SOW for the Navy IR Program will be tailored to comply with the framework defined by USEPA guidelines. USEPA and the Maine Department of Environmental Protection (MEDEP) will provide review and input of critical points throughout the RI/FS process.

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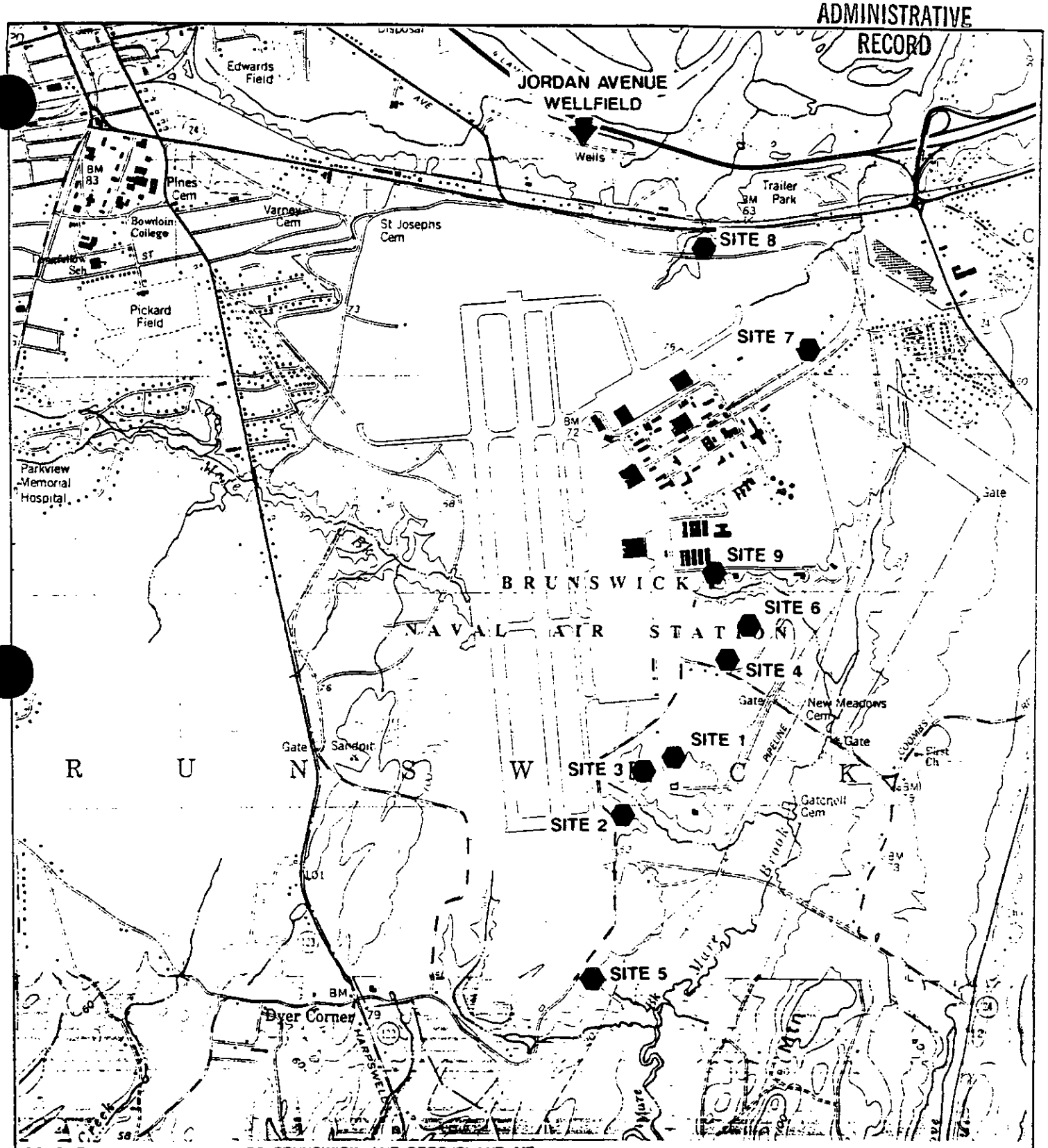

SOURCE: U.S.G.S. QUADRANGLES, BRUNSWICK, AND ORRS ISLAND, ME., 1984, 1978, 7.5 MINUTE SERIES.

QUADRANGLE LOCATION

SCALE

0 2,000 4,000 FEET

FIGURE 1
SITE LOCATION MAP
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1.2 PREVIOUS STUDIES AT NASB

An Initial Assessment Study (IAS) was completed for NASB by Roy F. Weston, Inc. (Weston) and a report was submitted to the Navy in June 1983. The IAS consisted of a preliminary assessment of background information on chemicals used at the Navy facility and site-specific waste disposal activities. Ten sites were identified and ranked based on available information. Potential hazards to human health and the environment were also evaluated. On the basis of this ranking and evaluation, seven sites were selected for Site Inspection (SI) studies.

Subsequent to the Weston IAS study, NUS Corporation (NUS) conducted a Field Investigation Team (FIT) SI at NASB for USEPA. The investigation encompassed Sites 1, 2, and 3. Results from soil and surface water analytical samples indicated the presence of pesticides and various volatile organic compounds (VOCs).

On September 15, 1984, Jordan was contracted by the Navy to complete SI studies for seven of the 10 sites at NASB identified in the Weston report. The seven sites are grouped into the following five areas:

AREA	NASB IDENTIFICATION
Sites 1, 2, and 3	Orion Street Landfill and Hazardous Waste Burial Area
Site 4	Acid/Caustic Pit
Site 7	Old Acid/Caustic Pit
Site 8	Perimeter Road Disposal Site
Site 9	Neptune Drive Disposal Site

Locations of these sites are presented in Figure 1-1. The scope of work and findings of the SI studies conducted by Jordan at each area are contained in an SI report submitted to the Navy, dated June 1985. Based on the conclusions and recommendations presented by Jordan, and meetings with regulatory agencies, the Navy contracted Jordan to conduct an RI/FS study for nine of the 10 sites originally identified in the IAS report. Site 10, the Harpswell Fuel Depot, is not included because the property is not under NASB jurisdiction.

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2.0 RI/FS WORK PLAN OVERVIEW (TASK R2)

This section provides an overview of the RI/FS Work Plan. Section 2.1 describes the objectives of the RI/FS and Section 2.2 discusses the schedule for the RI/FS program.

2.1 PLAN OF ACTION

The objectives of the RI/FS Work Plan for Sites 1 through 9 at NASB are to (1) outline the technical approach to the RI/FS; (2) summarize the procedures for conducting RI/FS activities; and (3) present the program schedule. The Work Plan was developed in response to requests from the Navy and USEPA, meetings with Jordan, and written regulatory agency comments. This RI/FS Work Plan includes sampling and data management plans and, under separate cover, a QAPP, HASP, and CRP, as follows:

- A QAPP was developed by Jordan in February 1988 and submitted to the Navy under separate cover for approval. The QAPP is designed to meet the quality assurance/quality control (QA/QC) requirements as defined in Section 4.0 of the SOW. Jordan also prepared a site-specific QAPP Addendum (QAPPA), which references sections of the QAPP applicable to the NASB RI/FS. This document is included in Appendix B of this report.

- A corporate HASP was developed by Jordan and submitted to the Navy in September 1985. The plan addresses potential hazards that investigation activities may present to the FIT and the community. Jordan also prepared a site-specific HASP addressing site-specific contaminants, personnel, decontamination procedures, emergency procedures, and equipment. The site-specific HASP is included in Appendix A of this report.

- A CRP was developed by Jordan following USEPA guidelines for implementation by Navy personnel during the RI/FS. Jordan will provide technical support to the Navy's community relations process. This plan will be submitted separately.

2.2 RI/FS SCHEDULE

Schedules for the RI/FS program for NASB, presented in Figures 2-1 and 2-2, outline the major RI and FS tasks, meetings, and associated deliverables.

The initial RI field work is scheduled to begin in May 1988, and will take approximately three months to complete. Three sampling rounds of environmental media subsequent to the field investigation program are scheduled; the third round will be completed approximately 45 weeks after Notice to Proceed. Approximately eight weeks after each sampling round, a Technical Memorandum (see Section 6.1) will be prepared and delivered to the Navy and USEPA. Preliminary Screening of Remedial Alternatives tasks will be initiated

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FIGURE 2-1
RI/FS PHASE I + II SCHEDULE
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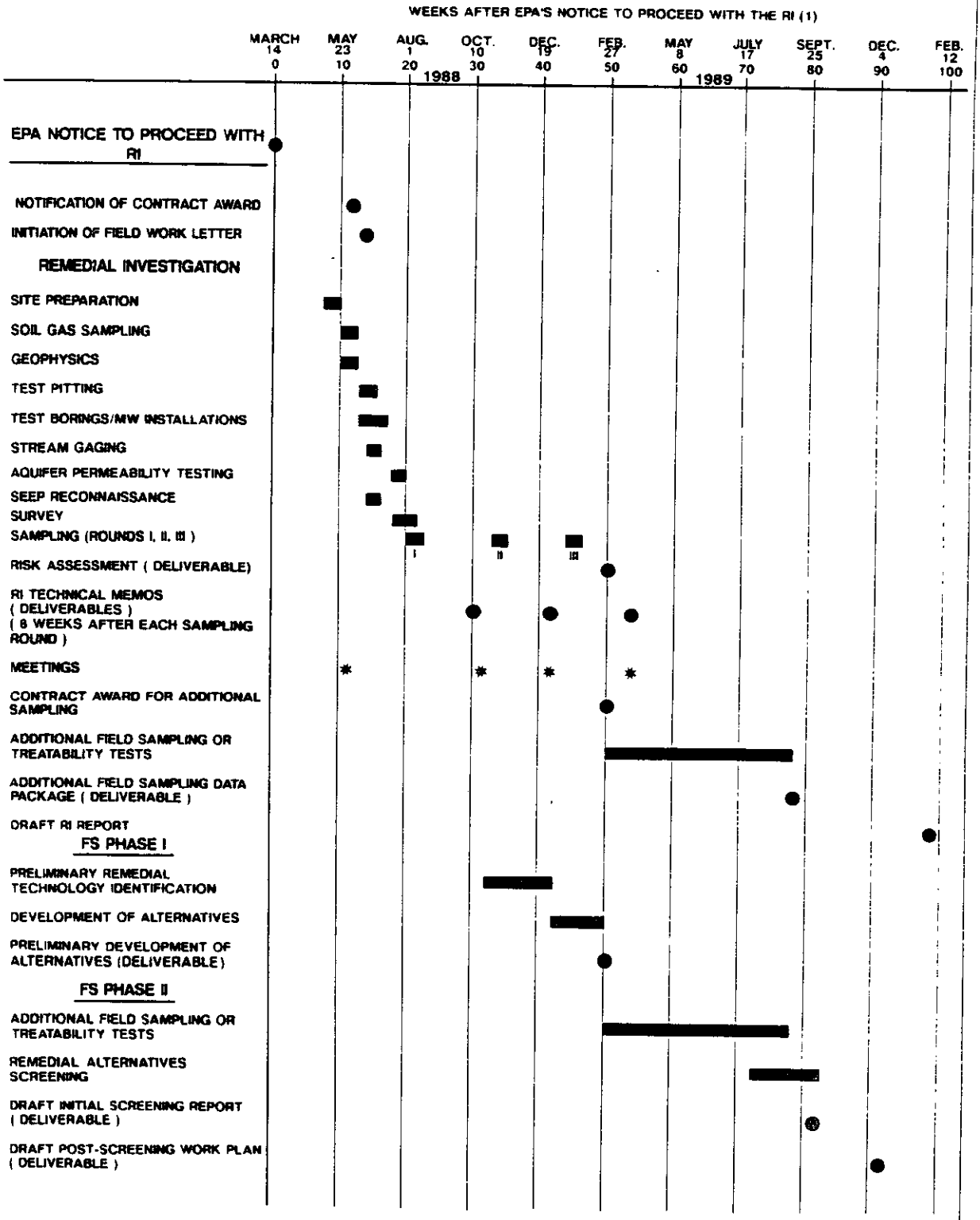

NOTES: (1) EPA NOTIFIED THE NAVY ON 15 MARCH 1988 TO PROCEED WITH THE RI AT NASB.

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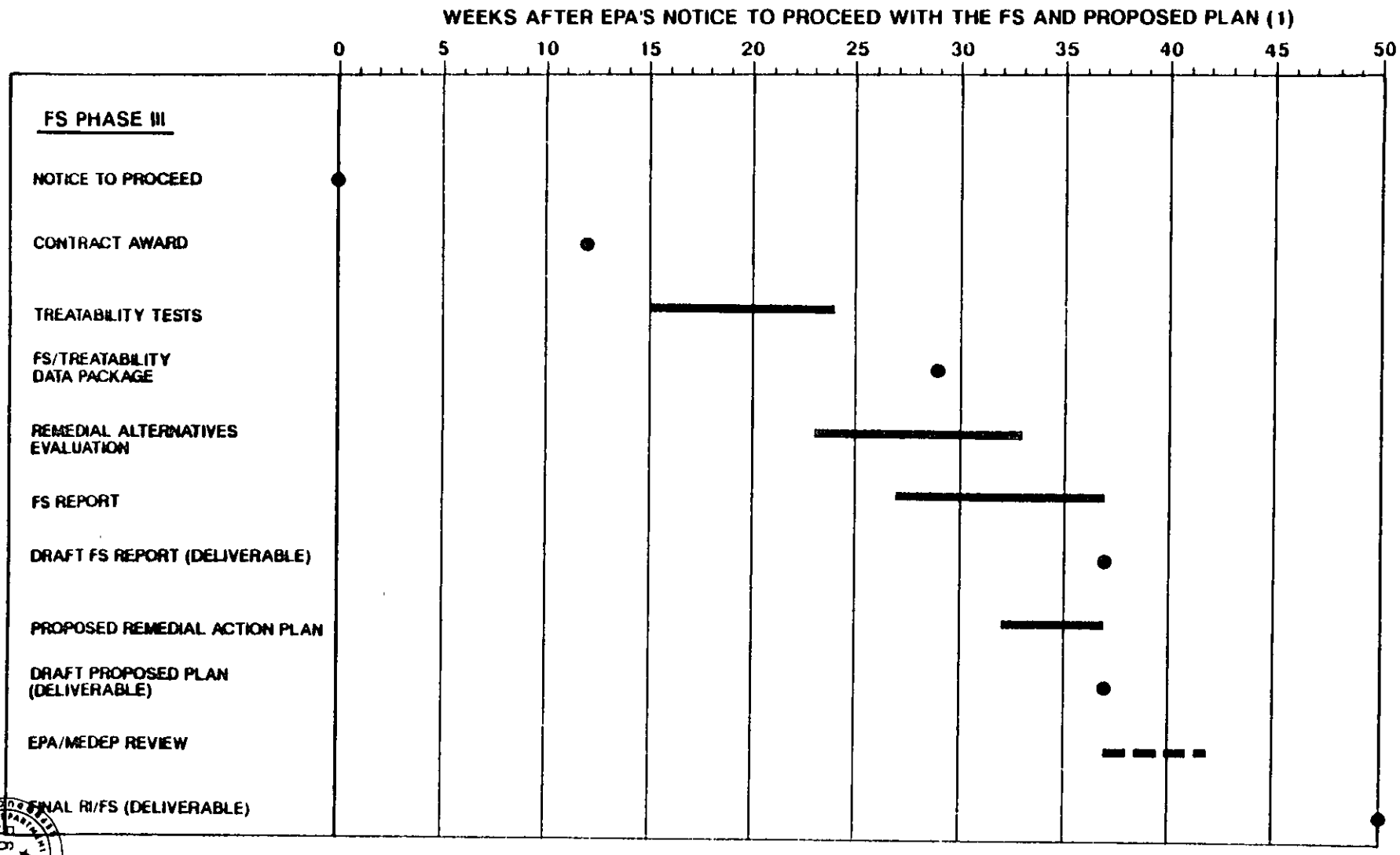
FIGURE 2-2
FS PHASE III SCHEDULE
NAS BRUNSWICK



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following results of the first round of sampling, and will continue through the subsequent sampling episodes. RI and FS reports will be prepared following completion of RI and FS tasks. USEPA will be notified prior to initiation of each phase of field activities.

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3.0 PROJECT LOGISTICS

To ensure proper arrangements for access and operations on the base, a preliminary meeting was held on March 3, 1988, at NASB with representatives from Weapons, Security, Ground Electronics, Engineering, and the Marines. This section addresses the logistics of security arrangements, communications, field operations, decontamination facilities, and disposal of various wastes.

3.1 SECURITY

Access to the base in general and to the restricted area at Sites 1, 2, and 3 will be with one security pass. The pass will be a picture-identification, contractor pass adequate for the entire field program. Information required about Jordan personnel involved in the field work and personnel from John Mathes and Associates (Mathes) (i.e., the drilling subcontractor) will be provided to NASB as soon as the schedule and personnel for the project are finalized. Representatives from the regulatory agencies should arrange for their own clearances through Commander Geoffrey Cullison, NASB Public Works Officer (PWO).

3.2 COMMUNICATIONS

While on-base, Jordan and Mathes personnel will use telephones to communicate with off-base parties; a list of emergency telephone numbers will be available at all times. Personnel conducting on-site work at NASB will use two-way radios to maintain communications with personnel working in other areas. A specific radio frequency has been assigned by NASB and will be used during the field program. This will also allow the Marines and the NASB security to monitor communications for added security coordination and safety reasons.

3.3 FIELD OPERATIONS

The geophysical portion of the field investigation will require the use of small amounts of explosives to conduct a seismic refraction survey in part of the restricted magazine area. During the seismic survey, a person from Weapons will be present on-site to communicate the timing of each blast to the Marines and NASB security. Locations of seismic lines have been given preliminary approval by Marines, Weapons, Security, and Ground Electronics. Final approval will be provided by NASB after the lines have been staked in the field by Jordan personnel. Weapons will store explosives and blasting caps in a magazine and will escort Jordan personnel on- and off-base when carrying explosives. Jordan will provide Weapons with copies of the quantity logs, as required by the federal government.

Each night before on-site personnel leave the restricted area, drill rigs and backhoes left overnight will be disabled by removing a critical electrical component. Boring, test pit, and soil gas exploration locations received preliminary approval during the March 3, 1985, meeting. Final approval will be

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given by NASB after locations are staked in the field before the start of field work.

Potable water, necessary for drilling and decontamination procedures, is reportedly available at the NASB fire station (Building No. 292) as necessary; arrangements will be made by NASB Engineering.

3.4 DECONTAMINATION FACILITIES

Field work at the NASB sites will require mobilization and support of subcontractors, sampling teams, and survey crews. Staging and decontamination facilities will be needed to conduct these operations. Staging of the field operations will be done from vehicles and an office trailer used by Jordan personnel. Support vehicles will be parked in uncontaminated areas identified at each site, and will not require decontamination. Decontamination zones for personnel and equipment will be established at locations to be determined for each site. Contaminated materials and protective gear will either be disposed of in Department of Transportation (DOT)-approved, Spec 17, 55-gallon drums or decontaminated before site personnel proceed into the clean zone. Specific decontamination procedures to be used are outlined in the site-specific HASP and QAPPA (see Appendices A and B).

An equipment decontamination zone will be designated at each site. Drill rigs, casings, rods, and associated equipment will be steam-cleaned at the completion of each boring before moving to the next location, as well as at the beginning and end of the field program. Sampling tools will be decontaminated between samples to prevent cross-contamination. Specific decontamination procedures are described in the sampling protocols provided in the QAPP.

3.5 DISPOSAL OF INVESTIGATION-GENERATED WASTES

Fluids generated during personnel and equipment decontamination will be disposed at each specific site within a designated contamination reduction area. Contaminated items such as disposable clothing or sampling equipment will be placed in plastic bags, which will then be stored in DOT-approved, Spec 17, 55-gallon drums with locking ring lids. The drums will be supplied and transported by Mathes to the Defense Reutilization and Marketing Office (DRMO) at NASB for future disposal by the Navy.

Drill fluids, drill cuttings, and water resulting from monitoring well installation and development will be monitored for contamination using a portable photoionization (PI) meter. Fluids and cuttings that show no evidence of contamination, based on visual inspection and PI meter readings, will be disposed of on the ground surface at the exploration location. Cuttings that show no evidence of contamination may be used for backfill in the boreholes. Drill cuttings and fluids that indicate the presence of contamination will be placed in DOT-approved 55-gallon drums. The drums will be transported by Mathes to the NASB DRMO for future disposal by the Navy.

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4.0 REMEDIAL INVESTIGATION FIELD PROGRAM (TASK R3)

The initial sampling plan (Jordan, 1988) was discussed with the regulatory agencies at meetings held on June 12, 1987, and February 10, 1988. The RI field program was developed on the basis of Jordan's review of the IAS and results of the SI study conducted between September 1984 and June 1985. The program consists of a phased series of tasks identified in the SI report and Appendix A of the SOW - IR Program dated November 25, 1987. The RI field program incorporates regulatory agency technical comments from the two meetings; recorded minutes dated June 30, 1987; and written comments from these meetings submitted by the agencies on March 15, 1988.

The objective of the RI at Sites 1, 2, 3, 4, 7, 8, and 9 is to provide a quantitative assessment of contamination sources, distribution of contamination, and contaminant migration pathways. The scope of work for the RI was designed to provide sufficient data to permit an evaluation of the vertical and horizontal distribution of contamination, and to support FS tasks at each site. The study will include an evaluation of the hydrogeology and groundwater flow directions at each site. The following sections describe general methods of exploration, site-specific explorations, and rationale for various field explorations. The field exploration program is summarized in Table 4-1.

The objectives of the RI for Sites 5 and 6 are to thoroughly review the IAS and other available background information, and visit the sites to evaluate present conditions at ground surface. Air monitoring with a PI meter will also be performed at both sites to identify potential VOC emissions.

4.1 SITE RECONNAISSANCE

The first activity of the field program will be a site reconnaissance, performed by Jordan personnel, to identify and physically mark exploration and sampling locations. This will require staking and flagging locations of test borings, test pits, seeps to be sampled, soil gas sampling locations, and seismic lines. Soil gas probe locations will not be staked in areas designated by the Navy to be free of underground utilities. Following staking of subsurface explorations, Jordan will coordinate with William Hitchcock, Director of Engineering at NASB, to obtain utility clearances for intrusive explorations.

During the site reconnaissance and field program, condition of existing monitoring wells will be evaluated by Jordan field personnel. Several wells are reported to have damaged or loose protective casings, and several are reported to be unlocked. If possible, the damaged wells will be repaired and unlocked wells will have new padlocks installed. Due to concerns about the integrity of damaged and/or unlocked wells, several precautions will be taken. The wells will be redeveloped during the drilling program, evacuating a minimum of seven well volumes. The wells will also be purged during each sampling event. In the event that unusual conditions are observed during redevelopment or sampling, or if laboratory analyses detect unusual contaminants or unexpectedly high levels of contaminants, the data will be suspect and the well may be replaced during a subsequent field effort. If the analytical data from the

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TABLE 4-1

EXPLORATION PROGRAM SUMMARY
RI/FS PROGRAM
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Site No.	Location & Elevation Survey	Soil Gas	Seismic Survey	Magnetometer Survey	Ground Penetrating Radar	Terrain Conductivity	Test Pits	Monitoring Wells	Aquifer Permeability Testing	Stream Gaging Stations	Seep Recon	Seep Sampling	SW/SED Sampling	Analytical Soil Samples (1)
1	X	3 days	2000 L.F.	X(2)	X		5+	14	X	2	X	5	11(3)	24
2	X	2 days	2000 L.F.	X(4)	X			2	X		X	2		2
3	X	1 day		X(4)	X		5+	1	X		X			4
4	X	1 day						2	X					5
7	X	1 day			X	X		3	X					9
8	X	1 day		X				4	X		X	3	9	8
9	X	1 day						2	X				5(5)	4
TOTAL	All 7 Sites	10 days	4,000 L.F.	4 Sites	4 Sites	1 Site	10+ test pits	28 wells	All 7 Sites (28 Wells)	2 Stations	4 Sites	10 Locations	25 Locations	56 Samples

NOTES:

(1) Analytical soil samples obtained from test borings prior to installation of monitoring wells.
(2) Magnetometer survey prior to locating test pits and test borings.
(3) Plus one sediment sample from deeper portions of Beaver Pond.
(4) Grid pattern across entire site.
(5) Plus one sediment sample from deeper portions of pond adjacent to Meadow Cemetery.

L.F. - Linear Feet
SW/SED - Surface Water/Sediment

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repaired wells generally reflect the same type and level of analytes previously identified in that well or nearby wells, it will be assumed that the integrity of the well was not compromised.

4.2 SITE PREPARATION

Site preparation activities for the RI field program will be performed by Jordan personnel with the support of the PWO. Preparation will include arranging for office space or an office trailer on-base, with electricity and telephones. In addition, a potable water source for decontamination of field equipment and drilling rigs will be identified. Field and office equipment and supplies will be transported to the site and set up before commencement of the field program.

4.3 EXPLORATION METHODS

Each exploration technique is described in this section. Application of these techniques to specific sites is presented in Section 4.4.

4.3.1 Exploratory Soil Gas Survey

Soil gas surveys will be used at each site to aid in delineating areas with potential soil and/or groundwater contamination. This information will be used to optimize locations of test borings, monitoring well installations, and test pits. Considering the size and variety of waste disposal activities that occurred at some sites, soil gas surveys will assist in identifying areas with evidence of significant contamination. Soil gas studies are proposed for all sites, as shown in Table 4-2. Up to 200 points will be sampled in the program.

Soil gas is sampled by driving a 1-inch hollow steel probe into unsaturated soil to a designated depth. Probe depth is dependent on site-specific factors, such as soil type, depth to groundwater, location of underground utilities, potential source of contamination, and type of contaminants anticipated. Once the probe is in place, a tube is attached; the probe is then pulled back 1 to 2 inches, and the tube is connected to a suction pump. The pump pulls a sample of soil gas through the probe. The sample is extracted from the tube with a syringe prior to reaching the pump and injected into a gas chromatograph (GC) to determine the presence of indicator VOCs. Target compounds are benzene, toluene, xylene, trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), and tetrachloroethylene (PCE). Other compounds may be selected or identified based on site-specific conditions.

Soil gas analysis will be performed in the field using a Varian 3500 GC equipped with dual-heated columns and a Flame Ionization Detector (FID) and Electron Capture Detectors (ECDs). Data plotting and assessment will be performed simultaneously in the field to maximize the effectiveness of data collection and use.

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TABLE 4-2

SUMMARY OF SOIL GAS SURVEY
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Site	Maximum Estimated Sampling Points
Orion Street Landfill - North (Site 1)	60
Orion Street Landfill - South (Site 2)	40
Hazardous Waste Burial Area (Site 3)	20
Acid/Caustic Pit (Site 4)	20
Old Acid/Caustic Pit (Site 7)	20
Perimeter Road Disposal Area (Site 8)	20
Neptune Drive Disposal Area (Site 9)	20
Total	200

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4.3.2 Exploratory Geophysics Program

Geophysical survey techniques at NASB will consist of magnetometry, ground-penetrating radar (GPR), seismic refraction profiling, and terrain conductivity. These four techniques will be used to assess subsurface conditions before installation of test pits, soil borings, and monitoring wells, and will assist in optimizing sampling locations.

Magnetometry will help locate and define the limits of dumping within four of the former landfills (i.e., Sites 1, 2, 3, and 8). Background data indicate that trench-filling was the disposal method used at Sites 1 and 2. Jordan expects that the covered trenches will be definable as areas of increased ferrous-metallic signatures where waste was placed. The effort at the four landfills is expected to cover an approximate 8 acres total.

After a walkover of the area, magnetometer survey grids will be developed to identify locations of concentrations of buried metallic objects. The instrument used for this work will be an EDA Omni-IV Tie Line Magnetometer with vertical gradiometer capability. Measurements will be established on a 20-by-20-foot grid at each site with a compass and cloth tape. Data will be processed and contoured on a computer at the conclusion of each field day.

Jordan will perform seismic refraction profiling at the Site 1 and Site 2 landfills to estimate the depth to bedrock, and the location(s) of major geologic structures. This information will be used to develop a better understanding of the area geology and hydrogeology. A Geometrics ES-2415F Signal Enhancement Seismograph will be used to develop the profile. It is anticipated that the energy source for the seismic survey will be small buried explosives charges (i.e., less than a half-pound of dynamite detonated at a depth of 3.5 to 5 feet). The spacing between individual geophones (seismometers) is anticipated to be either 20 or 40 feet, depending on the depth to bedrock.

A GPR survey will be conducted at Sites 1, 2, and 3 to confirm the magnetometer survey results for locating buried metal materials, and at Site 7 to develop a better understanding of source location. The equipment used for this survey will be GSSI SIR System 3 GPR. GPR is effective in detecting subsurface conditions based on variations in dielectric properties.

A terrain conductivity survey will be performed at Site 7 to locate as accurately as possible the former acid/caustic disposal pit. The instrument used will be a Geonics EM 31 terrain conductivity meter. This equipment will sense variations in soil conductivity, anticipated as a result of the disposal of liquid wastes, including battery electrolyte.

4.3.3 Test Pits

Test pits will be machine-excavated at several sites to examine subsurface conditions and to assess the horizontal and vertical distribution of shallow soil contamination to a maximum depth of approximately 15 feet. The backhoe bucket will be steam-cleaned between test pits to prevent cross-contamination. Test pit soils and stratigraphy will be logged by a Jordan geologist, soils scientist, or geotechnical engineer, and excavated soil will be replaced in the

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excavations. Soil samples will be collected and placed in glass jars; the headspace will be screened using a PI meter. As specified in the sampling and analytical schedule for each site (see Sections 4.4 and 5.0), soil samples from the test pits will be submitted to the analytical laboratory for chemical analysis based on results of the PI meter and GC screening and visual evidence of contamination.

4.3.4 Test Borings

The stratigraphy and location of soil contamination at NASB will also be investigated with test borings and soil sampling. Borings will be observed and logged by a qualified geologist, soils scientist, or geotechnical engineer. The numbers of and rationale for explorations at each site are described in Section 4.4. Estimated quantities for monitoring well installations are summarized in Table 4-3. Final exploration locations will be determined in the field based on results of the soil gas survey, the geophysical surveys, accessibility, and utility clearances. Procedures for subsurface explorations are presented in the following paragraphs.

The primary test boring exploration method to be used at NASB will be hollow-stem augers (HSA). Using this method, drill cuttings are forced laterally outward from the HSA cutting head, and then carried vertically upward to the ground surface by the auger flights. This method requires little, if any, drilling water as a drilling fluid. In areas where the HSA method is unable to penetrate cobbles or boulders, flush casing will be driven or spun into the ground and the soil washed out with recirculated potable water. If wash-boring techniques are used during the drilling program, representative samples of the drilling water will be collected and analyzed for the presence of all elements and compounds being investigated in the RI. At shallow/deep paired boring locations, soil sampling will not be conducted in the shallow borings. Borings designated for obtaining soil samples for laboratory chemical analysis will be drilled using the HSA method, whenever possible. Subsurface soils will be sampled either continuously or at 5-foot intervals, depending on depth and proximity to source contamination. Sampling in source areas will be performed continuously in the unsaturated zone.

Samples will be obtained by driving a standard 1-and-3/8-inch ID, split-spoon sampler with a 140-pound hammer dropped 30 inches. Blow counts will be noted and recorded for driven samples. Samples will be obtained for geologic logging, laboratory chemical analysis, and grain-size analyses, depending on specific site conditions and requirements. Split-spoon soil samples will be screened using an HNU or Photovac PI meter. Based on results of field screening and visual observations (i.e., PI meter readings above background and/or visual evidence of contamination), soil samples will be submitted for chemical analysis. In general, samples with the highest PI meter or GC readings, or most visibly contaminated, will be submitted for analysis. Selected soil samples from the well screen depth will also be submitted to Jordan's soil testing laboratory for grain-size distribution analyses, which will be performed by sieve analysis or Atterberg Limit tests, as appropriate.

Cuttings from soil boring activities will be inspected visually for discoloration or other indications of contamination, and monitored with a PI meter for

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TAB -3

SUMMARY OF ESTIMATED QUANTITIES FOR MONITORING WELL INSTALLATIONS
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Site	Boring ID	Estimated Depth (ft)	Sampling Intervals Continuous	5-Foot	None	Grout Backfill (ft)	Screen Length (ft)	Riser Length (ft)[1]	Bentonite Seal (ft)
1	MW-201	30	0	30	0	0	10	23	3
3	MW-202	30	10	20	0	0	10	23	3
1	MW-203	30	0	30	0	0	10	23	3
1	MW-204	30	0	30	0	0	10	23	3
1	MW-205	100 + 50	0	100	0	50	10	93	3
1	MW-206A	100 + 50	0	100	0	50	10	93	3
1	WW-206B	50	0	0	50	20	10	43	3
1	MW-207A	100 + 50	0	100	0	50	10	93	3
1	MW-207B	50	0	0	50	20	10	43	3
1	MW-208	100 + 50	0	100	0	50	10	93	3
1	MW-209	50	0	50	0	20	10	43	3
1	MW-210A	100 + 50	0	80	0	50	10	93	3
1	MW-210B	50	0	0	50	20	10	43	3
1	MW-211A	100 + 50	0	100	0	50	10	93	3
1	MW-211B	50	0	0	50	20	10	43	3
2	MW-212	50	0	50	0	20	10	43	3
2	MW-213	50	0	50	0	20	10	43	3
4	MW-404	30	0	30	0	0	10	23	3
4	MW-405	30	20	10	0	0	10	23	3
7	MW-704	30	20	10	0	0	10	23	3
7	MW-705	30	20	10	0	0	10	23	3
7	MW-706	20	20	0	0	0	10	13	3
8	MW-805	50 + 20	0	50	0	20	10	43	3
8	MW-806	50 + 20	0	50	0	20	10	43	3
8	MW-807	30	20	10	0	0	10	23	3
8	MW-808	50 + 20	0	50	0	20	10	43	3
9	MW-904	30	0	30	0	0	10	23	3
9	MW-905	30	10	20	0	0	10	23	3
Total		1450	140	1110	200	500	280	1254	84

[1] Assumes well riser stick up is 3 feet above ground surface.
All estimated quantities are in linear feet.
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the presence of organic vapors. Cuttings that exhibit no sign of contamination, or those obtained from areas not suspected to be either contaminated or previously used for disposal, will be spread and landscaped on the ground surface at the boring location or used as backfill in the completed borehole. Cuttings thought to be potentially contaminated on the basis of the criteria described previously will be placed in DOT-approved, 55-gallon steel drums, and transported to the NASB DRMO. NASB will be responsible for disposal of the drums containing cuttings determined to be hazardous. Due to the number of soil borings, Jordan anticipates that approximately 75 drums may require temporary storage.

Air quality in the breathing zone will be monitored during borehole advancement using a PI meter. Personnel protection is anticipated to be primarily Level D, with occasional upgrades to Level C (based on criteria presented in the HASP).

4.3.5 Monitoring Well Installation

Groundwater monitoring wells will be installed in the borings to permit collection of groundwater samples for laboratory analysis, and to enable groundwater elevations to be measured at the well locations. Groundwater levels will be monitored after installation, during the three sampling rounds.

Shallow wells will be installed in the outwash sands that overlie the marine deposits of silt and clay at most sites. As described in Section 4.4 for each site, deep wells will be installed in granular deposits underlying the marine silts and clays, or in the top of bedrock. Specific well screen placement will be determined by geologic conditions encountered in the field. Well screens will be long enough to accommodate seasonal variations in the water table, but short enough to allow discrete sampling. Shallow and deep well pairs will be installed at several locations at Site 1 to document vertical hydraulic gradients observed previously.

Figure 4-1 presents a typical monitoring well to be installed. The wells will be constructed of 2-inch ID, flush-threaded, Schedule 40 PVC, with 10-foot sections of machine-slotted PVC well screen. The annulus around the screen will be backfilled with a silica sand to a minimum of 2 feet above the top of the screen. A 2-foot bentonite pellet seal will be installed above the sandpack. In deep borings where the relatively impermeable marine silt and clay layer is penetrated, a bentonite/cement grout will be tremied into place above the bentonite pellet seal to eliminate the vertical conduit created by the drilling process. Shallow borings in unconsolidated sands will be backfilled with clean cuttings (if available) or sand borrow.

The well will be developed to remove fines and to provide a good hydraulic connection with the surrounding natural soils. The wells will be developed by pumping and/or airlift methods.

Aboveground protective steel casings will be installed and cemented into the ground over the well risers. The steel casings will be equipped with locking covers and keyed-alike brass padlocks. A cement seal will be placed at ground surface around each protective casing to secure the casing and to prevent surface runoff from entering the borehole. The aboveground portions of both

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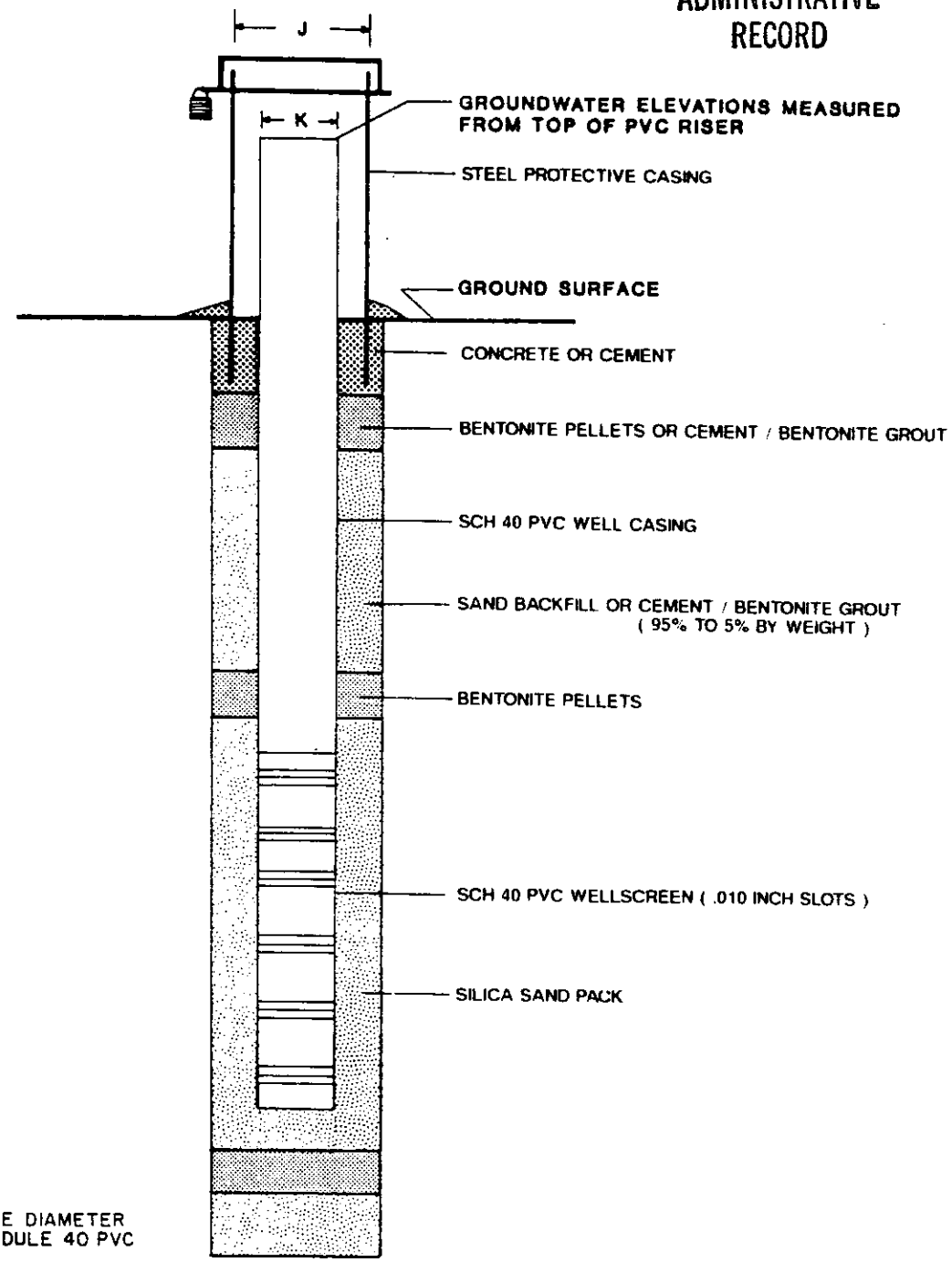

NOTE:

K= 2" INSIDE DIAMETER SCHEDULE 40 PVC

J= 4" STEEL PROTECTIVE CASING WITH LOCKING COVER

NOT TO SCALE

FIGURE 4-1
MONITORING WELL INSTALLATION DETAIL
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the well riser and protective casing will be vented. Wells will be properly identified and clearly marked in the field.

4.3.6 Aquifer Permeability Testing

Aquifer testing, using variable-head slug tests, will be conducted in the new wells at each site to assess hydraulic properties of the screened formations. Changes in water level will be measured over time by a pressure transducer or water level meter, as the water table or piezometric surface returns to its pre-test static level.

4.4 SITE-SPECIFIC EXPLORATIONS

The site-specific explorations developed for the RI field program are designed to acquire the data needed to define spatial distribution and magnitude of environmental contamination at the NASB sites, and to support future FS programs. The field program will also provide a qualitative assessment of geologic and hydrogeologic conditions at NASB.

To provide a framework for hydrogeologic characterization of the various sites at NASB, a review area for each of the nine sites or cluster of sites was identified. The review area for each site(s) is indicated on the referenced site maps. The site-specific explorations will provide a geologic and hydrogeologic assessment of the review area as part of the RI field activities and data evaluation. Each review area assessment will include identification of the direction of groundwater movement in the geologic units of concern and an evaluation of contamination.

4.4.1 Sites 1, 2, and 3 - Orion Street Landfill and Hazardous Waste Burial Area

VOCs detected in the surface water and groundwater at Sites 1, 2, and 3 by the SI study and pesticides detected in soils at Site 3 by the NUS FIT pose a potential threat to human health and the environment. RI studies will be conducted at these three sites to further assess contaminant distribution.

Site maps are presented in Figure 4-2 for Sites 1, 2, and 3. The exploration program at Sites 1, 2, and 3 will include the following activities:

- six days of soil gas sampling
- magnetometer survey
- GPR survey
- seismic refraction profiling
- 10 test pits
- 17 test borings with monitoring wells
- sampling of soils, groundwater, surface water, sediment, and seeps
- aquifer permeability testing

The methods and rationale for each activity are described in detail in the following sections.

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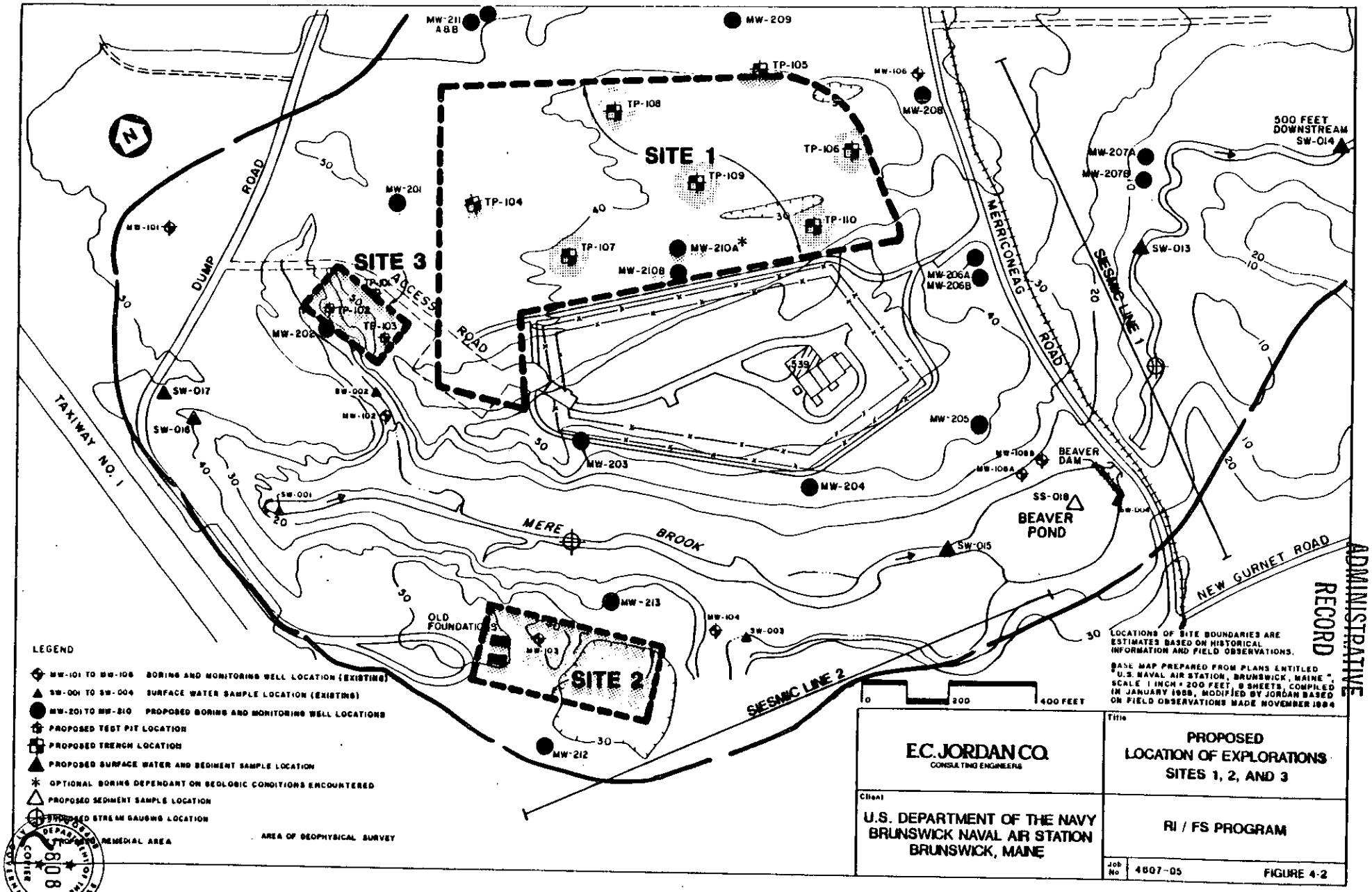

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Soil Gas Survey. Six days of soil gas sampling will be performed at Sites 1, 2, and 3 to identify potentially contaminated areas. Results of the soil gas survey will assist in finalizing exploration locations of test pits and test borings/monitoring wells.

Geophysical Surveys. The magnetometer will be used at Sites 1 and 2 to delineate former landfill trenches. The location of these trenches will enable borings and monitoring wells to be placed outside the trenches to avoid drilling through refuse. A magnetometer survey is proposed for Site 3 to determine the possible presence and location of buried drums. The magnetometer surveys will be conducted on a 20-by-20-foot grid, which may be reduced to a 10-by-10-foot grid over 25 percent of the area for additional detail, if necessary. The grid will cover portions of Site 1, in which test pitting and soil borings are planned, and the entire area of Sites 2 and 3. Survey results will be used to optimize test pit and boring/monitoring well locations.

A GPR survey will be conducted at Sites 1, 2, and 3 to confirm the magnetometer survey results. Geologic conditions at Sites 1, 2, and 3 are suitable for GPR, and the trenches should be visible using this geophysical method. GPR may also provide data on the depth to shallow groundwater, the depth to marine silts and clays believed to be present beneath the outwash sands and fill materials, and information about the continuity of the low-permeability marine deposits.

Seismic refraction profiling (4,000 linear feet) will be conducted to assess the depth to bedrock and to the low-permeability marine deposits encountered at Sites 1 and 3. Locations of the seismic profile lines are indicated in Figure 4-2. The data obtained from the seismic refraction profiling will be used to further characterize the geology and hydrogeology at these sites.

Test Pit Program. A test pit program is proposed for Sites 1 and 3 to obtain shallow subsurface geological and source characterization information. To provide this information, ten test pits will be excavated. The proposed test pit locations are presented in Figure 4-2. The excavations will consist of trenches approximately 10 feet in depth and up to 25 feet in length to be dug in the vicinity of disposed wastes, as delineated by the geophysical explorations. Jordan will observe the subsurface soils and water table conditions, collect soil samples for analysis, and observe the materials in the landfill trenches, if exposed. It is not the intent of the test pit program to expose or excavate wastes disposed at the sites. A PI meter, field GC, and visual evidence of contamination will be used to screen soils to select two samples from each test pit for laboratory analysis. The samples will be analyzed for pesticides, PCBs, VOCs, semivolatile organic compounds (SVOCs), and metals on the Target Compound List (TCL). Chemical analyses and methods are summarized in Section 5.0.

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Test Borings and Monitoring Well Installations. This section describes quantities and methods for conducting the following activities:

- o test borings
- o soil sampling for laboratory analysis
- o monitoring well installation and development
- o groundwater sampling for laboratory analysis
- o aquifer permeability testing

Seventeen new soil borings with monitoring well installations, 24 groundwater samples, and 30 soil samples will be collected at Sites 1, 2, and 3 to assess the distribution, concentration, and migration of contaminants in groundwater and soils. The proposed boring locations are indicated in Figure 4-2 and borings and monitoring wells are summarized in Table 4-3.

Thirty soil samples will be collected for laboratory chemical analysis from the test borings at Sites 1, 2, and 3. Soil samples will be analyzed for the presence of TCL VOCs, SVOCs, PCBs and pesticides, and metals. The laboratory analytical program is described in Section 5.0. The specific rationale for each boring/monitoring well is as follows:

- o MW-201 will be a shallow monitoring well located west of Site 1 and east of Site 3 to monitor shallow groundwater downgradient of Site 1 and upgradient of Site 3 and a tributary stream of Mere Brook.

- o MW-202 will be a shallow monitoring well located west of Site 3 to monitor shallow groundwater downgradient of Site 3 and upgradient of a tributary stream of Mere Brook.

- o MW-203 will be a shallow monitoring well located southwest of Site 1 and northeast of Mere Brook to monitor shallow groundwater downgradient of Site 1 and upgradient of Mere Brook.

- o MW-204 will be a shallow monitoring well located south of Site 1 and north of Mere Brook to monitor shallow groundwater downgradient of Site 1 and upgradient of Mere Brook.

- o MW-205 will be a deep monitoring well located southeast of Site 1 and north of Beaver Pond to monitor deep groundwater downgradient of Site 1 and to help understand the upward gradients previously observed at MW-105 A & B.

- o MW-206 A & B will be a deep/shallow well pair located west of Merriconeag Road and southeast of Site 1 to monitor deep and shallow groundwater downgradient of Site 1 and upgradient of Mere Brook.

- o MW-207 A & B will be a deep/shallow well pair located east of Site 1 and west of Mere Brook to monitor deep and shallow groundwater downgradient of Site 1 and upgradient of Mere Brook.

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- MW-208 will be a deep monitoring well located adjacent to MW-106, east of Site 1, and west of Merriconeag Road to monitor deep groundwater downgradient of Site 1.

- MW-209 will be a shallow monitoring well located northeast of Site 1 to monitor shallow groundwater upgradient of Site 1.

- MW-210 A & B will be a deep/shallow well pair located within the boundaries of Site 1 to monitor deep and shallow groundwater beneath Site 1.

- MW-211 A & B will be a deep/shallow well pair located north of Site 1 and southeast of the Dump Road to monitor deep and shallow groundwater upgradient of Site 1.

- MW-212 will be a shallow monitoring well installed southwest of Site 2 and east of the Dump Road to monitor shallow groundwater upgradient of Site 2.

- MW-213 will be a shallow monitoring well installed between Site 2 and Mere Brook to monitor shallow groundwater downgradient of Site 2.

Groundwater Sampling. Approximately two weeks after the completion and development of the monitoring wells, groundwater samples will be collected for laboratory chemical analysis at the 17 new and seven existing wells to obtain an initial data set. Two additional rounds of sampling and analysis of the new and existing wells will occur at three-month intervals, following the initial round of sampling.

Laboratory analysis for groundwater monitoring well samples will include TCL organic and inorganic parameters, including VOCs, SVOCs, PCBs and pesticides, and metals. The PCB and pesticide analyses will confirm the absence of these analytes from results reported in the SI study. A more detailed description of the laboratory analytical program is presented in Section 5.0, and Table 4-4 summarizes the laboratory analytical program.

Surface Water and Sediment Sampling Program. The purpose of the surface water sampling is to assess the impact of Sites 1, 2, and 3 on the water quality of Mere Brook and to evaluate whether these impacts pose a potential threat to human health or the environment. The surface water and sediment sampling program described in this section includes quantities of samples, sampling locations, and parameters for laboratory chemical analysis.

The sampling program for Mere Brook is an expansion of the plan followed in the SI study. Sampling locations are presented in Figure 4-2. A total of three sampling rounds will be conducted. Surface water sampling will be conducted during low flow conditions to reduce the dilution effect of high runoff, and the original surface water sampling locations (SW-001 through SW-004) will be resampled. Three new sampling points (SW-013 through SW-015), located downstream of the sites, will be sampled to detect shallow groundwater discharge from Site 1 to Mere Brook and Merriconeag Stream. Two additional sample points

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TABLE 4-4

SUMMARY OF LABORATORY ANALYTICAL PROGRAM
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Sample Source	Media	TCL Metals	TCL VOA	TCL Pest./PCB	TCL Semi-VOA	General Water Quality
Site 1, 2, and 3	Groundwater	24	24	24	24	--
	Surface Water	11	11	11	11	--
	Sediment	12**	12**	12**	12**	--
	Seeps (Sediment)	7	7	7	7	--
	Seeps (Water)	7	7	7	7	--
	Test Pits (Soil)	20	20	20	20	--
Site 4	Groundwater	5	5	5	5	--
Site 7	Groundwater	6	6	6	6	--
Site 8	Groundwater	8	8	8	8	8
	Surface Water	9	9	9	9	9
	Sediment	9	9	9	9	--
	Seeps (Sediment)	3	3	3	3	--
	Seeps (Water)	3	3	3	3	3
Site 9	Groundwater	5	5	5	5	--
	Surface Water	5	5	5	5	--
	Sediment	5***	5***	5***	5***	--
All Sites	Soil (Borings)	56	56	56	56	--
Two Additional Sampling Rounds	Sediment	72	72	72	72	--
	Water	166	166	166	166	40
Subtotal	Sediment/Soil	184	184	184	184	--
	Water	249	249	249	249	60

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TABLE 4-4 (cont.)

Sample Source	Media	TCL Metals	TCL VOA	TCL Pest./PCB	TCL Semi-VOA	General Water Quality
Duplicates	Sediment	19	19	19	19	--
	Water	25	25	25	25	7
Sampler Blanks	Sediment/Soil	8	8	8	8	--
	Water	3	3	3	3	3
Filtration Blank	Water	6	--	--	--	--
Trip Blanks	Water	--	6	--	--	--
Subtotal	Sediment	211	211	211	211	--
	Water	283	286	277	277	70
MS/MSD	Sediment	22	22	22	22	--
	Water	29	29	28	28	8
Grand Total	Soil/Sediment	233	233	233	233	--
	Water	312	315	305	305	78

** Includes one sediment sample from the deeper portions of Beaver Pond.

*** Includes one sediment sample from the deeper portions of the pond adjacent to Meadow Cemetery.

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(SW-016 and SW-017) will be located upstream of SW-001 to determine the contribution from potential upgradient sources.

Locations of these five sampling points are indicated in Figure 4-2. A sampling point will also be established below Sites 1 and 3, in a depositional area downstream from the confluence of Mere Brook and the tributary from Sites 4, 7, and 9. This will combine the influences of these areas together in a single channel leading to Harpswell Cove. Another sample location will be established at the mouth of Mere Brook, where the saltmarsh begins at Harpswell Cove. Surface water samples collected for laboratory chemical analysis will be analyzed for TCL organics and inorganics.

Sediment samples will be collected from surface water sampling locations, including the original locations (i.e., SW-001 through SW-004). In addition, a sediment sample will be taken from the deeper portion of Beaver Pond, which is downstream of Sites 1, 2, and 3. Sediment samples collected for laboratory chemical analysis will also be analyzed for TCL organics and inorganics. The analytical program is summarized in Table 4-4 and discussed in detail in Section 5.0.

Stream-gaging and Location of Surface Seeps. To monitor flow conditions on Mere Brook and the impact of runoff from adjacent Taxiway No. 1, two stream-gaging stations will be established on Mere Brook. These stations will identify low flow conditions appropriate for the surface water sampling programs for Mere Brook. The approximate locations of the stream-gaging stations are shown in Figure 4-2.

The site reconnaissance (see Section 4.1) will be undertaken to locate surface seeps associated with Sites 1, 2, and 3 to evaluate potential contamination of Mere Brook. Five identified seeps will be sampled from the embankments between Mere Brook and Sites 1 and 3. Two seeps will be sampled in the area between Site 2 and Mere Brook. Surface water and sediment samples will be collected for chemical analysis from each seep and analyzed for TCL organics and inorganics. The seep analytical program is summarized in Table 4-4.

4.4.2 Site 4 - Acid/Caustic Pit

Groundwater flow direction at Site 4 is not clearly understood due to small hydraulic gradients. However, data from the SI study indicate that groundwater appears to move in a southwesterly direction. The purposes of the additional study at Site 4 are to (1) more accurately determine the direction of groundwater flow; (2) monitor groundwater quality for TCL organics and inorganics downgradient from the suspected disposal pit location; and (3) sample and characterize the source of hazardous substances. To help locate the position of this site, historic aerial photographs will be obtained and reviewed. Proposed exploration locations are indicated in Figure 4-3. The exploration program at Site 4 will include the following activities:

- one day of soil gas sampling
- two test borings
- five soil samples for laboratory analysis

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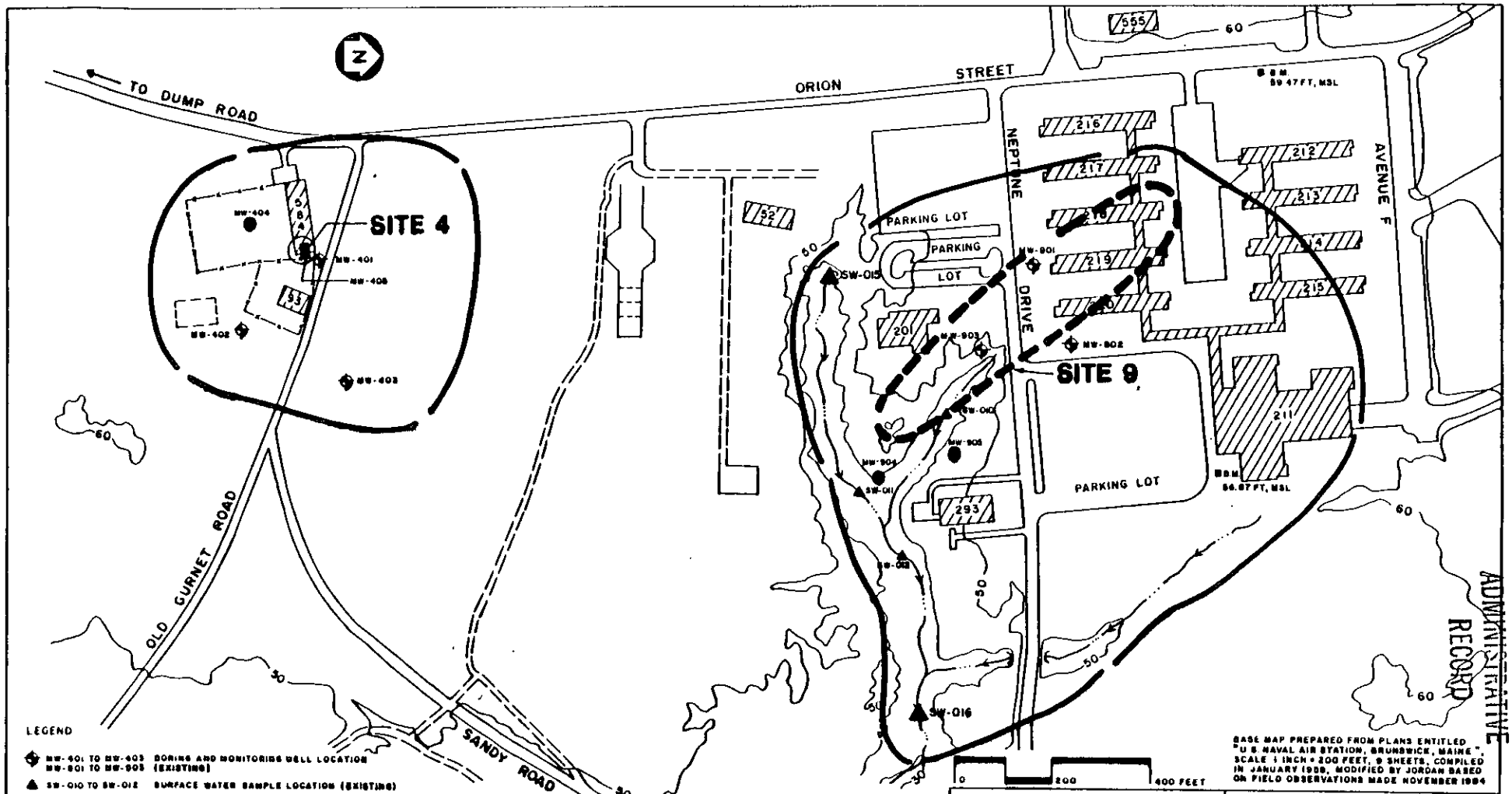

LEGEND

- MW-401 TO MW-403, MW-901 TO MW-905 — BORING AND MONITORING WELL LOCATION (EXISTING)
- SW-010 TO SW-012 — SURFACE WATER SAMPLE LOCATION (EXISTING)
- MW-904 — PROPOSED BORING AND MONITORING WELL LOCATION
- SW-015 AND SW-016 — PROPOSED SURFACE WATER AND SEDIMENT SAMPLING LOCATION
- PROPOSED REMEDIAL AREA

BASE MAP PREPARED FROM PLANS ENTITLED "U.S. NAVAL AIR STATION, BRUNSWICK, MAINE", SCALE 1 INCH = 200 FEET, 9 SHEETS, COMPILED IN JANUARY 1988, MODIFIED BY JORDAN BASED ON FIELD OBSERVATIONS MADE NOVEMBER 1984

E.C. JORDAN CO. CONSULTING ENGINEERS	Title: PROPOSED LOCATION OF EXPLORATIONS SITES 4 AND 9
Client: U.S. DEPARTMENT OF THE NAVY BRUNSWICK NAVAL AIR STATION BRUNSWICK, MAINE	RI / FS PROGRAM
	Job No. 4607-05 — FIGURE 4-3

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- o two monitoring well installations
- o five groundwater samples
- o aquifer permeability testing

Since the location of Site 4 is reportedly under Building 584, historic aerial photographs taken before construction of Building 584 will be procured to assist in site location. One day of soil gas sampling will be performed to assist in locating the source. If necessary, a boring and monitoring well will be installed through the floor of Building 584 to characterize the source. In addition, a downgradient soil boring and monitoring well will be installed. The test borings will be advanced approximately 30 feet below ground surface through the outwash sands with split-spoon soil samples taken continuously at the source boring and at 5-foot intervals in the downgradient boring. Soil samples will be selected for laboratory analysis based on screening with a PI meter and visual evidence of contamination. A total of five soil samples will be submitted for laboratory analysis for TCL organics and inorganics. The monitoring wells will be installed in each completed borehole with a 10-foot well screen placed in the shallow permeable aquifer above the marine silts and clays encountered in previous explorations at the site. Estimated quantities for monitoring well installations are summarized in Table 4-3.

Groundwater Sampling and Analysis. Groundwater samples will be collected from the two new and three existing monitoring wells in the three sampling rounds. Chemical analysis of the groundwater will include TCL organics and inorganics. Table 4-4 summarizes the analytical program. Analytical methods to be used are described in Section 5.0.

4.4.3 Site 7 - Old Acid/Caustic Pit

The groundwater surface at Site 7 is not well-defined, although it appears to slope downward in a south-southeast direction. In addition, the exact location of the source is poorly defined. Historic aerial photographs will be obtained before the RI field work to assist in identifying the location of the former pit. The purposes of additional study at this site are to (1) determine the direction of groundwater flow; (2) provide a better definition of source location and contamination; and (3) monitor groundwater quality for the presence of TCL organics and inorganics downgradient from the suspected disposal pit location. The exploration program at Site 7 will include the following activities:

- o one day of soil gas sampling
- o a terrain conductivity survey
- o a GPR survey
- o three soil borings
- o nine analytical soil samples
- o installation of three monitoring wells and sampling of six
- o aquifer permeability testing

One day of soil gas will be performed at the site to assist in locating the former disposal pit. In addition, a geophysical program including both terrain conductivity and GPR will be conducted. The terrain conductivity survey will be conducted on a grid pattern, centered on the anomaly previously identified

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on Line 1 in the SI study (Figure 7). The terrain conductivity survey will be supplemented by a GPR survey to assist in identifying the site location and stratigraphy of the site.

Once the soil gas and geophysical work is completed, the subsurface investigations will be implemented. Proposed exploration locations are indicated in Figure 4-4. Soil borings for MW-704 and MW-705 will be advanced approximately 30 feet below ground surface. A shallow well (MW-706) will also be installed near MW-701 to depths so as not to penetrate the marine silt and clay layer. Split-spoon soil samples will be collected at 5-foot intervals, except in potential source areas. Continuous soil sampling will be performed in the unsaturated zone of potential source areas. Three soil samples will be collected from each boring for laboratory chemical analysis, based on screening with a PI meter and visual observation. The nine soil samples will be analyzed for the presence of TCL organics and inorganics. Subsequent to the soil boring and sample collection, monitoring wells will be installed in each boring with a 10-foot well screen in the shallow permeable aquifer above the marine sediments. Estimated quantities for monitoring well installations are summarized in Table 4-3.

Groundwater Sampling and Analysis. Groundwater samples will be collected from the three new and three existing monitoring wells for laboratory chemical analysis for TCL organics and inorganics. Table 4-4 summarizes the analytical program; analytical methods to be used are described in Section 5.0.

4.4.4 Site 8 - Perimeter Road Disposal Site

Because of the presence of heavy metals (i.e., lead and chromium) detected in shallow groundwater and the site's proximity to the city of Brunswick's Jordan Avenue Wellfield (JAW), Site 8 will be investigated. A hydrogeologic investigation of the JAW was conducted by Jordan (Hydrogeologic Evaluations for Designation of Aquifer Protection Zones; submitted to Brunswick and Topsham Water District; Brunswick, Maine; January 1986).

The purposes of the investigation are to (1) assess the areal distribution of waste deposited at this site; (2) monitor the shallow and deep groundwater downgradient of the site for the presence of contamination; (3) assess the significance of the chemicals detected in the shallow and deep groundwater; and (4) assess the impact of this site on surface water quality. The exploration and sampling program for Site 8 will include the following activities:

- one day of soil gas sampling
- a magnetometer survey
- four test borings
- installation and sampling of eight monitoring wells
- eight analytical soil samples
- nine surface water and sediment samples
- seep reconnaissance
- aquifer permeability testing

One day of soil gas sampling will be performed at Site 8 to identify potential areas of contamination. A one-day magnetometer survey will be conducted to

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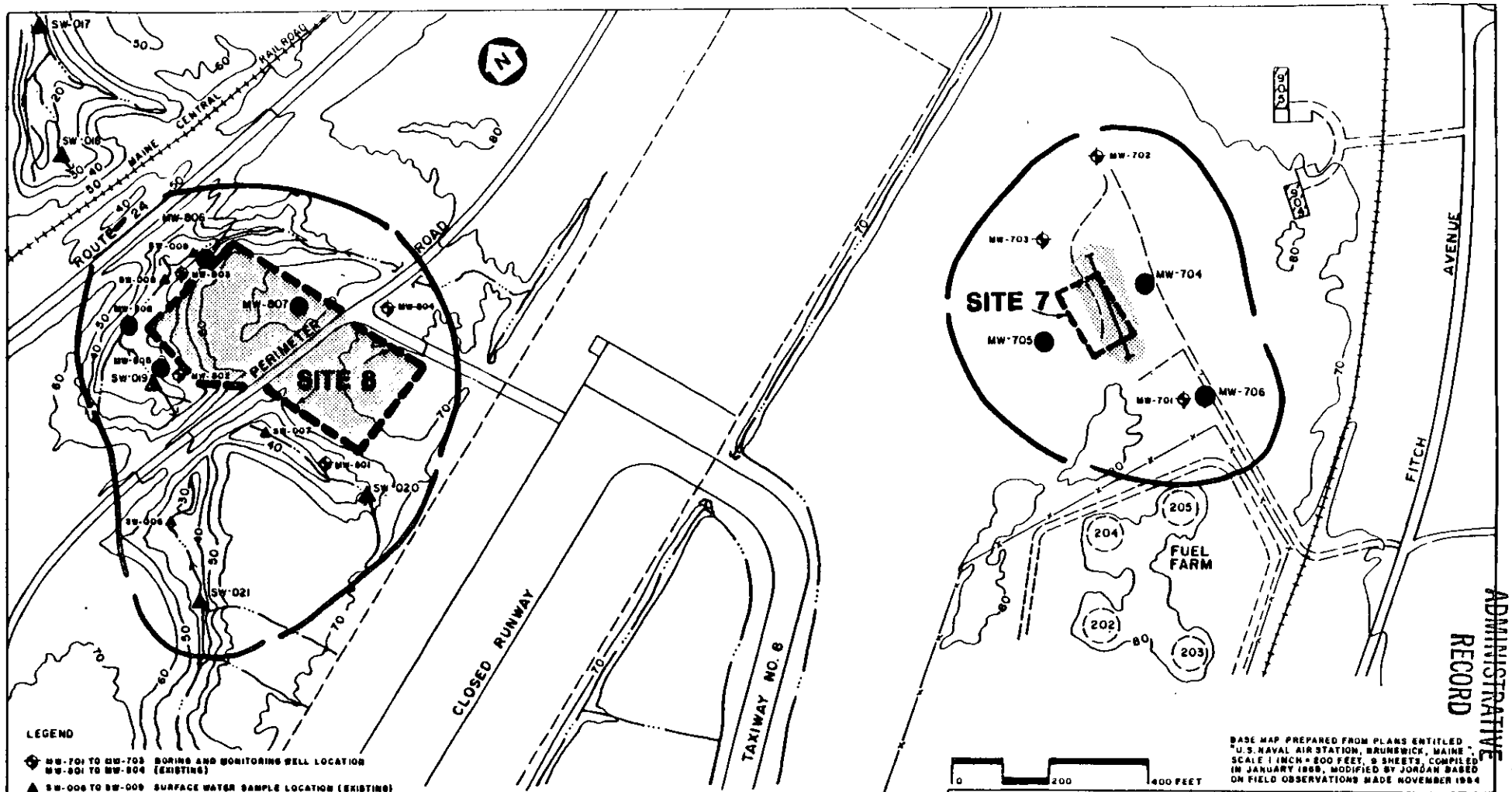

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assess the areal limits of wastes deposited at this site. This information will be used to optimize monitoring well and surface water/sediment sampling locations and to confirm the present location, which is based on historical information and the SI study.

As shown in Figure 4-4, three soil borings around the perimeter of the landfill at the base of the embankment will be advanced to an approximate depth of 50 feet below ground surface to penetrate the marine deposits, and one boring in the landfill itself to an approximate depth of 30 feet. Split-spoon soil samples will be collected at 5-foot intervals in the three perimeter borings. Sampling through the landfill will be continuous. Two soil samples will be collected from each boring for laboratory chemical analysis, based on screening with a PI meter and visual observation. Soil samples submitted to the laboratory will be analyzed for TCL organics and inorganics. Table 4-4 summarizes the analytical program; and the analytical program is discussed in Section 5.0. A monitoring well will be installed in each of the four borings. Three of the new boring/monitoring well installations will be located near the existing shallow monitoring wells to form multi-level, paired well locations. The monitoring well pairs will allow an assessment of vertical hydraulic gradients and monitor deep groundwater migration pathways.

Groundwater Sampling and Analysis. Groundwater samples will be collected from the eight new and existing wells. Samples collected for laboratory chemical analysis will be analyzed for TCL organics and inorganics and general water quality parameters. Due to the proximity of the JAW, the VOC analysis will be performed to meet Drinking Water Quality Standards. Table 4-4 summarizes the analytical program; analytical methods are discussed in Section 5.0.

Surface Water and Sediment Sampling. Surface water and sediment sampling will be performed to assess the impact the site may have on surface water quality in the streams bordering the site, which are tributaries to the Androscoggin River. The surface water and sediment sampling locations are presented in Figure 4-4. In addition to the four original sampling locations identified in the SI, five new locations will be sampled for laboratory chemical analyses. Sediment samples will be collected at surface water sampling locations. Sampling will be conducted during low flow conditions to reduce the potential for dilution effects caused by high surface runoff. Parameters of chemical analysis for sediment samples will include TCL organics and inorganics. Surface water will be analyzed for TCL organics and inorganics and general water quality parameters. Table 4-4 summarizes the analytical program; analytical methods are discussed in Section 5.0.

To further investigate the impact of the site on surface water quality, a field reconnaissance will be conducted to identify and sample surface seeps in the tributaries of the Androscoggin River adjacent to the site. Three of the identified seeps will be sampled for laboratory analysis. Both surface water and sediment samples will be collected from each seep and analyzed for TCL organics and inorganics and general water quality parameters (water only).

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4.4.5 Site 9 - Neptune Drive Disposal Site

Detectable VOC concentrations in surface water and mercury in the groundwater were detected during the SI study at Site 9. The purposes of the RI are to (1) better define the source and concentration of these chemicals; that is, groundwater from Site 9 or surface runoff from the runway area; and (2) confirm the presence of mercury in the groundwater. The exploration program at Site 9 will include the following activities:

- one day of soil gas sampling
- two test borings with monitoring well installations
- four analytical soil samples
- two monitoring wells
- groundwater, surface water, and sediment sampling
- aquifer permeability testing

Four of the five surface water and sediment sampling locations associated with Site 9 are shown in Figure 4-3. A fifth sample will be obtained from the pond adjacent to Meadow Cemetery. These five sampling locations include three locations previously sampled in the SI and two additional proposed surface water sampling locations. These five samples will be used to assess variations in concentrations of TCL organics and inorganics, and the dilution of contaminants in surface water with distance from the site. Chemical analyses of surface water and sediment samples will also assist in assessing whether the contaminant source is groundwater beneath Site 9 or the surface water drainage system from the runway area.

Two soil borings and monitoring wells (i.e., MW-904 and MW-905) will be installed at Site 9 to monitor the shallow groundwater downgradient of the site and upgradient of Merriconeag Stream. Locations of the boring/monitoring wells are presented in Figure 4-3. The two borings will extend approximately 30 feet below the ground surface; a monitoring well will be installed in each with a 10-foot well screen set near the surface of the water table. Two soil samples will be selected from each boring and analyzed for TCL organics and inorganics. Estimated monitoring well quantities are summarized in Table 4-3.

Groundwater samples will be collected from the existing wells and the new wells at Site 9 and analyzed for TCL organics and inorganics. Table 4-4 summarizes the analytical program; analytical methods and a summary of the analytical program are presented in Section 5.0.

4.5 AIR MONITORING

PI meter results and soil gas air blank results will be used by Jordan to monitor personnel exposure, determine if a more sophisticated air-monitoring program should be conducted before completion of the RI, and evaluate the potential for off-site exposure to VOCs. Ambient air quality results from PI meter and air blank screening will be summarized in a technical memorandum (see Section 6.0) and the RI Report. Detection limits of the instruments used, ambient conditions, VOCs detected, and sources of significant VOC emissions will also be recorded.

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Jordan will survey NASB ambient air quality throughout the field investigation program. Air quality at each site will be monitored and recorded during site reconnaissance, soil gas surveys, the drilling program, and the three rounds of sampling. Monitoring during the drilling program will consist of PI meter readings of ambient air, soil samples, drill cuttings, and any water evacuated from a borehole or monitoring well. Consistent PI meter readings above background will trigger Draeger tube air sampling for benzene as specified in the HASP. An HNU or Photovac PI meter will be used during sample acquisition events and explorations. In addition to ambient air quality associated with each site, a basewide PI meter air survey will be conducted during site reconnaissance activities. Areas of contaminated soil, seeps, leachate, and surface water will also be screened during site reconnaissance to determine baseline VOC emissions. Areas where detectable VOC concentrations are identified in the air will be recorded and mapped.

During the soil gas survey at NASB, approximately 20 air blanks will be obtained. The air blank samples, analyzed in the field using a GC equipped with an ECD and PI detector, will be screened for halogenated VOCs and hydrocarbons. These air blanks will provide information on background levels of contaminants in the air. At least two air blanks will be analyzed per site.

4.6 ADDITIONAL FIELD SAMPLING (TASK E1)

Additional field work beyond the studies proposed herein may be necessary to evaluate site conditions at NASB. The necessity for additional field work will be based on Jordan's interpretation of results from the initial RI field efforts and discussions with the Navy and USEPA. Additional studies will be designed to bridge data gaps and address unanswered conditions from the previous sampling event. If it is determined that additional field studies are to be undertaken, Jordan will develop a post-screening Work Plan, which will outline the level of effort and rationale for such activities.

4.7 SURVEY OF EXPLORATIONS

The location and elevation of the monitoring wells, test pits, and surface water sampling points will be surveyed by Jordan personnel to the nearest 0.05-foot horizontally and 0.01-foot vertically, and referenced to NASB datum. The location of geophysical explorations, monitoring wells, test pits, and surface water/sediment sampling points will be plotted on recent topographic maps of the sites (to be provided by the Navy).

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5.0 ANALYTICAL PROGRAM

5.1 PROGRAM SUMMARY

Soil or water samples selected for analytical testing will be analyzed to identify and quantify the chemical contaminants detected for each analytical method. Analytical services will be provided by Jordan and Environmental Monitoring & Services, Inc. (EMSI). The analytical program is summarized in Table 4-4. Based on results of the IAS and SI studies and comments from USEPA, water and soil analytical samples (except groundwater samples at Site 8) will be analyzed for TCL organics and inorganics using CLP methods (Table 5-1). Due to the proximity of the city of Brunswick's JAW to Site 8, USEPA requested that groundwater analyses for TCL analytes use Drinking Water Analytical Methods rather than CLP procedures. The Drinking Water Analytical Methods give a greater precision; they are included in Table 5-1. USEPA also requested that analysis for General Water Quality (GWQ) parameters be incorporated for water samples (both surface and groundwater) at Site 8. Because several analytes included in the GWQ parameters are part of the TCL, and the precision for Drinking Water Analysis exceeds that for GWQ parameters, only those GWQ analytes not on the TCL will be analyzed using GWQ methods. Analytical procedures for GWQ parameters are given in Table 5-2. Contract Required Detection Limits (CRDL) for TCL analytes are given in Table 5-3, and VOC Method Detection Limits (MDL) for drinking water analytical methods are shown in Table 5-4.

Three sampling rounds are planned for the analytical program at NASB. If, after the first sampling round, a particular analyte or class of analytes is found to be absent from one or more media at a particular site(s), a recommendation to discontinue the analysis for the analyte(s) may be made by Jordan. The decision to alter the scope of the analytical program will be made by the Navy with approval from USEPA.

5.2 DATA QUALITY OBJECTIVES

DQOs are based on the concept that different data uses may require different quality data. Data quality is the degree of uncertainty with respect to precision, accuracy, reproducibility, completeness, and comparability. DQOs are qualitative and quantitative statements specifying the required quality of data required to support RI/FS activities, including site screening, characterization, and RA, and to support engineering alternative evaluation and selection decisions and enforcement. The four broad categories of data quality used in the RI/FS process are described in the following paragraphs.

Level I - Field Screening. This level of data quality is the lowest; however, it provides the most rapid results and is used to assist in the optimization of sampling locations and for health and safety support. Data generated provide presence or absence of certain constituents and are generally qualitative rather than quantitative.

Level II - Field Analysis. This level of data quality is characterized by the use of analytical instruments carried into the field and the use of mobile

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TABLE 5-1

LABORATORY ANALYTICAL PROCEDURES
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MEDIA	PARAMETER	METHOD	REFERENCE
Soils	TCL Volatiles	Purge and Trap/ GC/MS	CLP-COP
	TCL Pesticides and PCBs	GC	CLP-COP
	TCL Element	AAS/PES	CLP-CIP
	Cyanide	Colormetric	CLP-CIP
	TCL Semivolatiles	GC/MS	CLP-COP
Surface Water/ Groundwater	TCL Volatiles	GC/MS	CLP-COP
	Volatile Organic Compounds (Site 8)	GC/MS	USEPA Method 524.2
	TCL Semivolatiles	GC/MS	CLP-COP
	TCL Pesticides and PCBs	GC	CLP-COP
	TCL Element	AAS/PES	CLP-CIP
	Cyanide	Colormetric	CLP-CIP
	pH (field)	Potentiometric	USEPA Method 150.1
	Specific Conductance (field)	Conductance	USEPA Method 120.1

GC/MS - Gas Chromatography/Mass Spectrometry
CLP-COP - Contract Laboratory Program - Caucus Organic Protocol, Control #887
CLP-CIP - Contract Laboratory Program - Caucus Inorganic Protocol, Control #787
AAS - Atomic Absorption Spectroscopy
PES - Plasma Emission Spectroscopy
TCL - Target Compound List
USEPA Method - Methods for the Chemical Analysis of Water and Wastes, USEPA 600/4-79-028, March 1983.
EPA Method 524.2. Volatile Organic Compounds in Water by Purge and Trap Capillary Column Gas Chromatography/Mass Spectrometry (August 1986).

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TABLE 5-2

LABORATORY ANALYTICAL PROCEDURES FOR GENERAL WATER QUALITY PARAMETERS
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MEDIA	PARAMETERS	METHOD	REFERENCE	MDL (mg/ℓ)
Surface Water/ Groundwater	Total dissolved solids	Gravimetric	EPA 160.1	10
	Chloride	Colovimetric	EPA 325.2	1
	Sulphate	Turbidimetric	EPA 375.4	1
	Nitrate-Nitrite	Colorimetric	EPA 353.2	0.05
	Iron	*	*	*
	Manganese	*	*	*
	Copper	*	*	*
	Zinc	*	*	*
	Boron	Colorimetric	EPA 212.3	0.1
	Sulfide	Titrimetric	EPA 376.1	1
	Arsenic	*	*	*
	Barium	*	*	*
	Cadmium	*	*	*
	Chromium (Cr^{VI})	Chelation-Extraction	EPA 218.4	0.1
	Selenium	*	*	*
	Antimony	*	*	*
	Lead	*	*	*
	Mercury	*	*	*
	Fluoride	Potentiometric	EPA 340.2	0.1
	Cyanide	*	*	*
	Endrin	*	*	*
	Lindane	*	*	*
	Methoxychlor	*	*	*
	Toxaphene	*	*	*
	2,4-D	Gas Chromatography	SM 509B	0.05
	2,4,5-TP silvex	Gas Chromatography	SM 509B	0.01
	Phenolics, total recoverable	Colorimetric	EPA 420.1	0.005
	MBAS	Colorimetric	EPA 425.1	0.025
	Total coliform Bacteria	Standard Plate Count	SM 909A	NA

EPA - Methods for the Chemical Analysis of Water and Wastes, USEPA 600/4-79-020, March 1983
SM - Standard Methods for the Examination of Water and Wastes, 16th Edition
* - Analyzed under CLP or EPA Method 524.2 procedures (see Table 5-1).
MDL - Method Detection Limit
NA - Not Applicable

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TABLE 5-3
TCL DETECTION LIMITS
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INORGANIC COMPOUNDS	ANALYTICAL METHOD	CRDL ug/l (water)	CRDL mg/kg (soil)
Aluminum	P	200	40
Antimony	P	60	12
Arsenic	F	10	2
Barium	P	200	40
Beryllium	P	5	1
Cadmium	P	5	1
Calcium	P	5000	1000
Chromium	P	10	2
Cobalt	P	50	10
Copper	P	25	5
Cyanide		10	2
Iron	P	100	20
Lead	P/F	5	1
Magnesium	P	5000	1000
Manganese	P	15	3
Mercury	CV	0.2	0.04
Nickel	P	40	8
Potassium	P	5000	1000
Selenium	F	5	1
Silver	P	10	2
Sodium	P	5000	1000
Thallium	F	10	2
Vandium	P	50	10
Zinc	P	20	4

VOLATILE ORGANIC COMPOUNDS	CRDL ug/l (water)	CRDL ug/kg (soil)
Chloromethane	10	10
Bromomethane	10	10
Vinyl Chloride	10	10
Chloroethane	10	10
Methylene Chloride	5	5
Acetone	10	10
Carbon Disulfide	5	5
1,1 - Dichloroethene	5	5
1,1 - Dichloroethane	5	5
1,2 - Dichloroethene (Total)	5	5
Chloroform	5	5
1,2 - Dichloroethane	5	5
2-Butanone	10	10
1,1,1 - Trichloroethane	5	5
Carbon Tetrachloride	5	5
Vinyl Acetate	10	10
Bromodichloromethane	5	5
1,2 - Dichloropropane	5	5
Trans- 1,3 -Dichloropropene	5	5
Trichloroethane	5	5
Dibromochloromethane	5	5
1,1,2 - Trichloroethane	5	5
Benzene	5	5
Cis- 1,3 -Dichloropropene	5	5
2-Chloroetylvinylether	10	10
Bromoform	5	5
4-Methyl-2-Pentanone	10	10
2-Hexanone	10	10
Tetrachloroethene	5	5
1,1,2,2 - Tetrachloroethane	5	5
Toluene	5	5
Chlorobenzene	5	5
Styrene	5	5
Total Xylenes	5	5

SEMI-VOLATILE COMPOUNDS	CRDL ug/l (water)	CRDL ug/kg (soil)
Phenol	10	330
bis(2-Chloroethyl)Ether	10	330
2-Chlorophenol	10	330
1,3 - Dichlorobenzene	10	330
1,4 - Dichlorobenzene	10	330
Benzyl Alcohol	10	330
1,2 - Dichlorobenzene	10	330
2-Methylphenol	10	330
bis(2-Chloroisopropyl)Ether	10	330
4-Methylphenol	10	330
N-Nitroso-Di-n-Propylamine	10	330
Hexachloroethane	10	330
Nitrobenzene	10	330
Isophorone	10	330
2-Nitrophenol	10	330
2,4 - Dimethylphenol	10	330
Benzoic Acid	50	1600
bis(2-Chloroethoxy)Methane	10	330
2,4 - Dichlorophenol	10	330
1,2,4 - Trichlorobenzene	10	330
Naphthalene	10	330
4-Chloroaniline	10	330
Hexacholorobutadiene	10	330
4-Chloro-3-Methylphenol	10	330
2-Methylnaphthalene	10	330
Hexachlorocyclopentadiene	10	330
2,4,6 - Trichlorophenol	10	330
2,4,5 - Trichlorophenol	50	1600
2-Chloronaphthalene	10	330
2-Nitroaniline	50	1600
Dimethyl Phthalate	10	330
Acenaphthylene	10	330
2,6 - Dinitrotoluene	10	330
3-Nitroaniline	50	1600
Acenaphthene	10	330
2,4 - Dinitrophenol	50	1600
4-Nitrophenol	50	1600
Dibenzofuran	10	330
2,4 - Dinitrotoluene	10	330
Diethylphthalate	10	330
4-Chlorophenyl-Phenylether	10	330
Fluorene	10	330
4-Nitroaniline	50	1600
4,6 - Dinitro-2-Methylphenol	50	660
N-Nitrosodiphenylamine (1)	10	330
4-Bromophenyl-Phenylether	10	330
Hexachlorobenzene	10	330
Pentachlorophenol	50	1600
Phenanthrene	10	330
Anthracene	10	330
Di-n-Butylphthalate	10	330
Fluoranthene	10	330
Pyrene	10	330
Butylbenzylphthalate	10	330
3,3' - Dichlorobenzidine	20	660
Benzo (a) Anthracene	10	330
Chrysene	10	330
bis (2-Ethylhexyl) Phthalate	10	330
Di-n-Octyl Phthalate	10	330
Benzo (b) Fluoranthene	10	330
Benzo (k) Fluoranthene	10	330
Benzo (a) Pyrene	10	330
Indeno (1,2,3-cd) Pyrene	10	330
Dibenz (a,h) Anthracene	10	330
Benzo (g,h,i,) Perylene	10	330

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TABLE 5-3 (Cont.)
TCL DETECTION LIMITS
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PESTICIDES/PCB	CRDL ug/l (water)	CRDL ug/kg (soil)	PESTICIDES/PCB	CRDL ug/l	CRDL ug/kg
Alpha-BHC	0.05	8	Endrin Aldehyde	0.10	16
Beta-BHC	0.05	8	Endosulfan Sulfate	0.10	16
Delta-BHC	0.05	8	4,4'-DDT	0.10	16
Gamma-BHC (Lindane)	0.05	8	Methoxychlor	0.50	80
Heptachlor	0.05	8	Endrin Ketone	0.10	16
Aldrin	0.05	8	Alpha-Chlordane	0.50	80
Heptachlor Epoxide	0.05	8	Gamma-Chlordane	0.50	80
Endosulfan I	0.05	8	Toxaphene	1.00	160
Dieldrin	0.10	16	Aroclor-1016	0.50	80
4,4-DDE	0.10	16	Aroclor-1221	0.50	80
Endrin	0.10	16	Aroclor-1232	0.50	80
Endosulfan II	0.10	16	Aroclor-1242	0.50	80
4,4-DDD	0.10	16	Aroclor-1248	0.50	80
			Aroclor-1254	1.00	160
			Aroclor-1260	1.00	160

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TABLE 5-4

VOC METHOD DETECTION LIMITS FOR DRINKING WATER ANALYTICAL METHODS
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Analyte	MDL (μg/L)
Dichlorodifluoromethane	0.10
Chloromethane	0.13
Vinyl Chloride	0.17
Bromomethane	0.11
Chloroethane	0.10
Trichlorofluoromethane	0.08
1,1-Dichloroethene	0.12
Methylene Chloride	0.02
Trans-1,2-Dichloroethene	0.06
1,1-Dichloroethane	0.04
2,2-Dichloropropane	0.35
cis-1,2-Dichloroethene	0.12
Chloroform	0.03
Bromochloromethane	0.04
1,1,1-Trichloroethane	0.08
Carbon Tetrachloride	0.21
1,1-Dichloropropene	0.10
Benzene	0.04
1,2-Dichloroethane	0.06
Trichloroethene	0.19
1,2-Dichloropropane	0.04
Bromodichloromethane	0.08
Dibromomethane	0.24
Toluene	0.11
1,1,2-Trichloroethane	0.10
Tetrachloroethene	0.14
1,3-Dichloropropane	0.04
Dibromochloromethane	0.05
1,2-Dibromoethane	0.06
1-Chlorohexane	0.05
Chlorobenzene	0.04
1,1,1,2-Tetrachloroethane	0.05
Ethylbenzene	0.06
p-Xylene	0.13
m-Xylene	0.05
o-Xylene	0.11
Styrene	0.04
Bromoform	0.12
Isopropylbenzene	0.15
1,1,2,2-Tetrachloroethane	0.04
Bromobenzene	0.03
1,2,3-Trichloropropane	0.32
n-Propylbenzene	0.04
2-Chlorotoluene	0.04
1,3,5-Trimethylbenzene	0.05

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TABLE 5-4 (cont.)

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Analyte	MDL (μg/L)
4-Chlorotoluene	0.06
tert-Butylbenzene	0.14
1,2,4-Trimethylbenzene	0.13
sec-Butylbenzene	0.13
p-Isopropyltoluene	0.12
1,3-Dichlorobenzene	0.12
1,4-Dichlorobenzene	0.03
n-Butylbenzene	0.11
1,2-Dichlorobenzene	0.03
1,2-Dibromo-3-Chloropropane	0.26
1,2,4-Trichlorobenzene	0.04
Hexachlorobutadiene	0.11
Naphthalene	0.04
1,2,3-Trichlorobenzene	0.03

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laboratories. Depending on the instrumentation, environmental matrix, and other factors, data may be either qualitative or quantitative.

Level III - Laboratory Analysis. This level of data quality represents data generated under laboratory conditions using USEPA-approved procedures, but using methods other than Contract Laboratory Program - Routine Analytical Services (CLP-RAS) protocols. This level of data is used for certain types of source, extent, or characterization and to support engineering treatability studies. These data are both qualitative and quantitative.

Level IV - CLP-RAS. This data quality level represents confirmational data characterized by rigorous quality control and validation procedures. This level is adequate for site characterization to support RA, enforcement, and engineering alternative selection and design, and for cost recovery documentation. Level IV data may be both qualitative and quantitative.

Data from the RI at NASB will be used for several purposes depending on the specific task and the medium of concern. DQOs for NASB are identified by medium in the following paragraphs.

- Groundwater, surface water, sediments, and soil samples collected during the RI field program at NASB will be analyzed by CLP methods to provide Level IV data. One exception will be Site 8 water samples analyzed for Drinking Water Quality Parameters (Method 524.2) to obtain lower detection limits than the CRDL. Method 524.2 detection limits are summarized in Table 5-4.

- Soil gas samples will be analyzed in the field by GC, providing Level II screening data to assist in locating potential areas of contamination for test pits, test borings, and monitoring wells.

- Soil samples from the test borings will be screened in the field with a GC, providing Level II data to assist in selecting samples for laboratory analysis.

- Air quality will be monitored by PI meter, providing Level I data, and by GC, providing Level II data.

- GWQ parameters to be analyzed for at Site 8 will be performed by laboratory methods indicated in Table 5-2. Detection limits for these methods are also included in the table.

- Temperature, pH, and specific conductance will be monitored in the field for surface water and groundwater samples, providing Levels I and II data.

- Subsurface soils collected during drilling will be screened with a PI meter and a field GC unit, providing Levels I and II data.

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5.3 DATA VALIDATION

Validation of the laboratory data is a systematic process to provide assurance that the data are adequate for their intended use. The process includes the following activities:

- auditing measurement system calibration and calibration verification
- auditing QC activities
- reviewing data for technical credibility versus the sample site setting
- auditing field sample data records and chain-of-custody
- checking intermediate calculations
- certifying the process

Data validation will be performed by Jordan using the procedures and specifications contained in "Laboratory Data Validation - Functional Guidelines for Evaluating Organic Analyses," Technical Directive Document No. HQ-8410-01; "Laboratory Data Validation - Functional Guidelines for Evaluating Inorganic Analyses," Draft Technical Directive Document; and Data Validation Guidelines for CLP Organic and Inorganic Analyses - Region I, January 1987. For analytical methods other than CLP, Jordan will perform data reviews based on functional guidelines for laboratory blank contamination and laboratory QC.

QC during sample analysis is described by USEPA's CLP-Caucus Organic Protocol (CLP-COP) and CLP-Caucus Inorganic Protocol (CLP-CIP). QC for other aspects of the analytical program will be in accordance with USEPA guidelines for the various analytical methods presented in Tables 5-1 and 5-2.

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6.0 RI DATA EVALUATION (TASK R4)

6.1 RI TECHNICAL MEMORANDA

Evaluation of data obtained during the RI at NASB will be an ongoing process, beginning with the site reconnaissance prior to the field exploration program. Data obtained during the RI will include geological and hydrogeological information from subsurface explorations and site reconnaissance, and laboratory analytical data from three rounds of sampling. Approximately eight to 10 weeks after each round of sampling in the field, a data package or technical memorandum will be prepared by Jordan and submitted to the Navy and USEPA. It is anticipated that each data package will include summary tables of validated laboratory analytical data, draft plans indicating contaminants and concentrations identified at various locations on each site, a draft groundwater contour map, and a brief narrative letter summarizing the most significant results obtained during the sampling round. Delivery of the data packages to the Navy and USEPA is contingent upon receiving all laboratory data within the CLP 30-day turnaround period. After the analytical data are received, each package will require approximately four weeks to complete data validation, data evaluation, and preparation of the data package.

Following the subsurface exploration program, field logs of test borings, monitoring well installations, aquifer permeability testing, and results of the air monitoring activities, geophysics, and soil gas surveys will be provided to the Navy and USEPA. In addition, groundwater table maps will be generated for each site to document the interpreted path of groundwater movement at the sites in both shallow and deep aquifers, as appropriate. The preliminary groundwater maps will be modified as additional data become available. Groundwater flow may be different at various times throughout the year.

The intent of these technical memoranda will be to present basic site data and preliminary evaluations of site conditions. They will serve as working documents for discussion and comment by the Navy and USEPA; however, they will not be revised or reissued after comment.

6.2 EVALUATION OF SITES 5 AND 6

Site 5 (Asbestos Disposal Site) and Site 6 (Rubble and Asbestos Disposal Site) were reviewed and evaluated for the IAS in 1983. These inactive sites reportedly were used exclusively for the disposal of rubble and asbestos, which indicates a very low level of risk to public health and the environment. During the RI/FS, the previously obtained information will be reviewed, risk will be identified, explorations and sampling will be proposed if deemed appropriate, and FS issues will be addressed in conformance with USEPA guidance.

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7.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or relevant and appropriate requirements (ARARs) are federal and state public health and environmental requirements and guidelines that apply to hazardous waste site cleanup. Section 121 of CERCLA, amended by SARA, and the NCP require that CERCLA-mandated hazardous waste site remedial actions comply with federal ARARs. SARA also requires attainment of state ARARs if they are more stringent than federal ARARs, legally enforceable, and consistently enforced statewide. According to CERCLA Section 121, the SARA requirements are applicable to remedial actions at federal facilities where hazardous substances are present in the same manner that they are applicable to remedial actions at non-federal facilities.

ARARs are used to determine the appropriate extent of site cleanup, scope and formulate remedial action alternatives, and govern the implementation and operation of the selected action. According to SARA, requirements may be waived by USEPA under specific conditions, provided that protection of human health and the environment is still assured.

7.1 ARARS DEFINITION

Applicable requirements and relevant and appropriate requirements are defined in the following paragraphs.

Applicable Requirements are those clean-up standards, standards of control, or other substantive environmental requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. An example of an applicable requirement is the use of Maximum Contaminant Levels (MCLs), promulgated under the Safe Drinking Water Act, for a site where groundwater contamination is entering a public water supply.

Relevant and Appropriate Requirements are federal and state promulgated clean-up standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations that, while not legally applicable, can be applied if, in the decision-maker's best professional judgement, site circumstances are similar to jurisdictionally covered situations, and use of the requirements makes good sense. The term "relevant" is included so that requirements initially screened out as non-applicable because of jurisdictional restrictions can be reconsidered. For example, MCLs would be relevant and appropriate requirements for use at a site where groundwater contamination could affect a potential (as opposed to an actual) drinking water source. Relevant and appropriate requirements should be given the same weight for consideration as applicable requirements.

To Be Considered Material (TBCs) are federal and state non-promulgated advisories or guidance documents that do not have ARAR status. However, if there are no specific ARARs for a chemical or situation, or if existing ARARs are not deemed to be sufficiently protective, then guidance or advisory criteria should be identified and used to better ensure public health and environmental protection.

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7.2 DEVELOPMENT OF ARARS

As described in the NCP, ARARs may be characterized as chemical-specific, location-specific, or action-specific. Chemical-specific ARARs govern the extent of site cleanup and provide either actual clean-up levels or a basis for calculating such levels. Groundwater and surface water criteria and standards, as well as air standards, will normally be used to establish clean-up goals for hazardous waste sites. Chemical-specific ARARs are also used to indicate acceptable levels of discharge to determine treatment and disposal requirements, and to assess the effectiveness of remedial alternatives.

Location-specific ARARs govern natural site features such as wetlands and floodplains, as well as manmade features (e.g., landfills, disposal areas, and historic buildings). Location-specific ARARs generally impose restrictions on the conduct of on-site activities because of the site's particular characteristics or location. These ARARs provide a basis for assessing both existing site conditions and potential remedies.

Action-specific ARARs are usually technology- or activity-based limitations that control actions at CERCLA sites. After remedial alternatives are developed, action-specific ARARs pertaining to proposed site remedies provide a basis for assessing the feasibility and effectiveness of the remedies. For example, these action-specific ARARs may include hazardous waste transportation and handling requirements, air and water emissions standards, and the Resource Conservation and Recovery Act (RCRA) landfilling and treatment requirements.

7.3 ARARS IDENTIFICATION

ARARs will be identified and updated throughout the RI/FS as data on the sites are confirmed and quantified. Table 7-1 lists points when the different ARARs categories will be identified and considered during the remedial planning process.

Based on Jordan's initial understanding of characteristics and chemical contaminants found to be present at the nine sites, potential chemical- and location-specific ARARs are identified in Table 7-2. Action-specific ARARs will be considered and developed during the development and analysis of remedial alternatives. On the federal level, primary action-specific ARARs to be considered most likely would include RCRA requirements (40 CFR 264), which would govern hazardous waste containment, removal, transport, treatment, and site closure; Toxic Substances Control Act requirements (40 CFR 761), which apply to the marking, storage, treatment, and disposal of PCBs; and Occupational Health and Safety Administration requirements (29 CFR 1904, 1910, and 1926), which would provide for on-site worker health and safety. Depending on the remediation method selected, other action-specific ARARs (e.g., the Clean Water Act, National Pollutant Discharge Elimination System, and Clean Air Act requirements) would become important. MEDEP'S Hazardous Waste Management Rules, which are generally more stringent than federal requirements, may also be applicable.

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TABLE 7-1

REMEDIAL PLANNING PROCESS WHERE ARARs
SHOULD BE IDENTIFIED AND CONSIDERED
RI/FS PROGRAM
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PHASE	ARARs
- Scoping of RI/FS	Preliminary identification of chemical- and location-specific ARARs
- Site Characterization Phase of RI	Identification of chemical- and location-specific ARARs and advisories
- Development of Target Levels Phase of FS	Use of chemical-specific ARARs to determine clean-up goals
- Development of Remedial Alternatives Phase of FS	Preliminary consideration of action-specific ARARs
- Screening of Remedial Alternatives Phase of FS	Identify action-specific ARARs for each of the proposed alternatives
- Detailed Analysis of Alternatives Phase of FS	Determine compliance of each alternative to all identified ARARs
- Selection of Alternative in FS	Alternatives must attain compliance with all ARARs unless one of the six statutory waivers is invoked
- Remedial Design	Technical specifications of construction must ensure attainment of ARARs

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TABLE 7-2

POTENTIAL FEDERAL AND STATE CHEMICAL- AND LOCATION-SPECIFIC ARARS
RI/FS PROGRAM
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MEDIA	FEDERAL ARARS	STATE ARARS	OTHER TBCS	CONSIDERATION FOR REMEDIATION
Chemical-specific				
Groundwater	Safe Drinking Water Act Maximum Contaminant Levels (MCL) (40 CFR 141.11-141.16) Safe Drinking Water Act - Maximum Contaminant Level Goals (MCLG) (40 CFR 141.50-141.51) Federal Ambient Water Quality Criteria (AWQC) RCRA - Subpart F Groundwater Protection Standards, Maximum Concentration Limits (40 CFR 264.94)	Rules Relating to Drinking Water (10-144A CMR 231, Section 7) Maine Water Pollution Control Law 38 M.R.S.A., Ch. 3, Sec. 465-C - Standards of Classification of Groundwater	Health Advisories (EPA) Office of Drinking Water EPA Risk Reference Doses EPA Carcinogen Assessment Group Potency Factors Acceptable Intake Chronic and Subchronic EPA Health Assessment Documents EPA Office of Water Guidance, Water-related Fate of Priority Pollutants	ARARs will be used to establish groundwater clean-up levels for groundwater contaminants
Surface Water	NPDES Regulations (40 CFR, 122, 125) Federal Ambient Water Quality Criteria (AWQC)	Maine Water Pollution Control Law 38 M.R.S.A., Ch. 3, Sec. 465 - Standards for Classification of Fresh Surface Waters Maine Regulations Relating to Temperature, Ch. 582 Maine Regulations Relating to Water Quality Criteria, Ch. 584		ARARs will be used to establish discharge requirements for potential direct discharges to surface waters

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MEDIA	FEDERAL ARARS	STATE ARARS	OTHER TBCS	CONSIDERATION FOR REMEDIATION
Chemical-specific				
Soils/Sediment	No applicable or relevant and appropriate clean-up standards have been established for soils/sediments			Site-specific target clean-up levels for soils will be based on public health and environmental risk assessment
Air	Clean Air Act - National Air Quality Standards (NAQS), (40 CFR 50)	Maine Incinerator Particulate Emission Standard, Ch. 104 Maine Ambient Air Quality Standards, Ch. 101	Threshold Limit Values	Standards for particulate matter must be used when assessing excavation and emission controls for soil treatment TLVs could be used for assessing site inhalation risks for soil removal operations
Location-specific				
Wetlands	Clean Water Act, Section 404 Fish and Wildlife Coordination Act (16 USC 661)	Maine Coastal Wetland Law, 38 M.R.S.A, Section 471 Maine General Policies and Procedures Under the Coastal Wetland Law, Ch. 342 Maine Interference with Recreational and Navigational Uses Standard of the Coastal Wetland Law, Ch. 343	Wetlands Executive Order (EO 11990)	Wetlands and their fish and wildlife habitants must be protected during actions that modify or discharge to wetlands

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TABLE 7-2 (cont.)

MEDIA	FEDERAL ARARS	STATE ARARS	OTHER TBCS	CONSIDERATION FOR REMEDIATION
		Maine Soil Erosion Standard of the Coastal Wetlands Law, Ch. 344 Maine Interference with Natural Flow of Water Standard of the Coastal Wetlands Law, Ch. 345 Maine Harm to Wildlife and Fisheries Standard of the Coastal Wetlands Law, Ch. 346 Maine Lowering of Water Quality Standard of Coastal Wetland Law, Ch. 347 Maine Site Location Act, 38 M.R.S.A, Sec. 484 Maine No Adverse Environmental Effect Standard of the Site Location Law, Ch. 375		Floodplains must be protected, and facilities must be designed, constructed, operated, and maintained to avoid flood washout
Floodplains	RCRA Location Standards 40 CFR 264.18		Floodplains Executive Order (EP 11988)	Floodplains must be protected, and facilities must be designed, constructed, operated, and maintained to avoid flood washout

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TABLE 7-2 (cont.)

MEDIA	FEDERAL ARARS	STATE ARARS	OTHER TBCS	CONSIDERATION FOR REMEDIATION
Critical Habitat upon which Endangered or Threatened Species Depend	Endangered Species Act (16 Use 1531 et seq.)			Action must be taken to conserve endangered species or threatened species
Areas of Historical Significance	National Historic Preservation Act; 36 CFR 65			Action must minimize harm to National Historic Landmarks and preserve historic properties
Androscoggin River Basin		Maine Water Quality Law 38 M.R.S.A., Sec. 467, Classification of Major River Basins		Remedial actions should not result in degradation of water quality classification

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8.0 RISK ASSESSMENT

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Public health and ecological RAs will be performed on a site-by-site basis for NASB. In an RA, site data are interpreted to determine whether chemical contamination poses a risk to human health or the environment. It is the interpretive link between the RI data-gathering phase and the remedial action planning phase of the FS. In addition to providing information on the potential for risk from site-derived chemicals in the absence of remedial action, the health and environmental RA also provides a baseline against which to evaluate alternative remedial solutions. The public health and environmental RAs are described in the following sections.

8.1 PUBLIC HEALTH RISK ASSESSMENT

The purpose of the public health RA is to estimate the probability and magnitude of potential harm to humans who live near NASB from exposure to chemicals which originate at any of the sites. The RA consists of four essential elements: (1) the selection of contaminants of concern; (2) the exposure assessment; (3) the toxicity assessment; and (4) the risk characterization. Each element is briefly described in the following sections.

8.1.1 Selection of Contaminants of Concern

In this section, a screening process will be performed to narrow the field of contaminants at each site that will be evaluated in the RA. The objective of this task is to select contaminants that have the greatest potential to cause harm to public health and/or are representative of site conditions. The selection will be accomplished through careful consideration of the following factors:

- the inherent toxicity of the chemicals within each chemical class (i.e., VOCs, SVOCs, PCBs and pesticides, and inorganics)
- the distribution of chemicals in all applicable media (e.g., surface water, sediment, soil, and groundwater)
- the location of all chemicals (so that the source area, contaminant migration, and all media are considered)
- physical and chemical properties relating to mobility and persistence

The selection of contaminants of concern will help to focus the investigation on chemicals that are of the most concern at each site at NASB. At a minimum, the following chemicals of concern will be selected:

- Sites 1, 2, and 3: PCE, TCA, and TCE
- Sites 4 and 7: lead
- Site 8: chromium, lead, and bis(2-ethylhexyl)phthalate

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- Site 9: TCE, xylenes, and mercury

This list will be reevaluated and may be revised when data from the RI field program are available.

8.1.2 Exposure Assessment

The public health exposure assessment will first identify the human population living near NASB or using the surrounding area, and will then characterize the human activity patterns (e.g., recreational and occupational) that may affect the extent to which this population is exposed to contaminants. These populations will include homeowners who use the JAW for domestic water supply, private or domestic wells in the vicinity of the base, or children who play in brooks, streams, or rivers immediately off-base and may be receptors of chemicals from NASB. These areas include Mere Brook, Merriconeag Stream, the Androscoggin River, and Harpswell Cove.

Potential routes of exposure for applicable environmental media will then be evaluated to identify the most significant site-specific routes of exposure. This evaluation will include direct contact with contaminated surface water or sediment in the surface water bodies identified previously, ingestion of contaminated groundwater (if applicable), and contact with soils (if they are found to be contaminated). Quantitative estimates of exposure dose levels will be developed for those potentially significant routes for which sufficient data are available (empirical or modeled). Because environmental chemical levels and human activity patterns are expected to vary over time, hypothetical scenarios encompassing a range of exposure conditions will be developed in an attempt to model both conservative and most-probable conditions at the site. If sufficient data are not available to quantitatively assess a significant exposure route, that exposure route will be discussed qualitatively.

8.1.3 Toxicity Assessment

The toxicity assessment will consist of a toxicological evaluation and a dose-response assessment. The toxicological evaluation will present brief toxicity profiles or summaries of the major toxic properties of the contaminants of concern as they relate to site conditions. The dose-response assessment is a list of pertinent federal and Maine state standards, criteria, and guidelines most appropriate for assessing risk to human health. This list provides the basis (along with hypothetical exposure doses calculated in the exposure assessment) for quantifying risk. This information can also be used in the FS in conjunction with chemical-specific ARARs information to help establish target clean-up levels for the site.

8.1.4 Risk Characterization

A public health risk characterization will be performed after the exposure and toxicity sections are completed.

In the health risk characterization, predicted exposure concentration ranges will be compared to dose-response information to develop a range of risk estimates for each chemical in each significant exposure route identified. In

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addition to generating numerical estimates, risks will be discussed in the context of conditions at each site. The risk characterization will then be summarized for each site by media, and risk summary tables will be included in the final section.

This risk characterization will serve as the baseline evaluation of contaminant conditions at each site. The information will be used to help determine whether remediation is warranted in each area and, if so, to what extent. During the remedial alternatives evaluation in the FS, each alternative will be compared to this baseline to determine whether it effectively reduces the identified risks, thereby adequately protecting public health.

8.2 ECOLOGICAL RISK ASSESSMENT

The purpose of the ecological RA for NASB is to define baseline ecological effects associated with chemical contamination of environmental media. The ecological RA supports the FS for site cleanup by providing information necessary to define remedial response objectives, develop and evaluate remedial alternatives, and design measures to mitigate adverse ecological effects associated with remedial activities.

Three elements comprise the ecological RA: (1) the biological characterization; (2) the ecological exposure assessment; and (3) the ecological risk characterization.

8.2.1 Biological Characterization

Several areas are potential ecological receptors of contamination, including Mere Brook, Merriconeag Stream, Harpswell Cove and associated wetlands, the Androscoggin River, several unnamed tributaries to these areas, and terrestrial ecosystems. These were described to some extent in the Initial Assessment (Weston, 1983). Jordan's biological characterization will verify and supplement the ecological information contained in the Weston report.

The first step of the biological characterization will be to identify the wetland and upland communities present at the site. Jordan will identify wetlands based on National Wetlands Inventory maps (if available), U.S. Geological Survey (USGS) topographic maps, aerial photographs, and field investigation. Surface water present at the base will be described and upland communities identified based on field investigation. The boundaries of the 100-year floodplain will also be delineated if sufficient information exists.

Next, Jordan will describe the species of aquatic and terrestrial vegetation present or expected at the site. Species of submergent, floating, emergent, shrub, and tree layer vegetation present in wetlands, streams, and other water bodies will be listed; herbaceous, shrub, and tree layer species will be described for upland areas.

Field personnel will record observations of terrestrial wildlife species (i.e., birds, mammals, reptiles, and amphibians). However, it is not possible to fully characterize all species of wildlife present without extensive trapping

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and field collection efforts. Therefore, Jordan scientists will perform a terrestrial wildlife habitat analysis based on the types of wetland and upland plant communities identified.

Aquatic organisms are more readily collected for identification than terrestrial wildlife. Jordan scientists will collect plankton, aquatic invertebrates, benthic macroinvertebrates, and fish for taxonomic identification in the surface water bodies and wetlands associated with NASB. Sampling equipment will include a plankton tow, an aquatic dip net, an Ekman dredge, and a beach seine. Site-specific characterization is important at NASB because aquatic organisms are the most likely receptors of chemical contamination, and extensive ecotoxicity data exist for them.

8.2.2 Ecological Exposure Assessment

Exposures to environmental contaminants will be evaluated in the ecological exposure assessment. Chemical exposure for organisms identified in the biological characterization will be assessed. The first step of the exposure assessment will be to develop exposure concentrations for each chemical in surface water, sediments, and surface soils. The primary basis for developing exposure concentrations will be analytical data for environmental samples.

The second step will be to identify life history characteristics for aquatic and terrestrial organisms that affect their potential exposure to chemical contaminants. These factors include home range, feeding preferences, habitat requirements, and reproductive characteristics. This information will be used to evaluate exposure pathways, such as direct contact with sediments or surface soils, uptake from the water column, and ingestion of contaminated prey.

The third and final step will be to combine analytical results with life history data to obtain an estimate of the degree of chemical exposure to aquatic and terrestrial organisms. At NASB, it is anticipated that exposures to aquatic organisms may be significant; insufficient data exist at this time to evaluate exposures to terrestrial organisms.

8.2.3 Ecological Risk Characteristics

The degree of risk to aquatic and terrestrial organisms will be evaluated based on results of the ecological exposure assessment and ecotoxicity data for chemicals present at NASB, which are available for many of the chemicals. These data describe the effects of chemicals on aquatic organisms, based on laboratory tests. However, limited test data are available for terrestrial organisms. By comparing results of ecotoxicity tests performed using test species identical or phylogenetically similar to organisms identified at NASB, the potential risk to aquatic organisms will be determined. If data are unavailable for terrestrial organisms, Jordan will qualitatively evaluate the potential risk to terrestrial systems. In addition, Jordan will report any such manifestations of stress observed during the biological characterization. The RA data and report will be presented in the RI report.

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9.0 RI AND MONTHLY PROGRESS REPORTS (TASK R6)

9.1 MONTHLY PROGRESS REPORTS

Jordan will prepare brief monthly progress reports to describe technical progress of the project. These reports will discuss the following items:

- identification of site and activity
- status of work at the site and progress to date
- percentage of completion and schedule status
- difficulties encountered during the reporting period
- actions being taken to rectify problems
- activities planned for the next month
- changes in personnel

The monthly progress report will list target and actual completion dates for each element of activity, including project completion, and will explain any deviation from milestones in the Work Plan.

9.2 RI REPORT

The RI report will contain results of information obtained during the RI at NASB, including information that is obtained during the additional field sampling phase described in Section 4.6. The data base for the RI report will be largely contained in three technical memoranda to be provided by Jordan following each round of field sampling (see Section 6.1). The RI report will include site-specific data and evaluations, including RI field investigations, laboratory analytical results, data validation, data evaluation, ARARs, and RA. The report will include but not be limited to the following items:

- a brief restatement of the appropriate IAS and SI findings and conclusions
- maps of activities identifying surveyed locations of sampling sites and subsurface explorations (maps will include local topography, wells, structures, survey control, and other pertinent information)
- a narrative describing the rationale used in the selection of analytical parameters and sampling objectives
- air monitoring results
- a detailed description of field investigations, including seep reconnaissance, soil gas results, geophysical survey results, test

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borings and monitoring well installations, test pitting, and aquifer permeability tests

- a site-specific assessment of actual/potential contaminant migration
- an RA including a public health evaluation and an environmental RA
- classify the on-site groundwater based on the Maine classification scheme
- chemical analytical results; analytical data will be stored on an IBM-compatible, microcomputer diskette (5-1/4 inch) and submitted to the Engineer in Charge at Northern Division, U.S. Department of the Navy.

The RI report will present and evaluate these data, forming the basis for the FS.

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10.0 FEASIBILITY STUDY

10.1 DESCRIPTION

Using results from the RI, an FS will be conducted for the NASB site. This study will consist of the following tasks:

- Preliminary Remedial Technology Identification (Task F9)
- Development of Alternatives (Task F10)
- Remedial Alternatives Screening (Task F11)
- Remedial Alternatives Evaluation (Task F12)
- FS Report (Task F13)
- Proposed Remedial Action Plan (Task F14)

Throughout the FS process, Jordan will use references, including SARA; USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (1988); National Oil and Hazardous Substances Pollution Contingency Plan: Final Rule, NCP (1985); Remedial Action Costing Procedures Manual (1984); Interim Guidance on Superfund Selection of Remedy, OSWER Directive (December 1986); Additional Interim Guidance for FY '87 Records of Decision, OSWER Directive (July 1987); Compendium of Costs of Remedial Technologies at Hazardous Waste Sites (1985); and technology-specific guidance and evaluation documents, as appropriate. As additional guidance regarding implementation of CERCLA reauthorization provisions becomes available, it will be incorporated in the FS process.

The overall objectives of the NASB site FS are to develop and evaluate remedial alternatives that will lead to the selection of a remedial action that:

- protects human health and the environment
- attains the legally applicable or relevant and appropriate federal and state public health and environmental requirements identified for the site, or provides the grounds for invoking one of the six waivers provided under CERCLA reauthorization
- uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, given technological feasibility and availability
- satisfies the preference for treatment that reduces toxicity, mobility, or volume as a principal element
- demonstrates cost-effectiveness

The selected remedial response should represent the best mix of effectiveness, implementability, and cost factors examined in the detailed analysis of alternatives.

The NASB FS will be conducted in a phased format consistent with the most recent USEPA RI/FS guidance. The phased approach will allow for coordinated

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interaction between RI and FS tasks. In this phased approach, the RI field activities focus on providing necessary information for the FS. Treatability studies and post-screening field investigations will be considered in the phased program to gather necessary information for the detailed analysis of alternatives.

Schedules for FS tasks as part of the NASB RI/FS are shown in Figures 2-1 and 2-2. The Preliminary Development of Alternatives (FS Phase I) will be completed after the initial RI field investigation is completed and one round of groundwater samples have been obtained from monitoring wells at the site. The data collected from the field investigation and one sampling round will be sufficient to develop quantitative remedial action objectives and general response actions. The Preliminary Development of Alternatives will also include identification and screening of applicable remedial technologies, and will conclude with the formal development of remedial alternatives for the NASB site.

Based on results of the initial field investigation and Preliminary Development of Alternatives, additional data may be required to complete the FS. A 28-week period will be necessary to conduct additional field sampling or to perform treatability studies to evaluate the applicability of a given technology to site conditions. Information obtained through additional field programs or treatability tests will focus on providing information for the detailed analysis of alternatives.

Additionally, data evaluation in conjunction with the Preliminary Development of Alternatives will allow Jordan to reassess the quarterly groundwater monitoring program after two rounds of sampling. After two rounds of data are obtained, Jordan will consider modifying the sampling program, including sampling frequency, parameters, and number of wells, to optimize data collection efforts and redirect future sampling to provide necessary information for the FS.

Jordan will complete a Draft Initial Screening Report (FS Phase II) four weeks after the Preliminary Development of Alternatives if no additional field sampling is required, or four weeks after completion of the additional sampling program. A Draft Post-Screening Work Plan will be submitted 10 weeks after the Initial Screening Report, which will outline additional treatability studies or post-screening investigations needed to complete the detailed analysis (FS Phase III). The detailed analysis of alternatives will be included in the FS report along with a discussion of alternative development and screening, results of bench/pilot studies, and remedy evaluation criteria. A draft proposed plan for the NASB site will be submitted with the draft FS.

The following sections provide a technical discussion regarding the components of each FS task.

10.2 PRELIMINARY REMEDIAL TECHNOLOGY IDENTIFICATION (TASK F9)

The preliminary remedial technology identification will use data collected during the RI and results of the RA to accomplish the following objectives:

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- development of remedial action objectives and general response actions
- identification and screening of applicable remedial technologies, including potential process options

10.2.1 Development of Remedial Action Objectives and General Response Actions

Using data collected in the RI, Jordan will develop remedial action objectives addressing substantial risks at the site. Remedial action objectives consist of media-specific goals for protecting public health and the environment. The remedial action objectives will specify the following:

- contaminants of concern
- exposure routes and receptors
- potentially acceptable contaminant levels or ranges of levels for each exposure route

Chemical- and location-specific ARARs will assist in determining the extent of site cleanup and will also be used to develop remedial action objectives.

General response actions describe media-specific measures that will satisfy the remedial action objectives, including consideration of treatment, containment, excavation, extraction, disposal, and institutional actions, or a combination of these measures. Jordan will use results of the RA and remedial action objectives to identify potential general response actions for the NASB sites. Identification of general response actions will also include an initial determination of areas or volumes of media to which the general response actions might be applied. For the NASB site, general response actions will be specific to contamination at each of the seven groups of sites. The subsequent development of remedial alternatives may either link groups of sites for similar remedial action, or maintain each group as a separate area with distinct remediation requirements.

10.2.2 Identification and Screening of Applicable Remedial Technologies

Based on remedial action objectives and general response objectives, Jordan will identify a list of applicable remedial technologies. Both source control and management of migration technologies will be identified for the NASB site, if necessary. Typically, broad technology types may be identified for each general response action, and several technology process options may exist within each technology type. Jordan will assess the applicability of different process options, given site conditions and the remedial action objectives.

Based on previous investigations at each site area, a preliminary list of applicable technologies for the NASB site may be identified. Remedial technology types can be identified for each site area to address primary contamination issues. The technology types can be further defined for each specific area after additional field data are collected and remedial action objectives have been established.

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Tables 10-1 through 10-4 present the initial identification of technology types and describe the general purpose of the potential remedial response in light of current understanding of environmental contamination. Additional technology types may also be necessary if the additional areas define source areas for groundwater and surface water contamination at site areas.

Source control and management of migration technologies will be screened on the basis of effectiveness and implementability, with emphasis on determining site or waste characteristics that might limit effectiveness or implementability at the site. In addition, implementability in terms of technical feasibility, demonstrated performance, availability of treatment, process residuals, storage and disposal services, and availability of contractors and equipment will be considered. Reasons for eliminating technologies in this stage will be documented in the FS report.

10.3 DEVELOPMENT OF ALTERNATIVES (TASK F10)

After remedial technologies have been defined and screened, Jordan will develop feasible remedial action alternatives. These will be further categorized as either source control or management of migration alternatives.

The purpose of source control alternatives is to prevent or minimize migration of hazardous substances from the source material. Management of migration alternatives typically involve groundwater response actions where contaminated groundwater has moved downgradient from the site. Groundwater and source control remedial alternatives will be presented separately in the FS report. Selection of remedial alternatives from each category will ensure a comprehensive site response that is effective and protective of both human health and the environment.

Alternative development will be governed by remedial action objectives, risk considerations, and other site remediation requirements. In keeping with CERCLA amendments and the NCP, a range of treatment alternatives will be developed by Jordan, based on the need for long-term management and each alternative's ability to reduce the mobility, toxicity, or volume of contaminants. A containment option involving little or no treatment and no-action alternatives will also be developed.

At this stage in the FS, each alternative will be described in sufficient detail to include the locations of areas to be excavated or contained, approximate volumes of soil and/or groundwater to be treated, and potential locations for interceptor trenches or discharges to surface water. These descriptions attempt to demonstrate the logic behind the assembly of general response actions into remedial technologies and remedial alternatives. The descriptions in the alternative development are broad, and are not substitutes for the detailed analysis of alternatives.

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TABLE 10-1

INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITES 1, 2, AND 3
RI/FS PROGRAM
NAS BRUNSWICK

SITES 1, 2, AND 3

Environmental Contamination	Potential Remedial Technology Types
Volatile organic constituents in groundwater downgradient of Site 1 and 3 in excess of MCLs	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring
Inorganic constituents (iron, chromium) in groundwater downgradient of Site 3 and at Sites 2 and 3	- Containment Technologies Capping Slurry Walls Grout Injection Interceptor Trench - Extraction Technologies Groundwater Pumping Wells Vapor Extraction Non-aqueous Phase Recovery - Treatment Technologies Aeration Precipitation/Flocculation/Neutralization (pretreatment scheme or inorganic treatment) Filtration Air Stripping Carbon Adsorption UV/O_3 Treatment Biological Treatment In-situ Biological Treatment Wet Air Oxidation Ion Exchange Reverse Osmosis Wastewater Treatment Facility (POTW) Off-site Treatment

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TABLE 10-[illegible]ntinued)

INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITES 1, 2, AND 3
RI/FS PROGRAM
NAS BRUNSWICK

SITES 1, 2, AND 3

Environmental Contamination	Potential Remedial Technology Types
	- Disposal Technologies POTW Discharge Subsurface Discharge Surface Water Discharge
Inorganic constituents in surface water near Site 3	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring
	- Collection Technologies Grading Diversion Collection
	- Treatment Technologies Aeration Precipitation/Flocculation/Neutralization Filtration Adsorption Neutralization
	- Disposal Technologies POTW Discharge Surface Water Discharge

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TABLE

INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITES 4 AND 7
RI/FS PROGRAM
NAS BRUNSWICK

SITES 4 AND 7

Environmental Contamination	Potential Remedial Technology Types
Methylene Chloride and Lead in Soil	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring - Containment Technologies Capping Slurry Walls Interceptor Trench Grading Soil Stabilization - Removal Technologies Excavation - Treatment Technologies Solidification/Stabilization In-situ Biological Treatment Biodegradation Low Temperature Thermal Aeration Incineration Vapor Extraction Supercritical Extraction Vitrification Soil Washing - Disposal Technologies Off-site Landfill On-site Landfill

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TABLE

INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITE 8
RI/FS PROGRAM
NAS BRUNSWICK

SITE 8

Environmental Contamination	Potential Remedial Technology Types
Inorganic constituents in groundwater at elevated concentrations	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring
Chloroform and bis(2-ethylhexyl)phthalate in groundwater	- Containment Technologies Capping Slurry Walls Grout Injection Interceptor Trench - Extraction Technologies Groundwater Pumping Wells Vapor Extraction Non-aqueous Phase Recovery - Treatment Technologies Aeration Precipitation/Flocculation/Neutralization (pretreatment scheme or inorganic treatment) Air Stripping Carbon Adsorption UV/O_3 Treatment Biological Treatment In-situ Biological Treatment Wet Air Oxidation Ion Exchange Reverse Osmosis Wastewater Treatment Facility (POTW) Off-site Treatment

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TABLE 10-3 (Continued)

INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITE 8
RI/FS PROGRAM
NAS BRUNSWICK

SITE 8

Environmental Contamination	Potential Remedial Technology Types
	- Disposal Technologies POTW Discharge Subsurface Discharge Surface Water Discharge
Methylene Chloride in Soil	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring
	- Containment Technologies Capping Slurry Walls Interceptor Trench Grading Soil Stabilization
	- Removal Technologies Excavation
	- Treatment Technologies Solidification/Stabilization In-situ Biological Treatment Biodegradation Low Temperature Thermal Aeration Incineration Vapor Extraction Supercritical Extraction Vitrification Soil Washing

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TABLE 10-3 (Continued)

INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITE 8
RI/FS PROGRAM
NAS BRUNSWICK

SITE 8

Environmental Contamination	Potential Remedial Technology Types
	- Disposal Technologies Off-site Landfill On-site Landfill
Inorganic constituents in surface water	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring
	- Collection Technologies Grading Diversion Collection
	- Treatment Technologies Aeration Precipitation/Flocculation Filtration Adsorption Neutralization
	- Disposal Technologies POTW Discharge Surface Water Discharge

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INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITE 9
RI/FS PROGRAM
NAS BRUNSWICK

SITE 9

Environmental Contamination	Potential Remedial Technology Types
Volatile organic constituents (TCE, chloroform, methylene chloride) in surface water	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring - Collection Technologies Grading Diversion Collection - Treatment Technologies Aeration Precipitation/Flocculation/Neutralization (Pretreatment) Filtration Adsorption Air Stripping Carbon Adsorption UV/O_3 Treatment Biological Treatment Wastewater Treatment Facility Off-site Treatment - Disposal Technologies POTW Discharge Surface Water Discharge
Inorganic constituents (mercury) in groundwater	- No Action/Institutional Action Fencing Deed Restrictions Environmental Monitoring

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TABLE 10-[illegible]ntinued)

INITIAL IDENTIFICATION OF REMEDIAL TECHNOLOGY TYPES: SITE 9
RI/FS PROGRAM
NAS BRUNSWICK

Environmental Contamination	Potential Remedial Technology Types
Inorganic constituents (mercury) in groundwater (continued)	- Containment Technologies Capping Slurry Walls Grout Injection Interceptor Trench - Extraction Technologies Groundwater Pumping Wells - Treatment Technologies Aeration Precipitation/Flocculation/Neutralization Filtration Adsorption Ion Exchange Wastewater Treatment Facility (POTW) - Disposal Technologies POTW Discharge Subsurface Discharge Surface Water Discharge

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10.4 REMEDIAL ALTERNATIVES SCREENING (TASK F11)

The list of remedial action alternatives will be screened to narrow the number of alternatives for subsequent detailed analysis, while still preserving a range of treatment options. The evaluations comprising this screening are not intended to substitute or supplement the detailed analysis of each alternative to be conducted in Task F12, Remedial Alternatives Evaluation.

The alternatives screening is the second of three phases in an FS. This phase attempts to further define the remedial action so that screening evaluations can be conducted. The scope and emphasis of the remedial alternative screening may vary, depending on the number and types of alternatives developed in Task F10 and the risks posed by separate site areas or contaminated media.

Three primary activities will be completed during alternative screening:

1. Alternatives will be further refined to provide information for quantifying areas and volumes to be remediated and to size process options.

2. Alternatives will be evaluated on a general basis with regard to effectiveness, implementability, and cost.

3. Based on this evaluation, alternatives will be screened from further consideration or retained for detailed analysis.

The screening is accomplished by considering the alternatives in terms of effectiveness, implementability, and cost factors. Cost is an important factor when comparing alternatives that provide similar results. However, costs may not be used to discriminate between treatment and nontreatment alternatives. The list of alternatives will be narrowed by eliminating the following:

- alternatives that are not technically reliable, do not effectively and adequately protect public health and the environment, or do not attain ARARs

- alternatives that are not technically feasible or available, or require significant institutional or administrative effort during implementation or operation

- alternatives that are significantly more costly than other alternatives, but fail to provide greater environmental/public health benefits, reliability, or effectiveness

Rationale for eliminating alternatives at this stage will be documented in the FS report. Remedial alternatives that contain innovative technologies will be carried through the screening if Jordan believes they offer potential for better treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs than demonstrated technologies.

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Results from the alternative screening will be presented in the Draft Initial Screening Report. The Initial Screening Report will also provide justification and recommendations for treatability studies for the NASB sites. Specific discussions regarding treatability study DQOs will be presented in the Post-Screening Work Plan.

10.5 REMEDIAL ALTERNATIVES EVALUATION (TASK F12)

The detailed analysis of alternatives (remedial alternatives evaluation) consists of several components:

- further definition of each alternative, including preliminary design calculations, process flow diagrams, sizing of key components, preliminary site layouts, and a discussion of limitations, assumptions, and uncertainties concerning the alternative
- assessment and summary of each alternative against evaluation criteria
- comparative analysis among alternatives to assess the performance of an alternative relative to each evaluation criterion

Remedial alternatives passing the alternative screening process (see Task F11) will be further evaluated and compared, as required in both the NCP and CERCLA as amended. In evaluating remedial alternatives, statutory factors listed in SARA Section 121(b)(1) must be addressed, including the following:

- long-term uncertainties of land disposal
- goals, objectives, and requirements of the Solid Waste Disposal Act
- persistence, toxicity, mobility, and bioaccumulation of contaminants at the site
- short- and long-term potential for adverse human health effects
- long-term maintenance costs
- potential for future remedial action costs
- potential threat to human health and the environment from the excavation, transportation, and redisposal or containment of hazardous substances, pollutants, or contaminants

Nine evaluation criteria were developed to address the CERCLA requirements and the considerations listed herein, as well as additional technical and administrative considerations. These criteria will serve as the basis for conducting the detailed analysis in the NASB FS. The criteria will also assist in comparing alternatives and subsequently help in selecting an appropriate remedial action. The evaluation criteria are as follows:

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- short-term effectiveness
- long-term effectiveness and permanence
- reduction of toxicity, mobility, or volume
- implementability
- cost
- compliance with ARARs
- overall protection of human health and the environment
- state acceptance
- community acceptance

The specific factors associated with each of the nine criteria are briefly summarized in the following sections.

10.5.1 Short-term Effectiveness

This evaluation considers the magnitude of reduction of existing risks and the time until full protection is achieved. Short-term risks that might be posed to the community, workers, or the environment during implementation are also assessed. Potential threats to human health and the environment associated with excavation, transportation, and redisposal/containment are addressed.

10.5.2 Long-term Effectiveness and Permanence

In this evaluation, factors associated with long-term effectiveness, permanence, and the degree of certainty that the remedy will succeed include the following:

- magnitude of residual risks associated with concentrations of waste remaining following implementation of a remedial action
- type and degree of long-term management required, including monitoring and operation and maintenance; this discussion includes an assessment of how well the technology is expected to perform once constructed, and the occurrence and extent of repairs and maintenance required under existing site conditions
- potential for exposure of human and environmental receptors to remaining waste, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal/containment
- long-term reliability of the engineering and institutional controls, including uncertainties associated with land disposal of untreated wastes and residuals

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- o potential need for replacement of the remedy

10.5.3 Reduction in Mobility, Toxicity, or Volume

In this evaluation, Jordan will address the ability of the remedial alternative to achieve a significant reduction in the mobility, toxicity, or volume of hazardous constituents. Permanence of remedial action and secondary waste management issues will also be discussed. Secondary waste management issues may include long-term monitoring of a site where wastes are contained with little or no treatment, or the management of concentrated hazardous waste residues remaining after the application of primary treatment methods, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances. Discussions regarding the quantity of hazardous materials to be treated, the degree of expected reduction in mobility, toxicity, or volume, and the irreversibility of the treatment will be included.

10.5.4 Implementability

The implementability of each alternative will be determined by evaluating the following:

- o technical feasibility and constructability of the technologies that each remedial alternative would employ
- o administrative feasibility of implementing each remedial alternative
- o availability of necessary services and materials

These implementability criteria are described in more detail in the following paragraphs.

Technical Feasibility. Jordan will assess whether the technologies comprising each remedial alternative could be applied under existing site conditions using available resources. Individual work activities will be described and technologies will be evaluated by considering several elements:

- o technical feasibility and demonstrated performance, given site- and waste-specific characteristics
- o difficulty of on-site construction/implementation and time required to complete construction and achieve remedial action objectives
- o ease of undertaking additional remedial actions
- o expected operational reliability of the technologies and the ability to monitor the effectiveness of the remedial alternatives
- o ability to perform operation and maintenance functions and the potential for replacing technologies

Administrative Feasibility. In this assessment, Jordan will assess the need for agency coordination, including the following:

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- ability and time required to obtain approvals from other agencies, and additional steps required to obtain approval

- activities needed to coordinate with other agencies

Availability of Services and Materials. This assessment examines issues regarding disposal services, storage capacity, and the need for specialists:

- available capacity and location of needed treatment, storage, and disposal services

- availability of necessary equipment, personnel, and special services

- timing of the availability of technologies under consideration

- availability of services, materials, and potential for obtaining competitive bids for innovative technologies

10.5.5 Cost

A detailed cost analysis will be performed for each alternative and will consist of the following steps:

- estimate the capital, operation, and maintenance costs

- calculate the annual costs and present worth

- evaluate the sensitivity of cost estimates to changes in key parameters (e.g., discount rates and effective life)

- summarize the data used in the alternative analysis

- assess the potential for future remedial action costs

For each alternative, the cost will be estimated within a range of -30 to +50 percent. The cost analysis will include separate evaluations of capital costs and operation and maintenance costs. Capital costs will consist of short-term installation costs, including engineering/design fees, materials and equipment, construction, and off-site treatment or disposal. Operation and maintenance costs will consist of long-term costs associated with operation and monitoring the remedial actions. Costs will be determined based on the anticipated time necessary for the alternative to achieve clean-up criteria, and will include costs of five-year reviews, where required.

A discount rate of 5 percent will be assumed for all present-worth calculations. Cost estimates will be prepared by Jordan using data from Jordan's project files, the current USEPA Remedial Action Costing Procedures Manual (1984), Compendium of Costs of Remedial Technologies at Hazardous Waste Sites (1985), USEPA technical reports, and quotations from equipment vendors. Equipment replacement costs will be included when the required performance period exceeds equipment design life.

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Sensitivity analyses will be conducted if sufficient uncertainty concerning specific assumptions exists. Potential candidates for consideration in the sensitivity analysis include the following:

- effective life of a remedial action
- operation and maintenance costs
- duration of cleanup
- volume of contaminated material
- other design parameters
- discount rate

10.5.6 Compliance with ARARs

ARARs will be considered during the detailed evaluation of alternatives. Alternatives will be assessed as to whether they attain ARARs or other federal and state environmental and public health laws. Action-specific ARARs will be outlined for each alternative, and chemical- and location-specific ARARs will be summarized. Jordan will develop tables for each alternative specifying what the remedial alternative must accomplish to attain ARARs. The tables will be used to establish design criteria for the selected remedial alternative.

10.5.7 Overall Protection of Human Health and the Environment

As part of the FS process, the ability of the remedial alternative to adequately protect public health and the environment will be evaluated. A comparison will be made between the potential public health risks for each remedial alternative and those for baseline site conditions, as predicted in the RA. Baseline site conditions represent the no-action alternative. Public Health Evaluations will be conducted according to guidance provided in the USEPA Superfund Public Health Manual.

Potential environmental impacts from each alternative will be compared with current (i.e., baseline) conditions described in the RA. Beneficial effects of each alternative will be evaluated by Jordan in terms of contaminant levels expected in environmental media during and after implementation of the remedial alternative; improvement in the biological environment as a result of decreased contamination levels; and improvement in human use resources (if applicable). Adverse effects associated with construction and operation of each alternative will be described in terms of direct effects (e.g., loss of habitat) or indirect effects (e.g., increased erosion and sedimentation). Measures to mitigate adverse effects will be outlined in this discussion.

10.5.8 State Acceptance

Concerns expressed by MEDEP will also be addressed during the evaluation of alternatives. Pertinent issues include the following:

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- o components of the alternatives that the state supports
- o components of the alternatives about which the state has reservations
- o components of the alternatives that the state strongly opposes

10.5.9 Community Acceptance

In this assessment, an evaluation of community attitudes toward the alternatives will be presented. Pertinent issues related to community acceptance include the following:

- o components of the alternatives that the community supports
- o components of the alternatives about which the community has reservations
- o components of the alternatives that the community strongly opposes

10.6 TREATABILITY STUDIES (TASK R5)

During the NASB FS, potentially applicable technologies will be evaluated to assess cost, effectiveness, and implementability. Many of these technologies are highly waste- and site-specific; that is, applicability and performance are dependent on site conditions and waste characteristics. Treatability studies can assess some of these variables and provide important information for use in the detailed analysis of remedial alternatives. Specific information provided by treatability studies includes the following:

- o the ability of technologies to meet remedial action objectives and discharge requirements (the need for advanced treatment or polishing steps can be identified through treatability studies)
- o the applicability and effectiveness of innovative, unproven technologies to site conditions and waste characteristics
- o detailed information on actual site costs and real field measurements of effectiveness for a proven technology (difficulties with implementing the technology [e.g., pretreatment requirements] can also be identified during the treatability study)

From information gathered in previous investigations, several important site and waste characteristics likely to impact the effectiveness, implementability, and cost of remedial alternatives were identified. These characteristics include the following:

Different Contaminant Locations. Contaminants were identified in several areas at the site. The potential exists for one treatment technology to be more feasible for treating contaminants in one area, and another to be more feasible in another area. Potential also exists for a variety of wastes to be buried in areas at the site.

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Data Deficiencies. Deficiencies in information relating to basic soil properties, such as moisture content, BTU content, total organic halogen, total organic carbon, silica content, clay content, mineral characterization, soil density, grain size, and pH, presently exist. Treatability studies will identify the effectiveness of treatment alternatives.

Treatability tests will be conducted (if appropriate) during two stages in the RI/FS process. Initially, treatability tests will be considered in conjunction with the additional field investigation, after the identification and screening of technologies and development of remedial alternatives has been completed. Treatability tests at this time would assist in performing the Remedial Alternatives Screening (Task F11) as well as the Remedial Alternatives Evaluation (Task F12). Treatability tests will also be considered in FS Phase III as part of the Post-Screening Field Investigation.

If treatability tests are performed immediately after the development of remedial alternatives, Jordan will discuss the scope of the tests in the Preliminary Development of Alternatives Report.

If treatability tests are conducted in the FS Phase III as part of the Post-Screening Field Investigation, Jordan will discuss the scope of the tests in the Post-Screening Work Plan. The Treatability Test Work Plan will describe DQOs for the studies, test objectives, experimental procedures and methods, and data analysis/interpretation.

The applicability of treatability study results will depend on the degree to which the operating conditions simulate those of anticipated full-scale operation. The process-specific information obtained during this study program will generate greater confidence in the detailed evaluation information, and will provide data for detailed cost estimates of a full-scale treatment facility.

10.7 FS REPORT (TASK F13)

The FS report will present a discussion of the alternative development and screening, including remedial action objectives, general response actions, and technology screening. Each alternative will be evaluated against the nine evaluation criteria in the detailed analysis of alternatives. The report will also provide a comparative evaluation of each alternative. The purpose of the comparative analysis is to identify the advantages/disadvantages of each alternative and to identify key tradeoffs to be evaluated by the decision-maker. A preliminary FS report outline is presented in Table 10-5.

10.8 PROPOSED REMEDIAL ACTION PLAN (TASK F14)

Section 117 of SARA requires USEPA to publish a notice and brief analysis of the Proposed Remedial Action Plan (PRAP) and provide the opportunity for public comment. The PRAP should contain sufficient information to provide an explanation of the proposed plan for remediation and alternative proposals considered.

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TABLE 10-5

FS REPORT OUTLINE
RI/FS PROGRAM
BRUNSWICK NAVAL AIR STATION

1.0 Executive Summary

2.0 Introduction

- 2.1 Report Purpose and Organization
- 2.2 Background Information (summarized from RI Report)
  - 2.2.1 Site Description
  - 2.2.2 Site History
  - 2.2.3 Nature and Distribution of Contamination
  - 2.2.4 Contaminant Fate and Transport
  - 2.2.5 Baseline Risk Assessment

3.0 Identification and Screening of Technologies

- 3.1 Remedial Action Objectives
  - 3.1.1 Soil
  - 3.1.2 Groundwater
  - 3.1.3
- 3.2 General Response Action
  - 3.2.1 Soil
  - 3.2.2 Groundwater
  - 3.2.3
- 3.3 Technology Identification
- 3.4 Technology Screening

4.0 Alternative Development

- 4.1 Source Control Alternatives
- 4.2 Management of Migration Alternatives

5.0 Alternative Screening

- 5.1 Source Control Alternatives
  - 5.1.1 Alternative SC-1
  - 5.1.N Alternative SC-N
- 5.2 Management of Migration Alternatives
  - 5.2.1 Alternative MM-1
  - 5.2.N Alternative MM-N
- 5.3 Screening Summary

6.0 Detailed Analysis of Source Control Alternatives

- 6.1 Alternative SC-1
  - 6.1.1 Description
  - 6.1.2 Assessment
    - o Short-term Effectiveness
    - o Long-term Effectiveness and Permanence

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TABLE 10-5 (cont.)

- o Reduction of Mobility, Toxicity, and Volume
- o Implementability
- o Cost
- o Compliance with ARARs
- o Overall Protection
- o State Acceptance
- o Community Acceptance

6.2 Alternative SC-2
- 6.2.1 Description
- 6.2.2 Assessment
  - o
  - o
  - o

6.3 Alternative SC-N
- 6.3.1 Description
- 6.3.2 Assessment
  - o
  - o
  - o

7.0 Detailed Analysis of Management of Migration Alternatives

7.1 Alternative MM-1
- 7.1.1 Description
- 7.1.2 Assessment
  - o
  - o
  - o

7.2 Alternative MM-N
- 7.2.1 Description
- 7.2.2 Assessment
  - o
  - o
  - o

8.0 Remedial Alternative Comparison

8.1 Source Control Alternatives
- 8.1.1 Short-term Effectiveness
- 8.1.2 Long-term Effectiveness and Permanence
- 8.1.3 Reduction of Mobility, Toxicity, and Volume
- 8.1.4 Implementability
- 8.1.5 Cost
- 8.1.6 Compliance with ARARs
- 8.1.7 Overall Protection
- 8.1.8 State Acceptance
- 8.1.9 Community Acceptance

8.2 Management of Migration Alternatives
- 8.2.1 Short-term Effectiveness
- 8.2.2 Long-term Effectiveness and Permanence

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TABLE 10-5 (cont.)

8.2.3 Reduction of Mobility, Toxicity, and Volume
8.2.4 Implementability
8.2.5 Cost
8.2.6 Compliance with ARARs
8.2.7 Overall Protection
8.2.8 State Acceptance
8.2.9 Community Acceptance
8.3 Remedial Alternative Summary

References
Appendices

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Jordan will prepare a report detailing the recommended plan for remediation at the NASB site. The PRAP will include the following:

- an introduction summarizing the purpose of the plan, the community's role, and background studies
- an identification of potential remedial alternatives and evaluation criteria
- a description of the proposed plan, including a description of plan components, key engineering and scheduling considerations, and the estimated capital and operating costs of the plan
- a comparative evaluation of remedial alternatives and conclusions stating the preferred alternative

Remedial actions will be evaluated on the following nine criteria:

- short-term effectiveness
- long-term effectiveness and permanence
- reduction of mobility, toxicity, or volume
- implementability
- cost
- compliance with ARARs
- overall protection of human health and environment
- state acceptance
- community acceptance

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11.0 POST-RI/FS SUPPORT

Jordan will provide technical support to the Navy for requested assistance in activities occurring after the RI/FS report is completed. The scope for this support will be determined from meetings with Jordan and the Navy, once the follow-up activities are identified. Technical support by Jordan will include community relations, assistance in preparing the Record of Decision or the responsiveness summary, and assistance during the remedial design/remedial action.

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GLOSSARY OF ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Caucus Inorganics Protocol
CLP	Contract Laboratory Program
COP	Caucus Organics Protocol
CRDL	Contract Required Detection Limits
CRP	Community Relations Plan
DOT	Department of Transportation
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
ECD	Electron Capture Detector
EMSI	Environmental Monitoring & Services, Inc.
FID	Flame Ionization Detector
FIT	Field Investigation Team
FS	Feasibility Study
GC	Gas Chromatograph
GPR	Ground-Penetrating Radar
GWQ	General Water Quality
HASP	Health and Safety Plan
HSA	Hollow-Stem Auger
IAS	Initial Assessment Study
IR	Installation Restoration
JAW	Jordan Avenue Wellfield
MCLs	Maximum Contaminant Levels
MDL	Method Detection Limits
MEDEP	Maine Department of Environmental Protection
NASB	Naval Air Station Brunswick
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NUS	NUS Corporation
OSWER	Office of Solid Waste and Emergency Response
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethylene
PI	Photoionization

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PRAP	Proposed Remedial Action Plan
PWO	Public Works Officer
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QAPPA	Quality Assurance Project Plan Addendum
RA	Risk Assessment
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
SOW	Statement of Work
SVOC	Semivolatile Organic Compounds
TBC	To Be Considered
TCA	Trichloroethane
TCE	Trichloroethylene
TCL	Target Compound List
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound

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REFERENCES

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E.C. Jordan. QAPP; 1988.

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Roy F. Weston, Inc. Initial Assessment Study Of Naval Air Station, Brunswick, Maine; June 1983.

Navy. SOW IR Program for Naval Air Station, Brunswick; November 1987.

NUS Corporation. Final Site Inspection Report for the U.S. Naval Air Station, Brunswick, Maine; August 1984.

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APPENDIX A

SITE-SPECIFIC HEALTH AND SAFETY PLAN

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SITE HEALTH AND SAFETY PLAN

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
CONTRACT: N62472-84-C-1108

PREPARED FOR

U.S. DEPARTMENT OF THE NAVY
NAVAL AIR STATION
BRUNSWICK, MAINE

PREPARED BY

E.C. JORDAN
PORTLAND, MAINE

APRIL 1988

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E.C. JORDAN CO.
SUMMARY SITE SAFETY PLAN

A. GENERAL INFORMATION

SITE: Brunswick Naval Air Station

SITE OWNER/CONTACT: U.S. Navy

LOCATION: Brunswick, ME

PLAN PREPARED BY: Mel Dickenson DATE: 1/27/88

APPROVED BY: Cindy Sundquist DATE: 4/13/88

OBJECTIVE(S): The objectives are to investigate the seven sites at BNAS using geophysics, soil gas, soil borings, test pits, groundwater monitoring wells, and collection and chemical analysis of soil and water samples as detailed in the RI/FS Work Plan.

PROPOSED DATE(S) OF INVESTIGATION: June 1988 - May 1989

BACKGROUND REVIEW: Complete: X Preliminary: ____

OVERALL HAZARD: Serious: ____ Moderate: ____ Low: X Unknown: ____

B. SITE/WASTE CHARACTERISTICS

SITE DESCRIPTION: The BNAS is used for all activities required to support their military aircraft. There are seven areas of concern. The site number and type of waste associated with each location are listed in Table 1. The location of each site is shown in Figure 1.

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TABLE 1. SITES TO BE INVESTIGATED

Site #	Name	Associated Wastes
1	Landfill-Orion Street Area	pharmaceutical wastes, off-spec. chemicals, wastes oils, filter packing from oil/water separator, pesticide and herbicide containers and degreasers
2	Landfill-Orion Street Area	solvents, paint residues, hydraulic fluids and oils
3	Hazardous Waste Burial Area	isopropyl alcohol, DANC, outdated paints and solvents
4	Acid/Caustic Pit	solvents, transformer oils, and pesticides
7	Old Acid/Caustic Pit	battery acid, caustics, pesticides, transformer oil and other liquid wastes
8	Perimeter Road Disposal Site	trash and solvents (TCE, MEK and toluene)
9	Neptune Drive Disposal Site	solvents and paint sludges

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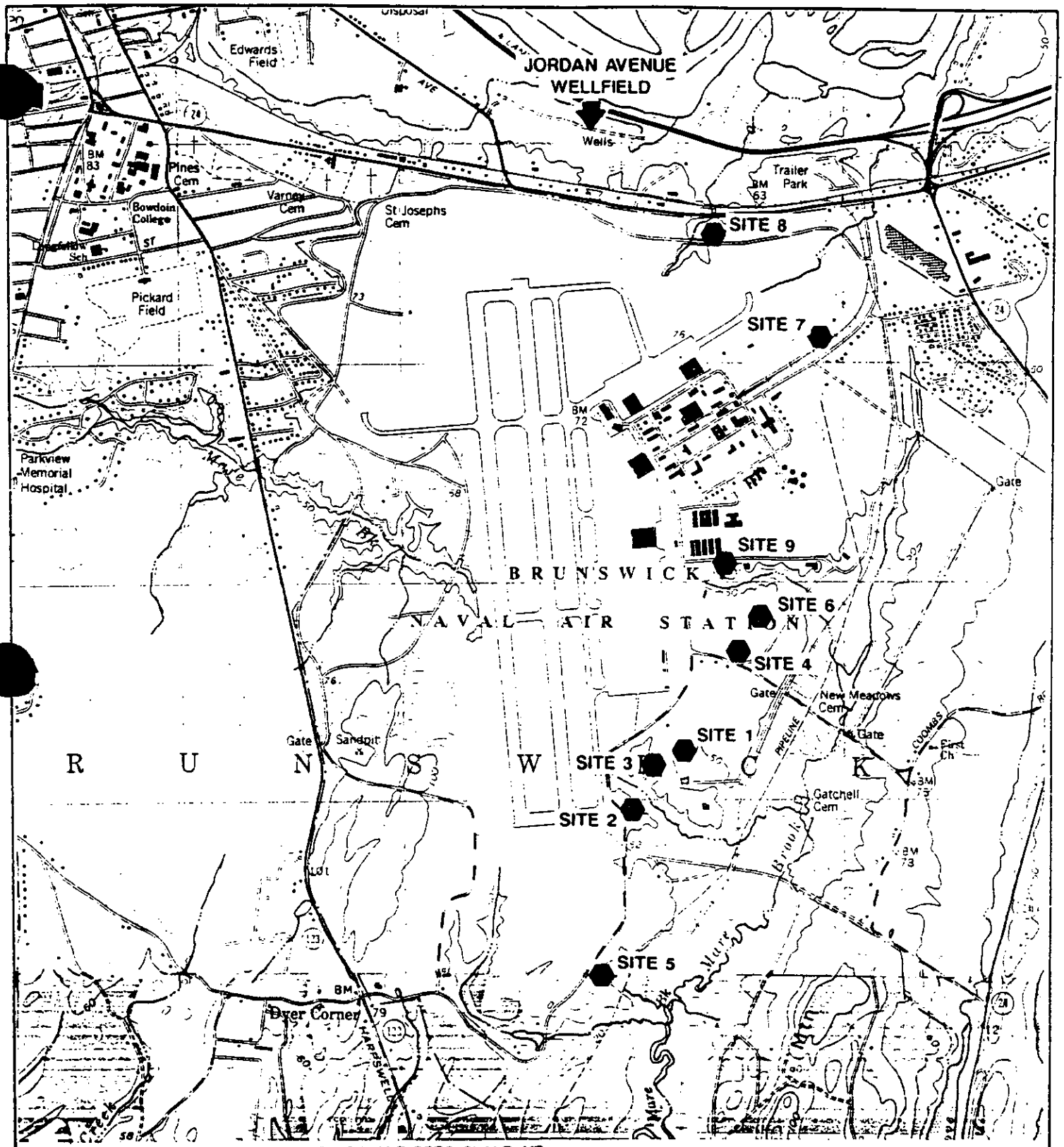

SOURCE: U.S.G.S. QUADRANGLES, BRUNSWICK, AND ORRS ISLAND, ME., 1984, 1978. 7.5 MINUTE SERIES.

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FIGURE 1
SITE LOCATION MAP
NAS BRUNSWICK

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WASTE DESCRIPTION:

Waste Types: Liquid X Solid X Sludge X Gas ___

Characteristics: Corrosive X Ignitable ___ Radioactive ___

Volatile X Toxic X Reactive ___ Unknown ___

Principal Disposal Method (type and location): The wastes generated and described in Table 1 were deposited in various pits, landfills, and disposal sites located on the base.

Unusual Features (dike integrity, power lines, terrain, etc.) None known as this time.

Status: (active, inactive, unknown) Inactive Sites/Active Base

History: (Worker or non-worker injury; complaints from public; previous agency action): The sites were identified as potential hazards under the Naval Assessment and Control of Installation Program (NACIP). No contamination or health problems associated with the sites have surfaced in the past.

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C. HAZARD EVALUATION

The suspected hazardous substances that may be encountered are listed in Table 2. It is not anticipated that large amounts of volatile substances will be encountered. Site conditions will be monitored at all times using a photoionization meter. Work on site will be conducted at level D respiratory protection and Level C or D dermal. The associated hazards may be greater with test borings and test pits than with the groundwater and surface water sampling. Upgrading of protection will be based on site conditions, and will be the responsibility of the Site Safety Officer. No confined spaces are expected.

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CONTAMINANTS OF CONCERN

Chemical	Approximate Odor Threshold (ppm)	TLV (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Methyl ethyl ketone	4.7-50	200	Colorless liquid, fragrant mint-like moderately-sharp odor.	low	Moderate inhalation toxicty. A strong irritant. Symptoms: Narcotic or anesthetic effects eye irritation, headache, dizziness. dizziness. Target organs: CNS, lungs.
Trichloroethylene	50	50	Sweet odor; colorless liquid. sol. = 0.1% density = 1.47		A strong skin and eye irritant. Moderate toxicity via inhalation and dermal routes Penetrates the skin. Symptoms: Headaches, vertigo, visual visual disturbance, tremors, somnolence, nausea, vomiting, irritated eyes, dermatitis, cardiac arrythmias, paresthesias. Target organs: Respiratory system, heart liver, kidneys, CNS, and skin.
Toluene	1	100 (skin)	Aromatic odor	Local + Systemic +	Penetrates through the skin.
Methylene chloride [CH_2Cl_2] dichloromethane methylene dichloride	500	100	colorless liquid	local systemic	Dangerous to eyes. It induces narcosis; can cause dermatitis with prolonged exposure highly volatile. It can decompose by contact with hot surfaces and open flame and produce toxic fumes. Symptoms: fatigue, weak, sleepy; limbs numb or tingling Target organ: skin, CVS, eyes,CNS <u>First Aid</u>: Swallow: Ipecac, vomit Incompatibilities: reacts violently with Li, Na, K, terbutoxite; strong oxidizers and caustics.

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D. SITE SAFETY PROCEDURES

Map/Sketch Attached? yes Site Secured? yes

Perimeter Identified? yes Zone(s) of Contamination Identified? No

Perimeter Establishment: Access to the BNAS restricted at all points.

MOBILIZATION AND SITE ENTRY: An air monitoring survey will be conducted prior to site investigation to assess health and safety requirements. A contamination reduction zone will be established at each site. Field work, preparation, staging and decontamination will take place in this area. Buddy System will be used at all times.

SITE MONITORING INSTRUMENTATION:	USE:
HNU photoionization meter	monitor volatiles
combustible gas indicator/O_2 meter	monitor LEL and O_2 level
radiation survey meter and dosimeter badges	monitor radiation exposure
Draeger Pump with Methylene Chloride and Benzene detector tubes	to measure Methylene Chloride and Benzene

TEAM ORGANIZATION:

Team Member	Responsibility	Qualified to Work @ Level
David Gulick	Site Safety Officer	A
Mel Dickenson	Technical Lead	A
Thomas Longley	Field Operations Leader	A

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PERSONNEL PROTECTION:

Task	Minimum Level Of Protection
Water Sampling	Level C dermal, level D Respiratory
Soil Sampling (boring & test pits)	Level D (uncoated tyveks)
Aquifer testing	Level C dermal
Well development	Level C dermal
Soil gas and geophysics	Level D

Action Level for Modification: Steady reading above background in the breathing zone.

Rationale: If steady reading above background is detected by PI meter, Draeger tube samples for benzene will be obtained. Methylene chloride samples using Draeger tubes will be taken simultaneously with the PI meter. Methylene chloride levels above 50 ppm Level B protection. Benzene above 1 ppm requires Level C protection.

DECONTAMINATION PROCEDURES:

Personnel- A decontamination procedure will be carried out by all personnel leaving hazardous waste sites. All disposable gloves and other equipment will be bagged and disposed on-site. Boots will be washed with soap and water. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination. Procedures for removal of protective clothing will be in accordance with Jordan policy.

Equipment- Standard clothing and equipment decontamination materials will be used. It is anticipated that drill rigs and backhoes contaminated during field activities will be steam cleaned. Loose materials will be removed by brush.

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WORK LIMITATIONS (Time of day, etc.): daylight hours, and as required by BNAS security.

PERSONNEL PROTECTIVE GEAR, DECONTAMINATION FLUID AND OTHER MATERIAL DISPOSAL:

Personnel will use level D respiratory protection with Level C dermal. See Table 3 for list of personnel protective gear. Decontamination fluids will be left on-site. Other disposable material will be bagged and turned over to base personnel for proper disposal.

SPECIAL FIRST AID INSTRUCTIONS:

Eye: flush eyes immediately with large quantities of water and get medical attention.

Skin: wash with soap and water and get medical attention promptly.

Breath: Move victim to fresh air and if breathing has stopped, perform artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Swallow: get medical attention immediately.

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E. EMERGENCY INFORMATION

LOCAL RESOURCES

Ambulance On Base: 921-2222 Local: 729-1477 or 725-5521

Hospital Emergency Room On Base: 921-2992 Local: 729-0181

Poison Control Center 1-871-2950

Police 725-5521

Fire Department On Base: 921-2457 Local: 911 or 725-5521

Airport

Explosives Unit On Base: 0800-1700 hrs 921-2210, 921-2622 Local 911 or 725-5521

USEPA Contact Charlotte Head

SITE RESOURCES

Water Supply Location on base

Telephone Number --

Radio Frequency 140.575

Other --

EMERGENCY CONTACTS

1. Maine Poison Control Center . . . . . (207) 871-2950
2. E.C. Jordan (Maine) . . . . . (207) 775-5401
3. E.C. Jordan (Florida) . . . . . (904) 656-1293
4. E.C. Jordan (Detroit) . . . . . (313) 569-3955
5. Envirologic Data . . . . . (207) 773-3020
6. USEPA Emergency Response . . . . . (800) 424-8802
7. National Poison Control Center . . . . . (800) 492-2414
8. CMA Chemical Referral Center . . . . . (800) 262-8200

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F. EMERGENCY ROUTES

(Give road or other directions; attach map)

HOSPITAL: Exit front gate, go left on Rt 24, go one mile to Maine Street, take left on Maine Street, go one mile. Parkview Hospital is on the left.

SITE EVACUATION: In the remote possibility that the site needs evacuating, Jordan personnel will notify BNAS authorities and evacuate through the nearest gate.

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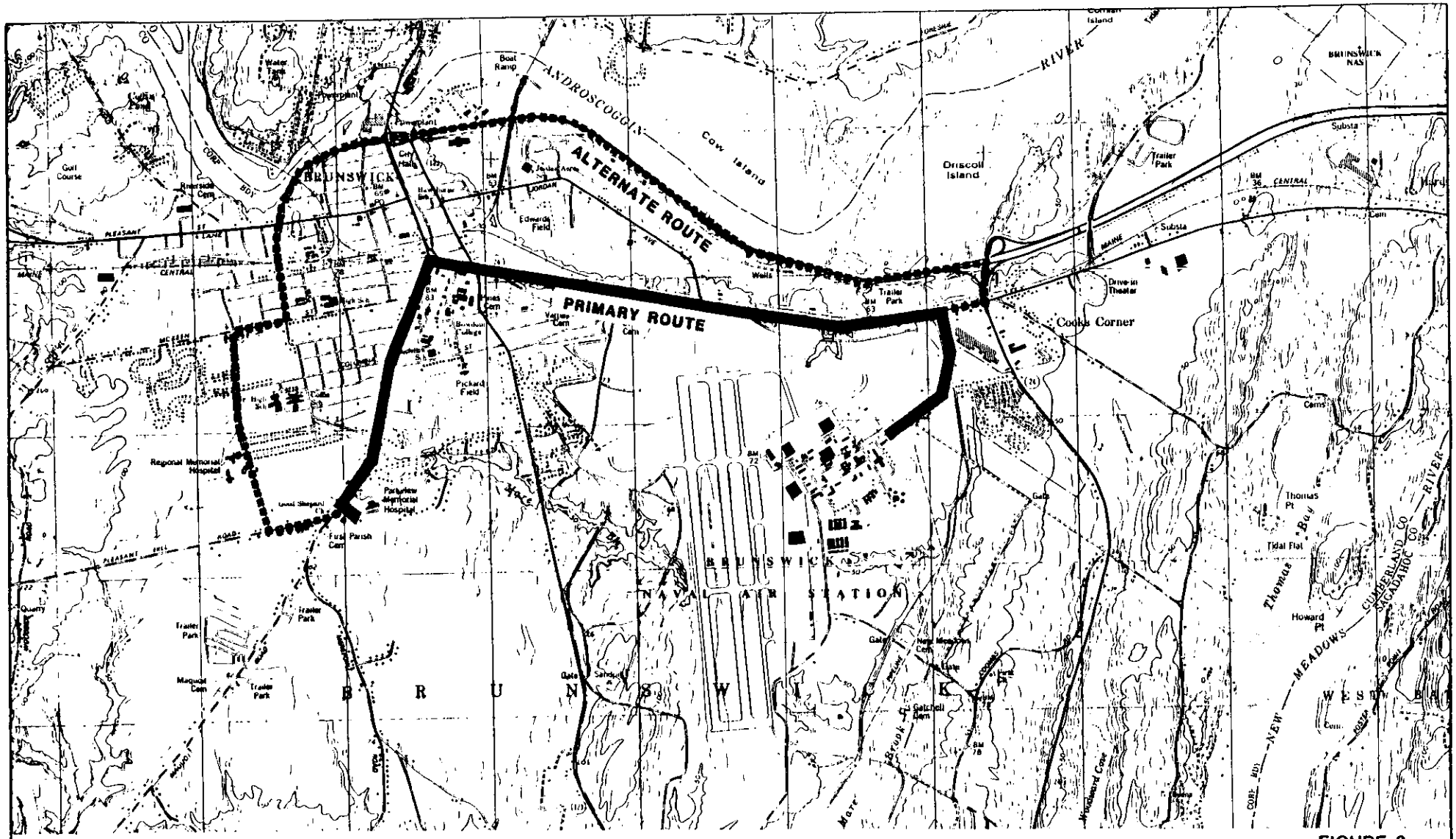

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FIGURE 2
EMERGENCY EVACUATION - HOSPITAL ROUTE
NAVAL AIR STATION
BRUNSWICK, MAINE
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TABLE 3
PERSONNEL SAFETY EQUIPMENT CHECK LIST

Quantity Required	Protective and Safety Equipment	Model or Material
	SCBA	MSA 401
	Spare Cylinders	
	Escape Mask	ELSA
1 pp	Full Face	
2 pp	Cartridge	
	Hardhat w/ Face Shield	
	*Safety Glasses	
	Ear Protection	
2 ppd	*Gloves, inner	surgical
1 ppd	*Gloves, outer:	nitrile
1 ppd	Chem Resist Coveralls	
	Disposable Coveralls	Coated Tyvek
	Splash Aprons	Vinyl
1 pp	*Boots: Safety Boots	
	Fully Encapsulated Suits	
	Dosimeters	TLD
	First Aid Equipment	
	*Utility first aid kit	
1	Industrial first aid kit	
1	Stretcher	
1	Oxygen	
1	*Eye Wash Station	Portable
	Emergency Shower	
1	*Fire Extinguisher	CO_2
	Safety Harness	
	Emergency Tools	
	Other	
1 per day	duct tape (rolls)	
2 per day	Draeger Pump	
20	Draeger Tubes for Methylene Chloride	
20	Draeger Tubes for Benzene	
2	Radiation Survey Meter	
2	LEL/Oxygen Meter	

* - Mandatory
pp - per person
ppd - per person per day

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TABLE 4

DECONTAMINATION EQUIPMENT/MATERIALS

Quantity	Type	Remarks
1	wash tubs	
	high pressure water sprayer	
1	cold	
	hot	
1	steam sprayer	
4	scrub brushes	
	containers	
	contaminated liquids	
1	contaminated disposables	trash bags
x	detergent	
	methanol/acetone/isopropanol	
x	clean water	
x	disposable wipes	
x	plastic wrap	
x	Ziploc bags	

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G. FIELD TEAM REVIEW

(This sheet must be received by the Site Safety Officer prior to onsite activity)

I, _____, have read the Site Safety Plan for the _____ site. I understand the rationale for the safety procedures specified and for modification of those procedures. I agree to comply with the provisions of this safety plan.

Signature _____

Date _____

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TRICHLOROETHYLENE

TCL

Common Synonyms	Watery liquid	Colorless	Sweet odor
Trichloroethylene Trilene, Algylen Chlorylen Gemalgene Trethylene Trichloran, Trilene	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $CHCl=CCl_2$
3.3 IMO/UN Designation: 9.0/1710
3.4 DOT ID No.: 1710
3.5 CAS Registry No.: 79-01-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Chloroform-like; ethereal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic, vapor-acid gas canister; self-contained breathing apparatus for emergencies, neoprene or vinyl gloves, chemical safety goggles, face-shield; neoprene safety shoes, neoprene suit or apron for splash protection.
5.2 Symptoms Following Exposure: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.
5.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting, repeat three times, then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min
5.6 Toxicity by Ingestion: Grade 3, LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 50 ppm
5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 90°F C.C.; practically nonflammable
6.2 Flammable Limits in Air: 8.0%-10.5%
6.3 Fire Extinguishing Agents: Water fog
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 770°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: 660 mg/l/40 hr/daphnia/kill/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical; dry cleaning; degreasing, extraction
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 16°C and 1 atm: Liquid
12.2 Molecular Weight: 131.39
12.3 Boiling Point at 1 atm: 189°F = 87°C = 360°K
12.4 Freezing Point: −123.5°F = −86.4°C = 186.8°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.46 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 34.5 dynes/cm = 0.0345 N/m at 24°C
12.10 Vapor (Gas) Specific Gravity: 4.5
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4×10^4 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 2.5 psia

NOTES

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TOLUENE

TOL

Common Synonyms	Watery liquid	Colorless	Pleasant odor
Toluol Methylbenzene Methylbenzol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Evacuate area

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_6H_5CH_3$
3.3 IMO/UN Designation: 3.2/1294
3.4 DOT ID No.: 1294
3.5 CAS Registry No.: 108-88-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract, cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.
5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed, call a doctor. INGESTION: do NOT induce vomiting, call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 600 ppm for 30 min
5.6 Toxicity by Ingestion: Grade 2, LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Kidney and liver damage may follow ingestion
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.17 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 40°F C.C.; 55°F O.C.
6.2 Flammable Limits in Air: 1.27%-7%
6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 997°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.7 mm/min.
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 8 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research, reagent, nitration-at 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 80/120 less pure than industrial.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 92.14
12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K
12.4 Freezing Point: −139°F = −95.0°C = 178.2°K
12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K
12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m^2
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.089
12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61×10^5 J/kg
12.13 Heat of Combustion: −17,430 Btu/lb = −9686 cal/g = -405.5×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 17.17 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 1.1 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

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METHYL ETHYL KETONE

MEK

Common Synonyms	Liquid	Colorless	Sweet odor
MEK 2-Butanone Ethyl methyl ketone	Floats and mixes with water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, alcohol foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Ketone
3.2 Formula: $CH_3COCH_2CH_3$
3.3 IMO/UN Designation: 3.2/1193
3.4 DOT ID No.: 1193
3.5 CAS Registry No.: 78-93-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like acetone; pleasant; pungent

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic canister or air pack, plastic gloves, goggles or face shield
5.2 Symptoms Following Exposure: Liquid causes eye burn. Vapor irritates eyes, nose, and throat; can cause headache, dizziness, nausea, weakness and loss of consciousness
5.3 Treatment of Exposure: INHALATION: remove victim to fresh air, if breathing is irregular or has stopped, start resuscitation and administer oxygen. EYES: wash with plenty of water for at least 15 min. and call physician
5.4 Threshold Limit Value: 200 ppm
5.5 Short Term Inhalation Limits: 290 mg/m³ for 60 min
5.6 Toxicity by Ingestion: Grade 2, LD_{50} = 0.5 to 5 g/kg (rat)
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin
5.10 Odor Threshold: 10 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 20°F C.C.; 22°F O.C.
6.2 Flammable Limits in Air: 1.8%-11.5%
6.3 Fire Extinguishing Agents: Alcohol foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 961°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 4.1 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 18

8. WATER POLLUTION

8.1 Aquatic Toxicity: 5640 mg/l/48 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 214%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: 99.5+%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P-Q-R-S

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	1
Aesthetic Effect	1
Reactivity	
Other Chemicals	2
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 72.11
12.3 Boiling Point at 1 atm: 175.3°F = 79.6°C = 352.8°K
12.4 Freezing Point: −123.3°F = −86.3°C = 186.9°K
12.5 Critical Temperature: 504.5°F = 262.5°C = 535.7°K
12.6 Critical Pressure: 603 psia = 41.0 atm = 4.15 MN/m²
12.7 Specific Gravity: 0.806 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 2.5
12.11 Ratio of Specific Heats of Vapor (Gas): 1.075
12.12 Latent Heat of Vaporization: 191 Btu/lb = 106 cal/g = 4.44×10^5 J/kg
12.13 Heat of Combustion: −13,480 Btu/lb = −7491 cal/g = -313.6×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: (est.) −9 Btu/lb = −5 cal/g = -0.2×10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.5 psia

NOTES

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DCM

Common Synonyms			
Methylene chloride Methylene dichloride	Watery liquid	Colorless	Sweet, pleasant odor

Sinks in water. Irritating vapor is produced.

Stop discharge if possible
Avoid contact with liquid and vapor
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Not flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.
Wear goggles and self-contained breathing apparatus
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea and dizziness.
Move to fresh air
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and pollution control officials
Notify operators of nearby water intakes

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Disperse and flush

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: CH_2Cl_2
3.3 IMO/UN Designation: 9.0/1593
3.4 DOT ID No.: 1593
3.5 CAS Registry No.: 75-09-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Pleasant, aromatic; like chloroform; sweet, ethereal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic vapor canister mask, safety glasses, protective clothing
5.2 Symptoms Following Exposure: INHALATION: anesthetic effects, nausea and drunkenness
CONTACT WITH SKIN AND EYES: skin irritation, irritation of eyes and nose
5.3 Treatment of Exposure: INHALATION: remove from exposure. Give oxygen if needed
INGESTION: no specific antidote. CONTACT WITH SKIN AND EYES: remove contaminated clothing, wash skin or eyes if affected
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min
5.6 Toxicity by Ingestion: Grade 2, LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin
5.10 Odor Threshold: 205-307 ppm
5.11 IDLH Value: 5,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable under conditions likely to be encountered.
6.2 Flammable Limits in Air: 12%-19%
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Dissociation products generated in a fire may be irritating or toxic.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 1184°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: Not pertinent
8.2 Waterfowl Toxicity: Not pertinent
8.3 Biological Oxygen Demand (BOD): Not pertinent
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Aerosol grade; technical grade
9.2 Storage Temperature: Data not available
9.3 Inert Atmosphere: Inerted
9.4 Venting: Data not available

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	1
Aesthetic Effect	2
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	0
Reactivity (Yellow)	1

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 16°C and 1 atm: Liquid
12.2 Molecular Weight: 84.93
12.3 Boiling Point at 1 atm: 104°F = 39.8°C = 313.0°K
12.4 Freezing Point: −142°F = −96.7°C = 176.5°K
12.5 Critical Temperature: 473°F = 245°C = 518°K
12.6 Critical Pressure: 895 psia = 60.9 atm = 6.17 MN/m²
12.7 Specific Gravity: 1.322 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 2.9
12.11 Ratio of Specific Heats of Vapor (Gas): 1.199
12.12 Latent Heat of Vaporization: 142 Btu/lb = 78.7 cal/g = 3.30 X 10⁵ J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 16.89 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 13.9 psia

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APPENDIX B

QUALITY ASSURANCE PROJECT PLAN ADDENDUM

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM

REMEDIAL INVESTIGATION
SITES 1, 2, 3, 4, 5, 6, 7, 8, and 9
NAVAL AIR STATION, BRUNSWICK, MAINE
CONTRACT N62472-84-C-1108

PREPARED FOR

U.S. DEPARTMENT OF THE NAVY

PREPARED BY

E.C. JORDAN
PORTLAND, MAINE

APRIL 1988

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1.0 PROGRAM DESCRIPTION

This Quality Assurance Project Plan Addendum has been developed in conjunction with E.C. Jordan's (Jordan) Quality Assurance Program Plan (QAPP) dated February 1988 prepared for the U.S. Department of the Navy's Installation Restoration Program. This addendum references specific sections of the February 1988 QAPP applicable to the RI/FS program at NASB.

1.1 PURPOSE

The purpose of the QAPP is to indicate prime responsibilities and prescribe requirements for assuring that the specific site investigations undertaken by Jordan for the Installation Restoration (IR) Program are planned and executed in a manner consistent with quality assurance objectives. The QAPP provides guidance and specifications to assure that:

- field determinations and analytical results are valid through preventive maintenance, calibration and analytical protocols;
- samples are identified and controlled through sample tracking systems and chain-of-custody (COC) protocols;
- records are retained as documentary evidence of the quality of samples, applied processes, equipment, and results;
- generated data are validated and their use in calculations is documented;
- calculations and evaluations are accurate, appropriate and consistent throughout the projects; and
- safety is maintained by requiring inclusion of the Health and Safety staff in the project organization.

1.2 SCOPE

The requirements of the QAPP apply to all Jordan and subcontractor activities as appropriate for each specific task undertaken. Section 3.0 of that plan provides a description of the quality assurance plan for the IR program. Section 4.0 describes the organization of the program and responsibilities of personnel. The program's quality assurance objectives are summarized in Section 5.0. Section 6.0, the largest section, provides details of sampling procedures for all aspects of the RI field work, with Section 7.0 focusing on sample custody and tracking procedures. Calibration procedures for field instruments are presented in Section 8.0. Sections 9.0 through 12.0 discuss the analytical program, data reporting and validation, quality control, and audits. Sections 13.0 through 16.0 briefly discuss preventive maintenance, data quality assessment, corrective actions to remedy conditions or practices with adverse input in data quality, and reporting.

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1.3 SUBTASKS

The following list of tasks references site specific activities described more fully in the QAPP and the RI/FS Work Plan that will be implemented at NASB during the RI/FS Program.

	Standard QAPP Protocol Selected
Sample Labels and Records	6.1
Sample Containers	6.2
Decontamination	6.3
o Drilling rigs, equipment and backhoes will be steam cleaned between locations	
Air Sampling	6.5
o Draeger tubes for methylene chloride and benzene as appropriate	
o Radiation survey meter	
Soil Sampling (borings and test pits)	6.6
o Program intent is to drill with hollow stem augers; in some areas due to geologic conditions it may be necessary to use casing (see RI/FS work plan)	
o Shallow soil samples will be collected by split spoon or with a tulip bulb planter during the drilling program.	
Sediment Sampling	6.6.5
o Sediments will generally be sampled using a gravity corer. In cases of poor recovery, a Ponar dredge or split spoon with a teflon basket may be required.	
Water Sampling	6.7
o No domestic well or wastewater sampling is anticipated	
o If ambient well-mouth organic vapors consistently exceed 1 ppm during sampling, sampling personnel will upgrade to Level C respiratory protection (see Health and Safety Plan for more information).	

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	Standard QAPP Protocol Selected
o Electronic water level meters will be rinsed with DI water subsequent to the ethanol:methanol rinse	
o Surface water samples will not be composited	
Soil Gas Sampling	6.8
o Will use a Varian 3300 or HP 5890 gas chromatograph or equivalent equipped with FID and ECD capabilities	
o Hollow steel probes will be driven into the ground for sampling, silicon tubing will be attached to the probe and pierced for sampling with an air tight syringe	
o Quality control will include three point calibration curves, air blanks, sample equipment blanks, and duplicates	
o Additional descriptions of current soil gas sampling methods and procedures are included in the RI/FS work plan	
Hydrocarbon Screen for Soil/Sediment and Water Samples	6.9
o To assist in determining which test boring and test pit soil samples will be submitted for laboratory analysis, a field gas chromatograph equipped with a PID will be utilized	
o Samples will be obtained by air tight syringe of headspace in the soil sample jars	
Sample Custody and Shipping, Data Tracking and Handling	7.0
Calibration Procedures and Frequency	8.0
Analytical Procedures	9.0
Data Management and Validation	10.0
Internal Quality Control	11.0
Audits	12.0
Preventive Maintenance	13.0
Data Assessment	14.0

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	Standard QAPP Protocol Selected
Corrective Action	15.0
Reports to Management	16.0
Aquifer Permeability Testing	see RI/FS work plan
Geophysical Explorations	see RI/FS work plan

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2.0 PERSONNEL

2.1 TASK ORGANIZATION

Name	Function
R. Wardwell	IR Program Manager
D. Gulick	Task Order Manager
M. Dickenson	Technical Lead
C. Olson	Contracts Administration

Subcontractors	Function
John Mathes & Associates, Inc.	Boring and Well Installation
EMSI	Chemical Analysis

NASB Contacts	Function
David Webster	USEPA, Superfund Section Chief
Charlotte Head	USEPA, Remedial Project Manager
Ronald Springfield	U.S. Navy, Northern Division

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SAMPLING DATA

Matrix/Analysis	No.[1] Samples	Duplicates	Sampler Blanks	Filtration Blanks	Trip Blanks	MS/MSD	Total
Water:							
VOA CLP-COP	225	23	3	--	6	26	283
VOA Drinking Water Analytical Methods	24	3	3	--	3	4	40
SVOA CLP-COP	249	25	3	--	--	28	305
Metals CLP-CIP	249	25	3	6	--	29	312
Pest/PCB CLP-COP	249	25	3	--	--	28	305
General Water Quality	60	7	3	--	--	8	78
Soil/Sediment:							
VOA CLP-COP	184	19	8	--	--	22	233
SVOA CLP-COP	184	19	8	--	--	22	233
Metals CLP-CIP	184	19	8	--	--	22	233
Pest/PCB CLP-COP	184	19	8	--	--	22	233

Locations of duplicate sampling to be determined in the field.

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SAMPLE IDENTIFICATION/CROSS REFERENCE

ECJ ID NO.	SAMPLE LOCATIONS
Monitoring Well Water Samples	
MW101 through 106XXXX	MW-101 through 106
MW201 through 213XXXX	MW-201 through 213
MW401 through 405XXXX	MW-401 through 405
MW701 through 706XXXX	MW-701 through 706
MW801 through 808XXXX	MW-801 through 808
MW901 through 905XXXX	MW-901 through 905
Test Boring Soil Samples	
TB201 through 213XXXX	TB-201 through 213
TB404 through 405XXXX	TB-404 through 405
TB704 through 706XXXX	TB-704 through 706
TB805 through 808XXXX	TB-805 through 808
TB904 through 905XXXX	TB-904 through 905
Test Pit Soil Samples	
TP101 through 110XXXX	TP-101 through 110
Surface Water Samples	
SW001 through 032XXXX	SW-001 through 032
Sediment Samples	
SD001 through 033XXX	SD-001 through 033

DEPARTMENT OF THE NAVY
5608
COPIER