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NAS BRUNSWICK
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RECORD OF DECISION
FOR A
REMEDIAL ACTION
AT
SITES 1 AND 3
NAVAL AIR STATION BRUNSWICK, MAINE

June 1992

NAVAL AIR STATION BRUNSWICK
RECORD OF DECISION

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DECLARATION

SITE NAME AND LOCATION

Naval Air Station (NAS) Brunswick, Sites 1 and 3
Brunswick, Maine

STATEMENT OF BASIS AND PURPOSE

This decision document presents a selected remedial action that will provide containment of landfill wastes and contaminated groundwater at Sites 1 and 3 on the NAS Brunswick in Brunswick, Maine. This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Contingency Plan. Through this document, the Navy plans to remedy the threat to human health, welfare, or the environment posed by contaminated groundwater, leachate, surface water, and sediment associated with Sites 1 and 3. This decision is based on the Administrative Record for the site. The Administrative Record for this site is located at the Public Works Office at NAS Brunswick.

The State of Maine Department of Environmental Protection (MEDEP) and the U.S. Environmental Protection Agency (USEPA) concur with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from Sites 1 and 3, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This action addresses the principal threat posed by Sites 1 and 3 by preventing endangerment of public health, welfare, or the environment by implementation of this ROD through containment of the waste and recovery of contaminated groundwater to prevent further migration to Mere Brook.

The selected remedy includes containment by constructing a cap over the landfills and a slurry wall around the waste to divert clean water away from the landfills. Contaminated groundwater contained by the cap and slurry wall will be pumped

using extraction wells and treated by chemical oxidation, flocculation, clarification, and filtration to remove inorganic compounds, and ultraviolet/oxidation to destroy organic compounds prior to discharge. Eliminating leachate seeps will mitigate surface water and sediment contamination in Mere Brook.

It is expected that treatment of contaminated groundwater from Sites 1 and 3 will be treated concurrently with groundwater extracted from the Eastern Plume, a plume emanating from a separate source on the base. Treatment of the combined waste streams was considered because of the similar contaminants, the low flow rate of groundwater from Sites 1 and 3, the short duration of the Sites 1 and 3 remedy's pump-and-treat component, and concurrent remediation schedules.

The preferred discharge method for treated water is the local wastewater treatment facility; however, the Brunswick Sewer District has not yet agreed to accept this additional hydraulic loading from the groundwater treatment system. Treated water must meet the pretreatment standards established by the local wastewater treatment facility. Ultimate discharge is to the Androscoggin River via a National Pollutant Discharge Elimination System permit. Before designing the treatment system, treatability tests will be conducted to provide information on the compounds and concentrations likely present in the effluent. Other options for effluent discharge considered in the Feasibility Study include surface water (i.e., Mere Brook), groundwater infiltration, and the Town of Brunswick storm sewer system.

Before start-up of the groundwater extraction system, the Navy will submit a monitoring program for approval by the MEDEP and the USEPA. The purpose of the monitoring program is to confirm that the containment system is effective.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances remaining on site, a review will be conducted by the Navy, the USEPA, and the MEDEP within five years after start-up of the containment and extraction well system to ensure that the remedy continues to provide adequate protection of human health and the environment. This review will be conducted at least every five years as long as hazardous substances remain on site above health-based cleanup levels.

The foregoing represents the selection of a remedial action by the Department of the Navy and the U.S. Environmental Protection Agency, Region I, with concurrence of the Maine Department of Environmental Protection.

Concur and Recommend for immediate implementation:

By: _____ Date: 12 June 92

Thomas A. Dames

Title: Captain CEC, U.S. Navy
Commanding Officer
Northern Division
Naval Facilities Engineering Command

By: _____ Date: 10 June 1992

H.M. Wilson

Title: Captain, U.S. Navy
Commanding Officer
Naval Air Station
Brunswick, Maine

The foregoing represents the selection of a remedial action by the Department of the Navy and the U.S. Environmental Protection Agency, Region I, with concurrence of the Maine Department of Environmental Protection.

By: Julie Belaga Date: June 16, 1992

Julie Belaga

Title: Regional Administrator, USEPA

DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

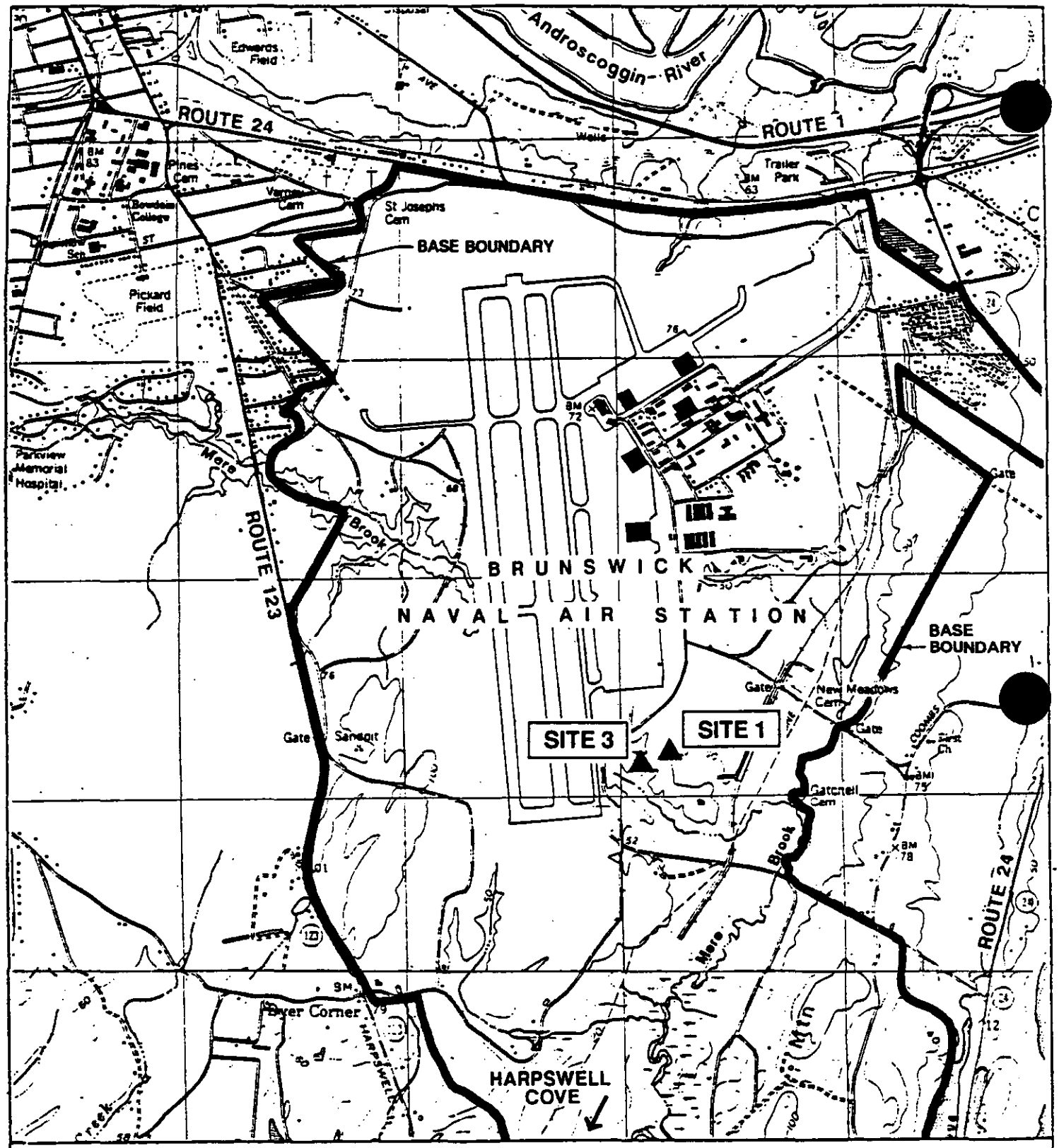
The U.S. Naval Air Station (NAS) Brunswick is a National Priorities List (NPL) site. There are currently 13 areas (Sites) within NAS Brunswick under investigation. This Record of Decision (ROD) relates to the contamination at Sites 1 and 3. These sites were grouped together based on their proximity and common historical land use (i.e., landfill areas).

NAS Brunswick is located south of the Androscoggin River between Brunswick and Bath, Maine, south of Route 1 and between Routes 24 and 123 (Figure 1). Undisturbed topography at NAS Brunswick is characterized by low, undulating hills with deeply incised brooks; ground surface elevations range from mean sea level (MSL) in lowland drainage areas and the Harpswell Cove estuary, to over 110 feet MSL west and southeast of the southern end of the runways. Topography in the developed areas of the base has been modified by construction, with ground surface elevations generally ranging from 50 to 75 feet above MSL.

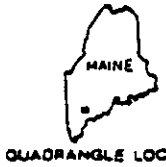
NAS Brunswick is located on 3,094 acres. The operations area (138 acres) lies east of the two parallel runways and consists of numerous office buildings, a steam plant, fuel farm, barracks, recreational facilities, base housing, hangars, repair shops, and other facilities to support NAS Brunswick aircraft. Forested areas (approximately 48 percent), grasslands (approximately 28 percent), and paved areas (approximately 12 percent) comprise most of the base property. Paved areas are mostly flight ramps and runways. The remaining 12 percent of the base includes the operations area (approximately 5 percent) and miscellaneous shrubland, marsh, and open water. The southern edge of the base borders coves and estuaries of the Gulf of Maine/Atlantic Ocean.

Property uses surrounding NAS Brunswick are primarily suburban and rural residential, with some commercial and light industrial uses along Routes 1, 24, and 123. An elementary school, a college, and a hospital are located within 1 mile of the western base boundary.

The general area of Site 1 covers more than 60 acres, although the specific area of documented refuse disposal is much smaller, approximately 8.5 acres. Site 3, contiguous to Site 1, occupies an area of approximately 1.5 acres (Figure 2). The 8.5-acre disposal area at Site 1 is currently an open, slightly rolling, grass-covered field bordered to the north, west, and east by woodlands, and to the south by the



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



QUADRANGLE LOCATION

SCALE IN FEET

0 2,000 4,000

FIGURE 1
SITE LOCATION MAP

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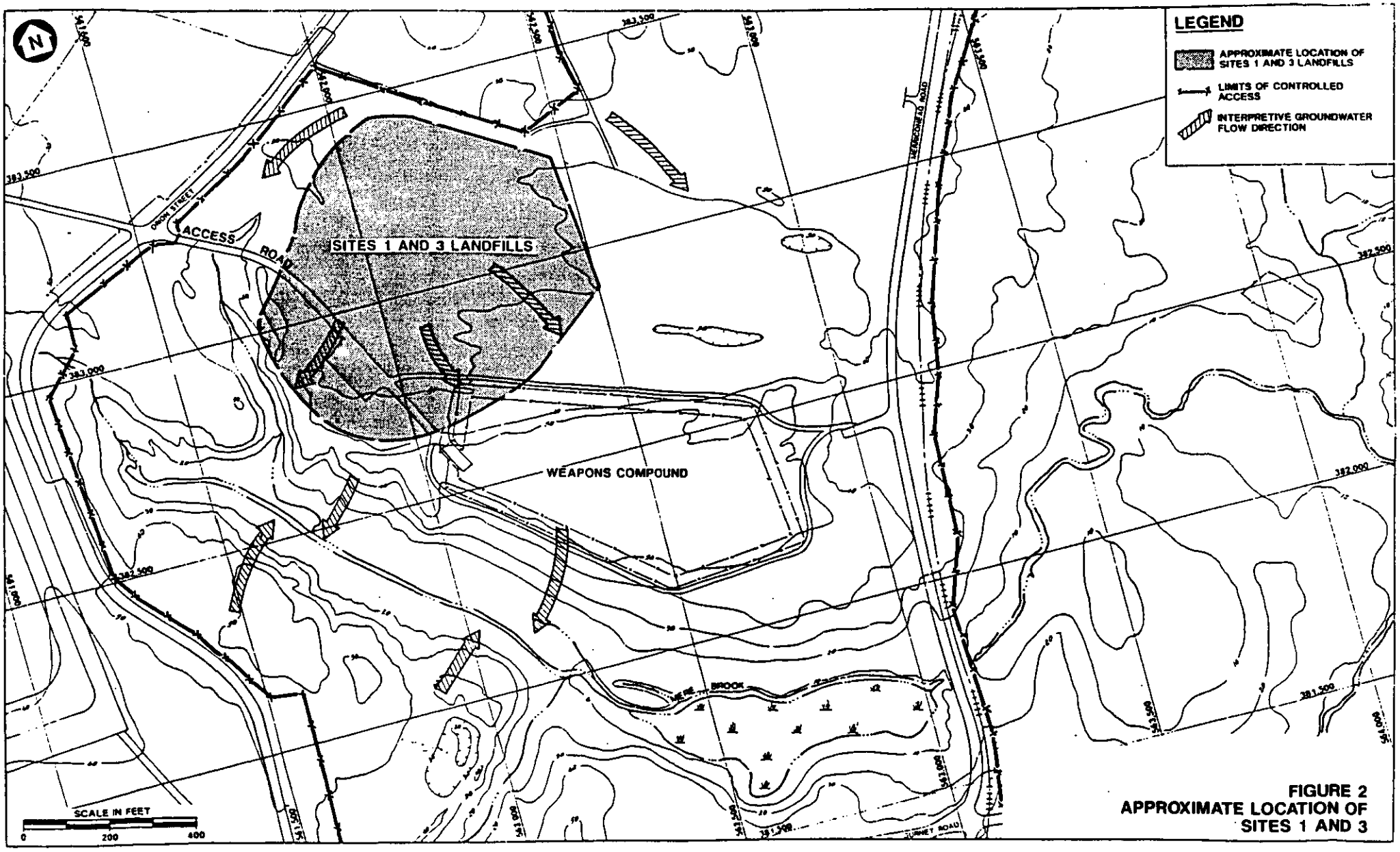

FIGURE 2
APPROXIMATE LOCATION OF SITES 1 AND 3

Weapons Compound and steep embankments bordering the Mere Brook beaver marsh. Site 3 is next to Site 1 to the southwest, and currently consists of a small knoll covered with grass and a pine grove.

Lowland areas along the Mere Brook beaver marsh are heavily wooded. The slopes along portions of the brook are typically very steep in areas next to the landfill.

Leachate seeps have been consistently observed at the base of slopes next to Site 3, as well as south of Site 1 (see Figure 2).

Groundwater associated with the site is not used for potable purposes or any other uses. The base is connected to a public water supply administered by the Brunswick - Topsham Water District, with the exception of the golf course. The golf course area is distant from Sites 1 and 3 and is not affected by groundwater flow from Sites 1 and 3. Mere Brook, south of Sites 1 and 3, receives drainage from the runways as well as runoff and leachate from the landfills. The brook is not commonly used for recreational activities in the reaches near Sites 1 and 3 because access to the area is restricted. Mere Brook flows into the Atlantic Ocean at Harpswell Cove, which is designated as a potential aquaculture area by the State of Maine. Harpswell Cove supports various commercially important fish species. For more information concerning natural resources at Sites 1 and 3, refer to Appendix Q of the Draft Final Remedial Investigation (RI) report.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. LAND USE AND RESPONSE HISTORY

NAS Brunswick is an active facility supporting the U.S. Navy's antisubmarine warfare operations in the Atlantic Ocean and Mediterranean Sea. The base's primary mission is to operate and maintain P-3 Orion aircraft. NAS Brunswick first became active in the 1940s during World War II, and underwent major expansion in the 1950s.

Sites 1 and 3 are located within a restricted area in the central portion of NAS Brunswick (see Figure 2). Historical records indicate that the Site 1 landfill was used from 1955 to 1975. Material reportedly disposed of in this landfill included garbage, food waste, refuse, waste oil, solvents, pesticides, petroleum products, paint wastes, aircraft and automobile parts, and various chemicals.

Site 3 is defined as the area across from Site 1, next to the access road into the Weapons Compound (see Figure 2). Historical information reports that Site 3 operated as a disposal area from 1960 to 1973. Wastes disposed of at this site included solvents, paints, and isopropyl alcohol. A more detailed description of the history of Sites 1 and 3 can be found in the Draft Final RI Report at page 6-1 and 6-3. No waste material was observed at Site 3 and only low-level soil contamination (i.e., 1.1 milligram per kilogram [mg/kg] of chlordane was the highest detection) was reported (E.C. Jordan Co., 1990a). Although Site 3 was originally believed to be a separate disposal area from Site 1, field sampling activities did not show a clear delineation between these two sites.

Based on the proximity of the two sites, common historical land use, and hydrogeologic characteristics, the impacts of past disposal practices from Sites 1 and 3 cannot be distinguished. Therefore, these areas of contamination are combined and discussed as one site. Test pit information and field sampling results were used to estimate the combined size of the landfills at 10 acres. The waste estimate is based on test pit data and boring logs. The waste in the trench area of the landfill is approximately 20 feet in the deepest areas with the depth of waste decreasing to the east and west. An average depth of 15 feet was assumed to estimate an approximate combined refuse volume of 300,000 cubic yards (cy) for Sites 1 and 3.

Environmental contamination was observed in several media at Sites 1 and 3, including soils, groundwater, leachate/sediment, and surface water/sediment. Contaminants detected above background levels include polynuclear aromatic hydrocarbons (PAHs) and pesticides in soil; volatile organic compounds (VOCs) and inorganic compounds in groundwater; inorganic compounds, VOCs, and semivolatile

organic compounds (SVOCs) in leachate; and inorganic compounds in surface water. The source area for this contamination is considered to be the landfill (Sites 1 and 3) located north and west of the Weapons Compound. No single, well-defined source of contamination has been identified in the landfill.

B. ENFORCEMENT HISTORY

The enforcement history at Sites 1 and 3 is summarized as follows:

- In 1983, an Initial Assessment Study (IAS) was completed detailing historical hazardous material usage and waste disposal practices at NAS Brunswick.

- In 1984, a Pollution Abatement Confirmation Study was conducted. These studies recommended further investigation of seven of the nine hazardous waste sites originally identified.

- In 1987, NAS Brunswick was placed on the U.S. Environmental Protection Agency's (USEPA's) NPL.

- The Remedial Investigation/Feasibility Study (RI/FS) process was begun in 1987 for the seven sites.

- In February 1988, the first Technical Review Committee (TRC) meeting was held. The TRC meetings have been held quarterly since that initial meeting.

- Two sites were added to the RI/FS program in 1989, as well as the two additional sites originally identified in the IAS.

- Two other sites were added to the program in 1990.

- In 1990, the Navy entered into a Federal Facility Agreement (FFA) with the USEPA and the Maine Department of Environmental Protection (MEDEP) regarding the cleanup of environmental contamination at NAS Brunswick. The FFA sets forth the roles and responsibilities of each agency, contains deadlines for the investigation and cleanup of hazardous waste sites, and establishes a mechanism to resolve disputes among the agencies.

- In August 1990, the Navy completed Draft Final RI and Phase I FS reports (E.C. Jordan Co., 1990a and 1990b). The Draft Final RI

Report described field sampling investigations, geology, and hydrogeology, and presented contamination and risk assessments. The Draft Final Phase I FS identified remedial action objectives, and developed and screened remedial alternatives for the nine original sites studied in the Draft Final RI. The Navy submitted Draft Final Supplemental RI Reports for Sites 5, 6, 12, and 14 and FS Sites 5, 6, and 12 in August and July of 1991, respectively (E.C. Jordan Co., 1991a and 1991b).

- Currently, the Navy is studying 13 sites under the Installation Restoration Program (IRP) (see Figure 1).

Because the Navy is committed to providing a timely response to environmental contamination at NAS Brunswick, a strategy was developed to expedite the RI/FS process. This strategy involves identifying the sites for which enough information exists to proceed to the ROD and design phases of the process. Separate timetables have been established for completing the Final FS reports and RODs for these sites. The Navy has identified Sites 1 and 3, and the groundwater associated with Sites 4, 11, and 13 (referred to as the Eastern Plume) as distinct areas of contamination and believes the remedial process can be initiated. Focused Feasibility Studies (FFSs) for Sites 1 and 3 and Site 8, and an FS for nine other sites (Sites 2, 4, 5, 6, 7, 9, 11, 12, and 13) have been submitted to the regulatory agencies for review (E.C. Jordan Co., 1991c, 1991d, and 1991e).

III. COMMUNITY PARTICIPATION

Throughout the site's history, the community has been active and involved. Community members and other interested parties have been kept abreast of site activities through informational meetings, fact sheets, press releases, public meetings, and TRC meetings.

In August 1987, the Navy established an information repository for public review of site-related documents at the Curtis Memorial Library in Brunswick. On December 3, 1991, the Navy placed the Proposed Plan for Sites 1 and 3 in the information repository at the Curtis Memorial Library. The Administrative Record for Sites 1 and 3 is available for public review at NAS Brunswick in the Public Works office. A notice and brief analysis of the Proposed Plan was published in the local newspaper, *The Times Record* on December 3 and 10, 1991.

The TRC has been an important vehicle for community participation. The TRC was established in early 1988 and comprises the Navy, USEPA, MEDEP, and various community representatives. The community members of the TRC include representatives from Brunswick, Harpswell, and Topsham as well as the Brunswick Area Citizens for a Safe Environment (BACSE). The TRC also has representatives from the Brunswick-Topsham Water District. The TRC meets quarterly, reviews the technical aspects of the program, and provides community input to the program.

In September 1988, the Navy released a Community Relations Plan that outlined a program to address public concerns and keep citizens informed about and involved in remedial activities. On August 16, 1990, the Navy held an informational meeting at the Jordan Acres School in Brunswick to discuss the results of the RI.

On December 12, 1991, the Navy held an informational meeting and public hearing to discuss the results of the Supplemental RI and the cleanup alternatives presented in the Phase I FS and FFS. The Navy also presented its Proposed Plan describing the preferred alternative for remediation at Sites 1 and 3 and the Eastern Plume. During this meeting, the Navy, its consultants, and regulatory representatives answered questions from the public and accepted formal comments. During a public comment period from December 6, 1991 through January 24, 1992, the Navy accepted comments on the alternatives presented in the FS, FFS, and the Proposed Plans for Sites 1 and 3 and the Eastern Plume, and on any other documents previously released to the public. The corresponding responses to comments are included in Appendix E, Responsiveness Summary, and are available through the information repository.

IV. SCOPE AND ROLE OF RESPONSE ACTION

The selected remedy for Sites 1 and 3 at NAS Brunswick was developed by combining components of different source control and management of migration alternatives to create a comprehensive approach for site remediation. The remedy includes containment by constructing a cap over the landfills and a slurry wall around the waste to divert clean water away from the landfills. Contaminated groundwater contained by the cap and slurry wall will be pumped using extraction wells and treated by ultraviolet (UV)/oxidation to destroy the organic compounds before discharging the treated water. The Brunswick Publicly Owned Treatment Works (POTW) is the preferred discharge location; however, the POTW has yet to commit to accepting this discharge. These remedial actions will minimize the human health and ecological risks associated with exposure to contaminated groundwater and leachate sediment.

V. SUMMARY OF SITE CHARACTERISTICS

The nature and extent of contamination at Sites 1 and 3 is summarized by medium in the following paragraphs. A list of contaminants and range of concentrations detected in each medium is included in Appendix A. A complete discussion of the site characteristics can be found in the Draft Final RI Report on pages 6-6 through 6-59.

SOIL/WASTE AREA

Soil boring and test pit samples were collected to identify contaminants in the surface and subsurface soils at Sites 1 and 3. Contamination detected in subsurface soil boring samples was considered to be low. Low levels of pesticides and polychlorinated biphenyls (PCBs) were detected in surface and shallow test pit soil samples. Pesticides typically totaled less than 0.050 mg/kg, with the exception of one test pit location where five pesticide compounds were reported with a total concentration of 2.1 mg/kg. PCBs were found in eight of the 52 test pit soil samples at concentrations less than 1 mg/kg. VOCs typically were not detected in test pit soils, although a variety of SVOCs were identified. The VOCs tested for include compounds in common industrial solvents, fuels, and degreasers that could have been disposed of in the landfills at Sites 1 and 3. A group of SVOCs called PAHs were detected in surface and shallow soils at Sites 1 and 3. The concentration of PAHs in the shallow soils was typically 1 to 8 mg/kg, with the highest reported value of 24 mg/kg. PAH compounds are components of coal and hydrocarbon fuels that survive the combustion process. The historical use of coal and fuels at NAS Brunswick may account for the presence of PAHs in soils across the base. Metals also were detected in the soils at Sites 1 and 3. The metals detected above naturally occurring background levels include lead and mercury.

Inorganics were found in all soil borings, but typically were restricted to aluminum, iron, magnesium, and manganese, with concentrations of these elements consistent with background levels. The elements chromium, lead, arsenic, and zinc were reported in several cases, but these inorganics were typically found in soil samples from clay-rich soils. Concentrations were low, and consistent with background concentrations observed in clays.

GROUNDWATER

Groundwater at Sites 1 and 3 flows in the overburden soil and bedrock formations. The overburden soil at NAS Brunswick is a stratified formation consisting of a sand layer, a transition layer, and a silty clay layer. The sand, transition, and silty clay layers make up the Presumpscot Formation, which occurs on top of the bedrock.

The thickness of the Presumpscot Formation varies from 40 to 80 feet in the Sites 1 and 3 area, with the silty clay layer having a thickness of 20 to 40 feet. This unit of soil was deposited on the bedrock during the late glacial marine submergence of southern Maine. The variability of soil types in the Presumpscot Formation was caused by the glacial retreat and sea level changes that occurred when the soils were deposited. The saturated thickness of the Presumpscot Formation, or thickness of the overburden that contains groundwater, varies from 20 to 60 feet across Sites 1 and 3, and the groundwater discharges into Mere Brook and nearby tributaries. Groundwater has not been observed to flow through the silty clay layer on top of the bedrock due to the low permeability of the silty clay; however, groundwater does flow in the fractures and joints of the bedrock (E.C. Jordan Co., 1990a). Contaminated groundwater observed above the silty clay layer has not been noted in the bedrock aquifer and is not expected to migrate through the silty clay into the bedrock aquifer.

Groundwater contamination from the landfill consists primarily of VOCs, metals, and inorganic compounds. The VOCs include both chlorinated solvents and fuel-related compounds. The concentrations of chlorinated solvents detected in groundwater typically were less than 0.2 milligrams per liter (mg/L), and total fuel-related VOCs had a maximum concentration of 1.1 mg/L. Metal and inorganic compounds were sporadically detected above Maximum Contaminant Levels (MCLs). The maximum concentration of metals and inorganic compounds include arsenic (107 micrograms per liter [μg/L]), chromium (11 μg/L), cyanide (34 μg/L), iron (962 mg/L), lead (60 μg/L), nickel (78 μg/L), sodium (181 mg/L), and zinc (2,500 μg/L). Pesticides, PAHs, and PCBs were not detected in groundwater at Sites 1 and 3.

LEACHATE SEEPS, SURFACE WATER, AND SEDIMENT

Contaminated leachate generated from the landfills at Sites 1 and 3 seeps out along the steep banks of Mere Brook and the tributary next to Sites 1 and 3 (see Figure 2). Seven seep locations were identified along the steep bank of Mere Brook. These seeps are a result of groundwater outbreak and are located above the elevation of Mere Brook and do not discharge directly to the brook. These leachate seeps were sampled for organic and inorganic compounds. In addition, surface soils were collected adjacent to the leachate outbreak areas to characterize the impact of leachate on surrounding soils. These leachate seeps typically contain trace levels of VOCs, SVOCs, pesticides, and inorganics, but do not contain PCBs. One leachate location detected VOCs at a maximum concentration of 1.3 mg/L. VOCs detected in leachate include vinyl chloride; 1,1-dichloroethylene (DCE); 1,1-dichloroethane (DCA); trichloroethylene (TCE); and 1,1,2,2 tetrachloroethane.

VOCs also were reported in sediment samples and include 1,1-DCA; TCE; 1,1,1-trichloroethane (TCA), ethylbenzene, and 1,1,2,2-tetrachloroethane.

SVOCs were reported in only two seep locations at a maximum concentration of 0.064 mg/L. SVOCs were only reported in one seep sediment sample at a maximum concentration of 6.8 mg/kg.

Pesticides were detected only in one of four sampling rounds. Dichlorodiphenyltrichloroethane (DDT) (0.17 μg/L), dichlorodiphenyldichloroethylene (DDE) (0.40 μg/L), and dichlorodiphenyldichloroethane (DDD) (0.36 μg/L) were the compounds reported. PCBs were not observed in leachate or sediment from Sites 1 and 3 seep locations, and pesticides were not detected in seep sediment samples.

Inorganics were also detected at elevated levels in all seven leachate samples. High levels of aluminum (0.400 to 119 mg/L); calcium (15 to 273 mg/L); magnesium (1.9 to 36 mg/L); and iron (11.5 to 2,510 mg/L) were typically found, and the elements arsenic (0.027 to 0.0590 mg/L); chromium (0.011 to 0.151 mg/L); copper (0.039 to 0.686 mg/L); cobalt (0.057 to 1.240 mg/L); mercury (0.0003 to 0.019 mg/L); vanadium (0.062 to 2.6 mg/L); and zinc (0.033 to 24.8 mg/L) were commonly detected. Cyanide (0.010 to 0.027 mg/L) was also found in several seeps (i.e., LT-301, LT-303, LT-304, and LT-305), but was not consistently detected in all sampling rounds. Mercury was found in leachate from five of the seven seeps in all sampling rounds; concentrations ranged from 0.3 (LT-303) to 19.3 μg/L (LT-304). Sediments at seep locations typically have concentrations of inorganics consistent with background values for sands and clays.

More than 20 surface water and sediment locations were sampled along Mere Brook. Low levels of VOCs (i.e., less than 0.030 mg/L) were detected in two surface water samples. Elevated levels of metals were detected at two different surface water locations. These same metals have been detected in the leachate and groundwater flowing beneath Sites 1 and 3. Two of the metals, iron and zinc, were also detected at elevated concentrations in the upgradient, background sampling locations.

PAHs were detected in Mere Brook sediments next to Sites 1 and 3. These compounds also were detected in Mere Brook sediment upgradient of Sites 1 and 3 from background stream sampling locations. The concentrations of PAHs in the background sampling locations are similar to those detected in sampling locations next to Sites 1 and 3. PAHs also were detected in surface and subsurface soils from the Sites 1 and 3 landfill area at concentrations ranging from 0.6 to 24 mg/kg. As stated, PAHs are components of coal and hydrocarbon fuels that survive the combustion process, and they may be present from the historical and current use of coal and fuels at NAS Brunswick.

VI. SUMMARY OF SITE RISKS

A baseline risk assessment was performed to estimate the potential risks to human health and the environment from exposure to contaminants associated with Sites 1 and 3. The human health risk assessment followed a four-step process: (1) contaminant identification, which identified those hazardous substances that, given the specifics of the site, were of significant concern; (2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; (3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances; and (4) risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the site, including carcinogenic and noncarcinogenic risks. The results of the baseline risk assessment are summarized in the following subsections.

The contaminants of concern identified for Sites 1 and 3, listed in Table 1, were selected for evaluation in the human health risk assessment and include 15 surface and nine subsurface soil, 16 groundwater, 13 surface water, and 21 leachate contaminants of concern. These contaminants constitute a representative subset of all the contaminants identified during the RI. The contaminants of concern were selected to represent potential site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. A summary of the health effects of each contaminant of concern is presented in Appendix Q, pages Q-122 through Q-151 of the Draft Final RI Report.

Human health risks were quantitatively evaluated based on potential exposure to contaminants of concern under both current (including worker exposure) and future land-use (e.g., residential) scenarios. Several hypothetical exposure pathways were developed to reflect possible exposure to hazardous substances detected in soils, groundwater, surface water, sediment, and leachate. The following is a brief summary of the exposure pathways evaluated. A more thorough description can be found in Appendix Q of the Draft Final RI Report.

Because access to these sites is currently controlled, long-term repetitive exposure to soils, sediments, and surface water is not considered likely. In addition, exposure to groundwater is not considered likely as this area of NAS Brunswick is serviced by a public water supply system. No exposure routes were considered to present a risk to human health under present land-use conditions. However, because the role of the baseline risk assessment is to address risks associated with the site in the absence of any remedial action, including institutional controls, potential risks under a future residential scenario were estimated. The evaluated exposure pathways included

TABLE 1
CONTAMINANTS OF CONCERN
SITES 1 AND 3

ROD: SITES 1 AND 3
NAS BRUNSWICK

SURFACE SOIL	SUBSURFACE SOIL	GROUNDWATER	SURFACE WATER	SEDIMENT	LEACHATE
Arsenic	Arsenic	Arsenic	Lead	Arsenic	Antimony
Cadmium	Bis(2-ethylhexyl)phthalate	Aluminum	Manganese	Bis(2-ethylhexyl)phthalate	Arsenic
Chromium	Cadmium	Barium	Zinc	Cadmium	Beryllium
Copper	DDT	Chlorobenzene		Chromium	Cadmium
Cyanide	Dieldrin	Chromium		Copper	Chromium
DDT	Lead	1,1-Dichloroethane		PAHs	Cyanide
Lead	Manganese	1,2-Dichloroethylene		Lead	DDT
Manganese	PAHs	Ethylbenzene		Manganese	1,4-Dichlorobenzene
Mercury	PCBs	Lead		Mercury	1,1-Dichloroethane
Nickel		Manganese		Nickel	1,2-Dichloroethylene
PAHs		Methylene Chloride		1,1,2,2-Tetrachloroethane	Ethylbenzene
PCBs		Nickel		Vanadium	Lead
1,1,2,2-Tetrachloroethane		Sodium		Zinc	Manganese
Vanadium		Toluene			Mercury
Zinc		Vinyl Chloride			Nickel
		Xylene			1,1,2,2,-Tetrachloroethane
					Trichloroethylene
					Vanadium
					Vinyl Chloride
					Xylene
					Zinc

Note:

See Appendix A for the range and frequency of detection of each contaminant of concern.

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direct contact and incidental ingestion of soil, sediment, surface water, and leachate, and ingestion of groundwater. These scenarios were based on the exposure parameters listed in Tables Q-23 through Q-28 in Appendix Q of the Draft Final RI Report. Average and maximum exposure estimates were generated assuming exposure to the average and the maximum concentration of each contaminant detected in that particular medium. A summary of the total incremental carcinogenic risks and summary Hazard Indices (HIs) for each exposure pathway are presented in Table 2. The chemical-specific risk estimates for each exposure pathway are presented in Appendix B.

Since the release of the Draft Final RI Report, USEPA has developed an additional guidance and standard default exposure scenario for use in evaluating exposure to groundwater. The assumptions include a 70-kilogram adult who consumes 2 liters of water per day, 350 days per year, for a 30-year exposure duration. These risks are summarized in Table 2 and chemical-specific risk estimates are presented in Appendix C of this ROD.

Excess lifetime cancer risks were estimated for each exposure pathway by multiplying the exposure level by the chemical-specific cancer slope factor (CSF). CSFs have been developed by USEPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g., 1×10^{-6} for 1/1,000,000) and indicate (using this example) that an individual is not likely to have more than a one-in-a-million chance of developing cancer over 70 years as a result of site-related exposure to the compound at the stated concentration. Current USEPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

The HI was also calculated for each pathway as USEPA's measure of the potential for noncarcinogenic health effects. The HI is the sum of Hazard Quotients (HQs), which are calculated for each chemical by dividing the exposure level by the reference dose (RfD) or other suitable benchmark for noncarcinogenic health effects. RfDs have been developed by USEPA to protect sensitive individuals over the course of a lifetime, and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The HQ is often expressed as a single value (e.g., 0.3) indicating the ratio of the stated exposure as defined to the RfD value (in this example, the exposure as characterized is approximately one-third of an acceptable exposure level for the given compound). The HQ is only considered additive for compounds that have the same or similar toxic endpoints.

TABLE 2
SUMMARY OF RISK ESTIMATES

ROD: SITES 1 AND 3
NAS BRUNSWICK

	AVERAGE		MAXIMUM	
	TOTAL HI	TOTAL CANCER RISK	TOTAL HI	TOTAL CANCER RISK
Ingestion of and Dermal Contact with Soil (0-15 feet)				
Adult Resident	0.02	$3x10^{-6}$	0.1	$5x10^{-5}$
Adult Worker	0.003	$2x10^{-7}$	0.02	$4x10^{-6}$
Ingestion of and Dermal Contact with Leachate Surface Water				
Child (ages 1-6)	0.05	$8x10^{-7}$	0.2	$7x10^{-6}$
Child (ages 7-12)	0.06	$1x10^{-6}$	0.2	$8x10^{-6}$
Ingestion of and Dermal Contact with Leachate Sediment				
Child (ages 1-6)	0.04	$4x10^{-7}$	0.3	$2x10^{-6}$
Child (ages 7-12)	0.04	$4x10^{-7}$	0.3	$2x10^{-6}$
Ingestion of and Dermal Contact with Surface Soils (0-2 feet)				
Child (ages 1-6)	0.0008	$1x10^{-6}$	0.01	$2x10^{-7}$
Child (ages 7-12)	0.0007	$1x10^{-6}$	0.01	$2x10^{-7}$
Ingestion of and Dermal Contact with Sediment				
Child (ages 1-6)	0.04	$1x10^{-6}$	0.04	$2x10^{-5}$
Child (ages 7-12)	0.3	$2x10^{-6}$	0.3	$3x10^{-5}$
Ingestion of Groundwater				
Adult	0.6	$6x10^{-4}$	20	$5x10^{-3}$

Notes:

See Appendices B and C for chemical-specific risk estimates for each exposure pathway.

HI = Hazard Index

Risk estimates developed as part of this baseline risk assessment were evaluated using the USEPA criteria and target risk range to identify the need for remedial actions at this site. Those chemicals present at Sites 1 and 3 at concentrations in excess of health-based criteria or the target risk range were identified for each exposure pathway and appropriate target cleanup levels were developed.

Carcinogenic risks in excess of 10^{-4} and noncarcinogenic risks greater than an HI of 1.0 were associated with future potential exposure to certain contaminants detected in groundwater beneath Sites 1 and 3. The carcinogenic risks ranged from $6x10^{-4}$ (average scenario) to $5x10^{-3}$ (maximum) and noncarcinogenic HIs from 0.6 (average) to 20 (maximum scenario) based on standard USEPA exposure parameters. The contaminants of concern in groundwater include arsenic, vinyl chloride, methylene chloride, 1,2-DCE, chromium, lead, and nickel. 1,1-DCA was originally listed as a contaminant of concern. However, because it was detected at concentrations less than its risk RfD (0.1 mg/kg per day or 3.5 mg/L, assuming a 70-kilogram adult ingests 2 liters of water per day), it has been eliminated as a contaminant of concern.

Human health risks associated with future potential exposure via long-term repetitive dermal contact and incidental ingestion of soil were also evaluated under a future scenario. The carcinogenic risks associated with this scenario ranged from $3x10^{-6}$ (average scenario, adult exposure) to $3x10^{-4}$ (maximum scenario, child exposure), and were attributed almost entirely to the presence of PAHs (E.C. Jordan Co., 1990a). These risk estimates are considered to be conservative as they do not account for any decrease in contaminant concentrations that will result from natural degradation and dispersion processes. Only one scenario had risks in excess of the USEPA target risk range of 10^{-6} to 10^{-4} and it was based on exposure to the maximum detected soil concentrations. All other risk estimates were within the USEPA target risk range. Risk estimates based on other exposure pathways were within or below the USEPA target risk range for carcinogens or HI of 1.0 for noncarcinogens (see Table 2).

The environmental risk assessment concluded that contaminated groundwater discharging to Mere Brook could adversely impact the aquatic environment. Mere Brook flows next to Sites 1 and 3 (see Figure 2) and groundwater flowing from the landfill areas discharges to the brook and flows out along the banks as leachate seeps.

Iron and zinc were detected in the surface water of Mere Brook adjacent to Sites 1 and 3 at levels exceeding their Ambient Water Quality Criteria (AWQC) established for the protection of aquatic life. These criteria are chemical concentrations in water that were developed to protect freshwater species from acute and chronic toxic effects. Iron and zinc were also detected at concentrations greater than their AWQC upstream of Sites 1 and 3, suggesting that other areas in addition to the Sites 1 and

3 leachate seeps are affecting the stream. Potential sources of iron and zinc are the runways upstream of Sites 1 and 3. Mere Brook is not being addressed directly by the remedy for Sites 1 and 3 because there are additional upstream sources of contamination. Information will be identified by the Navy regarding these potential sources and will be presented to the USEPA and MEDEP. If upstream sources of contamination that can be attributed to past disposal are identified, these newly identified sites would fall under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and would be included in the Navy's IRP. If not under the IRP, the Navy will take appropriate steps to ensure that state and federal requirements are met regarding sources identified at NAS Brunswick.

The environmental risk assessment concluded that iron and zinc in the portion of Mere Brook adjacent to Sites 1 and 3 may cause some adverse impacts to aquatic organisms. The concentrations of iron and zinc downstream of Sites 1 and 3 and at monitoring locations in Harpswell Cove are below their respective AWQC. All other contaminants in Mere Brook were detected below levels considered to present ecological risk. Visual observations of the Mere Brook ecosystem made during the RI did not identify any areas of stressed vegetation or gross impacts of contamination other than the leachate seeps.

The selected remedy for Sites 1 and 3 will eliminate the discharge of contaminated groundwater from the landfill areas to Mere Brook. This will result in a decrease in the amount of iron and zinc in Mere Brook. Surface water concentrations will be monitored to evaluate contaminant reduction over time. If long-term monitoring data show that concentrations of iron and zinc are not decreasing, additional remedial measures will be evaluated. However, because iron and zinc have been detected above their AWQC upstream of Sites 1 and 3, it may not be possible to achieve target cleanup levels as a result of remedial action at Sites 1 and 3.

Mercury has been detected in the sediment around these leachate areas. Because some environmental receptors (e.g., earthworms, small birds, and rodents) could feed in these areas, they may be exposed to mercury. The results of a quantitative food-web analysis indicates that potential exposure to mercury from these areas could cause adverse impacts to these organisms. The same food-web analysis indicates that all other contaminants in the sediment around the leachate areas were detected below levels considered to present an ecological risk. The food-web analysis is presented in Appendix Q of the Draft Final RI Report. Implementation of the selected remedy will eliminate leachate seeps and prevent further contamination of sediment in the vicinity of the seeps. While the remedial action will not directly reduce mercury concentrations in the sediments, other natural processes (e.g., scour or sedimentation) will reduce concentrations over time. Mercury concentrations in

the sediment will be monitored to assess the effectiveness of these processes in minimizing further impact to the Mere Brook ecosystem.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, might present an imminent and substantial endangerment to public health, welfare, or the environment. The objective of the selected remedial action is to cease the discharge of contaminated groundwater under Sites 1 and 3, remediate the groundwater, and by so doing, clean up the surface water, leachate, and related sediments.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. STATUTORY REQUIREMENTS/RESPONSE OBJECTIVES

Under its legal authorities, the lead agency's (i.e., Navy) primary responsibility at NPL and similar sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including a requirement that the Navy's remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that the Navy select a remedial action that is cost-effective and that uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Remedial alternatives were developed to be consistent with these congressional mandates.

Based on preliminary information relating to the types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were established to aid in the development and screening of alternatives. These remedial action objectives were established to mitigate existing and future potential threats to public health and the environment:

- to reduce the generation and migration of contaminated groundwater
- to reduce the potential risk associated with ingestion of contaminated groundwater
- to minimize future negative impacts to Mere Brook and the sediment in the leachate seeps resulting from the discharge of contaminated groundwater and leachate
- to reduce the concentrations of metals (iron and zinc) discharging to Mere Brook

B. TECHNOLOGY AND ALTERNATIVE DEVELOPMENT AND SCREENING

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives was developed for the site.

Remedial action alternatives for NAS Brunswick were developed to meet the following requirements: (1) the alternative adequately protects public health and the environment; (2) the alternative can attain chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) and can be implemented in a manner consistent with location- and action-specific ARARs; (3) the alternative uses permanent treatment technologies to the maximum extent practicable; (4) the alternatives developed are capable of achieving a remedy in a cost-effective manner, considering short- and long-term costs; and (5) the alternatives that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances will be selected, to the maximum extent practicable.

Alternatives for Sites 1 and 3 were developed by combining treatment technologies to form a range of feasible alternatives that address contamination in the media of concern (i.e., groundwater and leachate). Alternatives were developed that range from no action to containment to permanent treatment.

The RI/FS screened technologies based on site- and waste-limiting characteristics. These technologies were combined into remedial action alternatives. The Phase I FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories denoted in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated and screened according to its implementability, effectiveness, and cost.

Five of the six remedial action alternatives screened in the Phase I FS were retained for detailed analysis and are presented in Table 3. In addition, a true No Action Alternative (i.e., involves no remedial actions and includes no costs) was developed and included as part of the detailed elevation. The only alternative eliminated from further consideration included source removal and incineration and groundwater extraction and treatment. This alternative was eliminated because excavation and handling of the estimated 300,000 cy of waste was considered to be cost-prohibitive and more hazardous than leaving it in place.

TABLE 3
SUMMARY OF REMEDIAL ALTERNATIVES: SITES 1 AND 3

ROD: SITES 1 AND 3
NAS BRUNSWICK

ALTERNATIVE	COMPONENTS
1,3-A: No Action	No additional remedial actions
1,3-B: Minimal Action	Institutional controls and deed restrictions Environmental monitoring
1,3-C: Containment	Cap Subsurface hydraulic barrier Groundwater extraction wells Water treatment Discharge of treated water Institutional controls and deed restrictions Environmental monitoring
1,3-D: Passive Groundwater Collection/Treatment	Passive groundwater collection Water treatment Discharge of treated water Institutional controls and deed restrictions Environmental monitoring
1,3-E: Cap/Groundwater Extraction/Treatment	Cap Groundwater extraction wells Water treatment Discharge of treated water Institutional controls and deed restrictions Environmental monitoring
1,3-F: Cap/Passive Groundwater Collection/Treatment	Cap Passive groundwater collection Water treatment Discharge of treated water Institutional controls and deed restrictions Environmental monitoring

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VIII. DESCRIPTION OF ALTERNATIVES

This section summarizes each alternative evaluated. Detailed alternative descriptions can be found at pages 3-5, 3-7 through 3-10, 3-14 through 3-44, 3-63 through 3-72, 3-87 through 3-91, and 3-106 through 3-107 of the FFS.

ALTERNATIVE 1,3-A: NO ACTION

This alternative was developed and evaluated in the FFS to serve as a baseline for comparison with the other remedial alternatives under consideration. Under the No Action Alternative, no active measures would be taken to reduce or contain contamination emanating from the landfills. No costs would be incurred if this alternative were implemented. This alternative would not meet the cleanup objectives of the site.

ALTERNATIVE 1,3-B: MINIMAL ACTION

This alternative would consist of the following components:

- institutional controls and land-use restrictions
- environmental monitoring

Under the Minimal Action Alternative, no active measures would be taken to reduce or contain contamination emanating from the landfill. Institutional controls would consist of posting warning signs around the landfill and near the leachate seeps (the site is currently fenced and access is limited). Restrictions to future development would be incorporated to restrict land use should the base be closed.

The environmental monitoring program would monitor the migration and discharge of contaminated groundwater to Mere Brook. In addition to groundwater, surface water, sediment, and leachate seeps would be sampled and analyzed for the contaminants of concern. The environmental monitoring program would be submitted for regulatory review and would include a proposed sampling frequency. Data collected under this program would provide information necessary to assess the dispersion and degradation of contamination emanating from the landfill. The environmental monitoring program would continue for 30 years.

Estimated Time For Design and Construction: 6 months
Estimated Time For Operation: 30 years
Estimated Capital Cost: $10,000
*Estimated Operation and Maintenance Cost (net present worth): $788,000**
*Estimated Total Cost (net present worth): $1,147,000**

* Net present worth costs are based on a 10 percent discount factor and 30 years of operation

ALTERNATIVE 1,3-C: CONTAINMENT (slurry wall, cap, and groundwater extraction and treatment)

This alternative consists of the following components:

- slurry wall
- cap
- groundwater extraction wells
- groundwater treatment
- discharge of treated water
- institutional controls and land-use restrictions
- environmental monitoring

The landfill would be contained by a low-permeability cap and slurry wall. The containment system would minimize the amount of clean water (e.g., precipitation, snowmelt, or groundwater) coming in contact with the waste, and therefore minimize leachate production.

To achieve more rapid lowering of groundwater within the waste, and to prevent further migration of contaminated water to Mere Brook, extraction wells would be installed to pump the water contained within the slurry wall. This contaminated water would be treated before discharge.

The FFS evaluated several treatment processes (e.g., pretreatment, air stripping, and UV/oxidation) and discharge options for extracted groundwater. It is expected that groundwater would be pretreated to remove inorganics and then treated using a UV/oxidation technology to destroy organic contaminants. Because of the small volume of water and short duration of pumping for this alternative, it would be cost-effective to combine the flow from the Sites 1 and 3 extraction wells with groundwater pumped from the Eastern Plume and treat the flows concurrently. This assumes that the Eastern Plume treatment plant is on-line when pumping at Sites 1 and 3 commences.

Options evaluated for discharge of treated water include surface water (e.g., Mere Brook), groundwater (e.g., upgradient reinjection), the Brunswick Sewer District's POTW, and the Town of Brunswick's storm sewer system. The preliminary evaluation in the FFS identified discharge to the POTW to be the best option for this site; however, the POTW has not yet committed to accepting this discharge.

Because Alternative 1, 3-C does not remove the waste from the site, institutional controls consisting of fencing and signs would be maintained. In the event the base is closed, land-use restrictions would be enacted to prevent future development of the Sites 1 and 3 area.

A long-term monitoring program would be developed and submitted for regulatory agency review. This program would monitor the media of concern and provide information on the effectiveness of the remedy. This program would continue for a minimum of 30 years.

Estimated Time For Design and Construction: 2.5 years
Estimated Time For Operation: 1 year (groundwater extraction only)
Estimated Capital Cost: $3,874,000
*Estimated Operation and Maintenance Cost (net present worth): $1,432,000**
*Estimated Total Cost (net present worth): $7,842,000**

* Net present worth costs are based on a 10 percent discount factor and 30 years of operation

ALTERNATIVE 1,3-D: PASSIVE GROUNDWATER COLLECTION AND TREATMENT

This alternative consists of the following components:

- groundwater collection
- groundwater treatment
- discharge of treated water
- institutional controls and land-use restrictions
- environmental monitoring

Contaminated groundwater would be collected by either a downgradient collection trench surrounding the site or extraction wells placed within the landfill. The collection trench would be placed to a depth of approximately 25 feet below ground surface (bgs). A perforated polyvinyl chloride (PVC) pipe would allow water to flow to centrally located sump pumps. The collected water would be pumped and treated at a treatment plant. If an extraction system were used, it would be designed to contain and collect the contaminated groundwater before it discharges to Mere Brook.

Collected groundwater would be treated using the same pretreatment technologies and treatment options described in the FFS report. Air stripping and UV/oxidation

are the process options for VOC removal that were retained after alternative screening.

Both metals and VOC treatment would occur in the same treatment plant. Based on groundwater modeling, it is estimated to take between 18 and 73 years to collect and treat the groundwater to cleanup levels. More than 610 million gallons of water are estimated to require treatment. Because of the time required to treat the groundwater and the amount of water to be treated, this alternative would not be combined with the groundwater treatment proposed for the Eastern Plume, and a separate treatment facility would be constructed. Treated water would be preferably discharged to the POTW if this option is acceptable to the POTW, as described for Alternative 1,3-C.

Institutional controls would be required in this alternative, as described for Alternative 1,3-C, because the untreated waste would remain on site. Land-use restrictions would be enacted if NAS Brunswick is closed in the future. An environmental monitoring program would be implemented to assess the effectiveness of the pumping system at capturing the contaminated groundwater. The environmental monitoring program would be submitted for regulatory review and would include a proposed sampling frequency.

Estimated Time For Design and Construction: 2.5 years
Estimated Time For Operation: 18 to 73 years
Estimated Capital Cost: $2,710,000
*Estimated Operation and Maintenance Cost (net present worth): $6,821,000**
*Estimated Total Cost (net present worth): $12,938,000**

* Net present worth costs are based on a 10 percent discount factor and 30 years of operation

ALTERNATIVE 1,3-E: CAP AND GROUNDWATER EXTRACTION AND TREATMENT

This alternative would consist of the following components:

- cap
- groundwater extraction
- groundwater treatment
- discharge of treated water
- institutional controls and land-use restrictions
- environmental monitoring

The cap would be constructed over the landfill as described in Alternative 1,3-C. The groundwater extraction system would consist of groundwater extraction wells placed within the landfill to contain and collect the contaminated groundwater before it discharges to Mere Brook. Based on groundwater modeling, it is estimated to take between 18 and 73 years to achieve cleanup goals in the groundwater. More than 610 million gallons of water are estimated to require treatment.

Groundwater would be treated and discharged as described for Alternative 1,3-D. Because waste would remain on site, institutional controls and land-use restrictions would be required as described in Alternative 1,3-C. Results of the environmental monitoring program would provide information necessary to assess the performance of the groundwater extraction system. The environmental monitoring program would be submitted for regulatory review and would include a proposed sampling frequency.

Estimated Time For Design and Construction: 2.5 years
Estimated Time For Operation: 18 to 73 years
Estimated Capital Cost: $3,152,000
*Estimated Operation and Maintenance Cost (net present worth): $7,066,000**
*Estimated Total Cost (net present worth): $13,591,000**

* Net present worth costs are based on a 10 percent discount factor and 30 years of operation

ALTERNATIVE 1,3-F: CAP AND PASSIVE GROUNDWATER COLLECTION AND TREATMENT

This alternative would consist of the following components:

- cap
- groundwater collection
- groundwater treatment
- discharge of treated water
- institutional controls and land-use restrictions
- environmental monitoring

This alternative is the same as Alternative 1,3-E with the exception that a downgradient interceptor trench would be used to collect contaminated groundwater rather than an extraction well system. The collection trench would be the same as that described for Alternative 1,3-D. As with Alternative 1,3-D, between 18 and 73 years would be required to achieve groundwater cleanup goals and more than 610 million gallons of water would require treatment. Results of the environmental monitoring program would provide information necessary to assess the performance

of the groundwater extraction system. The environmental monitoring program would be submitted for regulatory review and would include a proposed sampling frequency.

Estimated Time For Design and Construction: 2.5 years
Estimated Time For Operation: 18 to 73 years
Estimated Capital Cost: $3,965,000
*Estimated Operation and Maintenance Cost (net present worth): $6,821,000**
*Estimated Total Cost (net present worth): $14,744,000**

* Net present worth costs are based on a 10 percent discount factor and 30 years of operation

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that, at a minimum, the Navy is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria to select a site remedy. The following is a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria. These criteria and their definitions are as follows:

Threshold Criteria

The two threshold criteria described below must be met for the alternatives to be eligible for selection in accordance with the NCP.

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with ARARs** describes how the alternative complies with chemical-, location-, and action-specific ARARs, or other criteria, advisories, and guidance.

Primary Balancing Criteria

The following five criteria are used to compare and evaluate the elements of one alternative to another that meet the threshold criteria.

3. **Long-term effectiveness and permanence** evaluates the effectiveness of alternatives in protecting human health and the environment after response objectives have been met, in terms of the magnitude of residual risk and the adequacy and reliability of controls.

4. **Reduction of toxicity, mobility, or volume through treatment** evaluates the treatment technologies by the degree of expected reduction in toxicity, mobility, or volume of hazardous material. This criterion also evaluates the irreversibility of the treatment

process and the type and quantity of residuals remaining after treatment.

5. **Short-term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until the remedial action objectives are achieved.

6. **Implementability** assesses the ability to construct and operate the technology; the reliability of the technology; the ease of undertaking additional remedial actions; and the ability to monitor the effectiveness of the remedy. Administrative feasibility is addressed in terms of the ability to obtain approvals from other agencies. This criterion also evaluates the availability of required resources, such as equipment, facilities, specialists, and capacity.

7. **Cost** evaluates the capital and operation and maintenance costs of each alternative, and provides an estimate of the total present worth cost of each alternative.

Modifying Criteria

The modifying criteria are used in the final evaluation of remedial alternatives generally after public comment on the RI/FS and Proposed Plan has been received.

8. **State acceptance** addresses whether, based on its review of the RI/FS and Proposed Plan, the state concurs with, opposes, or has no comment on the alternative the Navy proposed for the remedial action.

   The State of Maine has provided comments on the proposed plan and has documented its concurrence with the remedial action in the letter of concurrence presented in Appendix F of this ROD.

9. **Community acceptance** addresses whether the public concurs with the Navy's Proposed Plan. Community acceptance of the Proposed Plan was evaluated based on comments received at the public hearings and during the public comment period.

This is documented in the Responsiveness Summary presented in Appendix E of this ROD.

The state acceptance criterion has been addressed by incorporating comments received from the state on the Proposed Plan. The state is a party to the FFA and has had the opportunity to review and comment on all documents. Community acceptance criterion is addressed as part of the Responsiveness Summary in Appendix E of this ROD.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against seven of the nine criteria, was conducted. This comparative analysis can be found in Table 4-1 of the FFS.

The section below presents the nine criteria and a brief summary of each alternative and its strengths and weaknesses according to the detailed and comparative analyses.

Overall Protection of Human Health and the Environment

The selected alternative will reduce contaminant concentrations in groundwater, surface water, stream sediments, leachate seeps, and leachate sediment to levels protective of human health and the environment. The other three treatment alternatives would provide a similar degree of protection. However, the selected alternative includes an upgradient slurry wall to divert groundwater around the buried waste. This component of the alternative will decrease the amount of contaminated water to be extracted and treated compared to the other three treatment alternatives. The time required to achieve the remedial action objectives for the selected alternatives is estimated to be about one to two years, while the other treatment alternatives are estimated to require between 18 and 73 years to achieve the objectives.

The No Action and Minimal Action Alternatives would not achieve overall protection of human health and the environment because the cleanup objectives would not be achieved.

Compliance with Applicable or Relevant and Appropriate Requirements

The selected alternative and the three other treatment alternatives would meet all ARARs. The No Action and Minimal Action Alternatives would not meet ARARs because of the continued release of contaminants from the landfill to the groundwater discharging to Mere Brook.

Final treatment standards for groundwater will be based on discharge requirements. For the preferred discharge option, discharge to the POTW, treatment standards will be set such that the POTW will not be in violation of its National Pollutant Discharge Elimination System (NPDES) permit. These standards could be more stringent than MCLs.

Long-term Effectiveness and Permanence

The selected alternative will divert groundwater around the waste and limit rainwater infiltration into the landfill. The volume of contaminated groundwater remaining beneath the cap will be extracted and treated so that it will not discharge to Mere Brook. The remedial action objectives are estimated to be achieved in about one to two years. The contaminant source will not be remediated but the generation of contaminated groundwater will be minimized.

The other treatment alternatives would meet the remedial action objectives because contaminated groundwater would be extracted or collected and treated on a continual basis. Each of these options would provide a permanent remedy but would require between 18 and 73 years to achieve the remedial action objectives and would treat a much greater volume of contaminated groundwater.

Neither the No Action Alternative nor the Minimal Action Alternative would provide long-term effectiveness. The site would continue to pose a risk to humans and the environment.

Reduction of Toxicity, Mobility, or Volume through Treatment

The selected alternative will reduce the toxicity, mobility, and volume of contaminated groundwater through treatment. An estimated 16 million gallons of contaminated groundwater, which would otherwise discharge to Mere Brook, will be extracted and treated.

The other treatment alternatives would reduce toxicity, mobility, and volume through treatment. These alternatives would rely on natural flushing to decrease contaminant levels in groundwater and would require long-term treatment of contaminated groundwater to achieve the remedial objectives. A much greater volume of groundwater would require treatment in each of these alternatives.

The No Action Alternative and the Minimal Action Alternative would not reduce the toxicity, mobility, or volume of contaminants because no treatment would be involved.

Short-term Effectiveness

The selected alternative and the other three treatment alternatives have similar short-term effectiveness evaluations. Local truck traffic will increase because of the transportation of construction materials and equipment to and from the site. Environmental impacts will be minimal and are limited to the removal of trees to facilitate construction activities.

The No Action Alternative and the Minimal Action Alternative would not result in any adverse impacts to the public and the environment.

Implementability

All the alternatives evaluated in the FFS are implementable. All the necessary construction services required for the treatment alternatives are available. The extraction and treatment technologies proposed for the remedial action are implementable and have been successfully demonstrated at other sites. The preferred option of discharging treated water to the POTW must be approved by the Brunswick Sewer District before it can be implemented. If the application for discharge to the POTW is not approved, another discharge option would be required. Other discharge options include recycling the water back into the aquifer by upgradient recharge or discharge to surface water on base. Hazardous waste disposal sites able to accept waste from Superfund sites have been identified. These disposal sites would be used if the pretreatment metals sludge was determined to be hazardous. Coordination with base security would be required to obtain access to the secured area to conduct monitoring and construction activities.

Cost

The capital, operation and maintenance, and total costs for each alternative are provided as part of Section VII, Description of Alternatives. Although the selected alternative does not have the lowest estimated capital cost of the four treatment alternatives, it does have the lowest operation and maintenance cost and total cost. The higher capital cost is due mostly to the slurry wall component in the selected alternative. The lower operation and maintenance and total costs are a result of the reduced groundwater treatment time.

State Acceptance

As a party to the FFA, the State of Maine has provided comments on the RI/FS and the proposed plan and has documented its concurrence with the remedial action as

stated in Section XIII of this ROD. A copy of the State's letter of concurrence is presented in Appendix F of this ROD.

Community Acceptance

Community acceptance of the Proposed Plan was evaluated based on comments received at the public meetings and during the public comment period. This is documented in the Responsiveness Summary presented in Appendix E of this ROD.

X. THE SELECTED REMEDY

The selected remedial alternative chosen for Sites 1 and 3 (i.e., Alternative 1,3-C) is a comprehensive remedy having source control and management of migration components. It is designed to contain the buried waste and minimize the migration of contaminants from the landfill by reducing the water flowing through the waste.

A. CLEANUP LEVELS

Cleanup levels have been established for contaminants of concern in each media identified in the baseline risk assessment that were found to pose an unacceptable risk to either public health or the environment. The media of concern are groundwater, surface water, and leachate sediments. Cleanup levels have been set based on the appropriate ARARs (e.g., drinking water MCLs) if available. In the absence of a chemical-specific ARAR, or other suitable criteria to be considered, a 10^{-6} excess cancer risk level for each carcinogenic contaminant or a concentration corresponding to an HI of 1.0 for each noncarcinogenic contaminant was used to set cleanup levels for each exposure pathway. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and at the completion of the remedial action. If the remedial action is not found to be protective, further action shall be required.

1. Groundwater

Because the aquifer at and beyond the compliance boundary of the site is classified as GW-A, which is a potential source of drinking water, MCLs and non-zero Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act (SDWA) are ARARs.

Cleanup levels for known and probable carcinogenic compounds (Classes A and B) have been set at the appropriate MCL. Cleanup levels for the Class C, D, and E compounds (possible carcinogens not classified and no evidence of carcinogenicity) have also been set at the MCL. In the absence of an MCL, a proposed drinking water standard, or other suitable criteria to be considered (i.e., health advisory or state standard), a cleanup level was derived for carcinogenic effects based on a 10^{-6} excess cancer risk level considering the ingestion of groundwater.

Cleanup levels for compounds in groundwater exhibiting noncarcinogenic effects have been set at the MCL. In the absence of an MCL, cleanup levels for noncarcinogenic effects have been set at a level thought to be without appreciable risk of an adverse effect when exposure occurs over a lifetime (HI = 1.0).

Table 4 summarizes the cleanup levels for carcinogenic and noncarcinogenic contaminants of concern identified in groundwater.

These groundwater cleanup levels must be met at the completion of the remedial action at the points of compliance. These cleanup levels are consistent with ARARs for groundwater and attain USEPA's risk management goal for remedial actions (i.e., carcinogenic risk level between 10^{-4} and 10^{-6}) unless the MCL is outside the risk range. The MCL for arsenic is set at 0.050 μg/L and has a residual risk greater than 10^{-4}.

Risks presented by the soils at Sites 1 and 3 are within the acceptable range established by USEPA; therefore, residual risk remaining after implementation of the remedial action will also be in the acceptance range. Although soils/waste will not be removed or treated, containment technologies are generally considered appropriate for landfills where treatment is impracticable because of the volume and heterogeneity of the waste (USEPA, 1990). Therefore, no Target Cleanup Levels have been set for soils at Sites 1 and 3.

2. Other Cleanup Levels

Based on the results of the ecological risk assessment, remedial action objectives were developed to reduce exposure to or contaminant concentrations in surface water and leachate sediments around Mere Brook. Surface water Target Cleanup Levels for iron and zinc were proposed at the contaminants' AWQC for purposes of determining whether the contribution from Sites 1 and 3 to Mere Brook has been alleviated; leachate sediment Target Cleanup Levels for mercury were derived based on the food-web analysis.

Ecological Target Cleanup Levels for contaminants in leachate seeps and surface water were set at AWQC or risk-based levels. For zinc and iron (e.g., surface water contaminants), the Target Cleanup Levels were the AWQC; for soil/sediment contaminants (e.g., mercury) the cleanup levels were based on assumed exposure and risk conditions. Mercury was the only contaminant identified in the baseline risk assessment to present a propensity to bioaccumulate and biomagnify in terrestrial food chains. Other contaminants (e.g., VOCs and inorganic metals) do not exhibit the same behavior and, therefore, were not considered to present a risk to terrestrial receptors (E.C. Jordan Co., 1990a). The Target Cleanup Level of 1 mg/kg for mercury was developed using the same food-web analysis as in the baseline risk assessment. This model estimates the bioaccumulation of contaminants within a food web and can be used to estimate an acceptable soil/sediment concentration that is protective of higher trophic level organisms. Ecological Target Cleanup Levels are also presented in Table 4.

TABLE 4
PROPOSED CLEANUP LEVELS FOR SITES 1 AND 3

ROD: SITES 1 AND 3
NAS BRUNSWICK

MEDIUM	MAXIMUM CONCENTRATION	TARGET CLEANUP LEVEL	RATIONALE	RESIDUAL RISK[5]
Human Health				
Groundwater				
Arsenic	107 μg/L	50 μg/L	MCL[1,3]	1×10^{-3}(c)
Vinyl Chloride	180 μg/L	2 μg/L	MCL[4]	4.5×10^{-5}(c)
Methylene Chloride	460 μg/L	5 μg/L	MCL(p)	4.4×10^{-7}(c)
1,2-Dichloroethylene (cis)	140 μg/L	70 μg/L	MCL[3]	0.2 (nc)
1,2-Dichloroethylene (trans)	140 μg/L	100 μg/L	MCL[3]	0.1 (nc)
Chromium (total)	11 μg/L	100 μg/L	MCL	0.6 (nc)
Lead	60 μg/L	15 μg/L (action level)	MCL	NA
Nickel	78 μg/L	100 μg/L	MCL(p)[2]	0.1 (nc)
Ecological				
Leachate soil/sediment				
Mercury	3.3 mg/kg	1 mg/kg	Risk-based	

Notes:

MCL	=	Maximum Contaminant Level
MCL(p)	=	Proposed Maximum Contaminant Level
NA	=	quantitative dose-response data are not available
mg/kg	=	milligrams per kilograms
μg/L	=	micrograms per liter
1	=	The MCL for arsenic is currently under review; USEPA 1991a
2	=	MCL(p) is equal to MCLG.
3	=	USEPA 1991b.
4	=	MEG for Vinyl Chloride is 0.15 μg/L
5	=	(c) indicates carcinogenic compounds and (nc) indicates noncarcinogenic compounds

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B. Description of Remedial Components

The Navy's selected alternative is designed to contain the buried waste and minimize the migration of contaminants from the landfill by reducing the amount of water flowing through the waste. This alternative includes the following components:

- slurry wall
- cap
- groundwater extraction wells
- groundwater treatment
- discharge of treated water
- institutional controls and land-use restrictions
- environmental monitoring

Slurry Wall

The slurry wall would be placed around the landfill (with the exception of the Weapons Compound area), and would divert clean groundwater flow around the site, preventing groundwater contact with the landfill waste material (Figure 3). Because the slurry wall would be sealed into the underlying silty clay, and would have a permeability of 10^{-6} to 10^{-7} centimeters per second (cm/sec), minimal groundwater would flow beneath or through the wall. The location of the slurry wall in Figure 3 was estimated by computer simulation of the groundwater flow system. The actual placement of the wall will depend on further geotechnical explorations in the area, which are expected to be part of the pre-design efforts. Figures 4 and 5 show cross-sections of site geology, limits of waste, and the groundwater table interpreted from RI test pits and borings. The cross-sections also show the proposed location of the slurry wall. The final location of the slurry wall would be outside the limits of waste. Additional geotechnical borings, during the predesign phase, will more accurately map the location of the silty clay layer beneath the site.

Cap

A low-permeability cap would be placed over the landfill area to reduce the amount of rainfall infiltration and thereby reduce leachate production. The cap would also extend over the slurry wall to prevent desiccation of the slurry wall. The maximum permeability of the low-permeability soil (or clay) layer would be $1x10^{-7}$ cm/sec. The landfill cover would be designed to meet or exceed Resource Conservation and Recovery Act (RCRA) guidance as described in the USEPA document, *Design and Construction of RCRA/CERCLA Final Covers* (USEPA, 1991b) and sound engineering design practices. Site-specific conditions will be considered in determining the most effective cap design. A typical cover system is composed of a

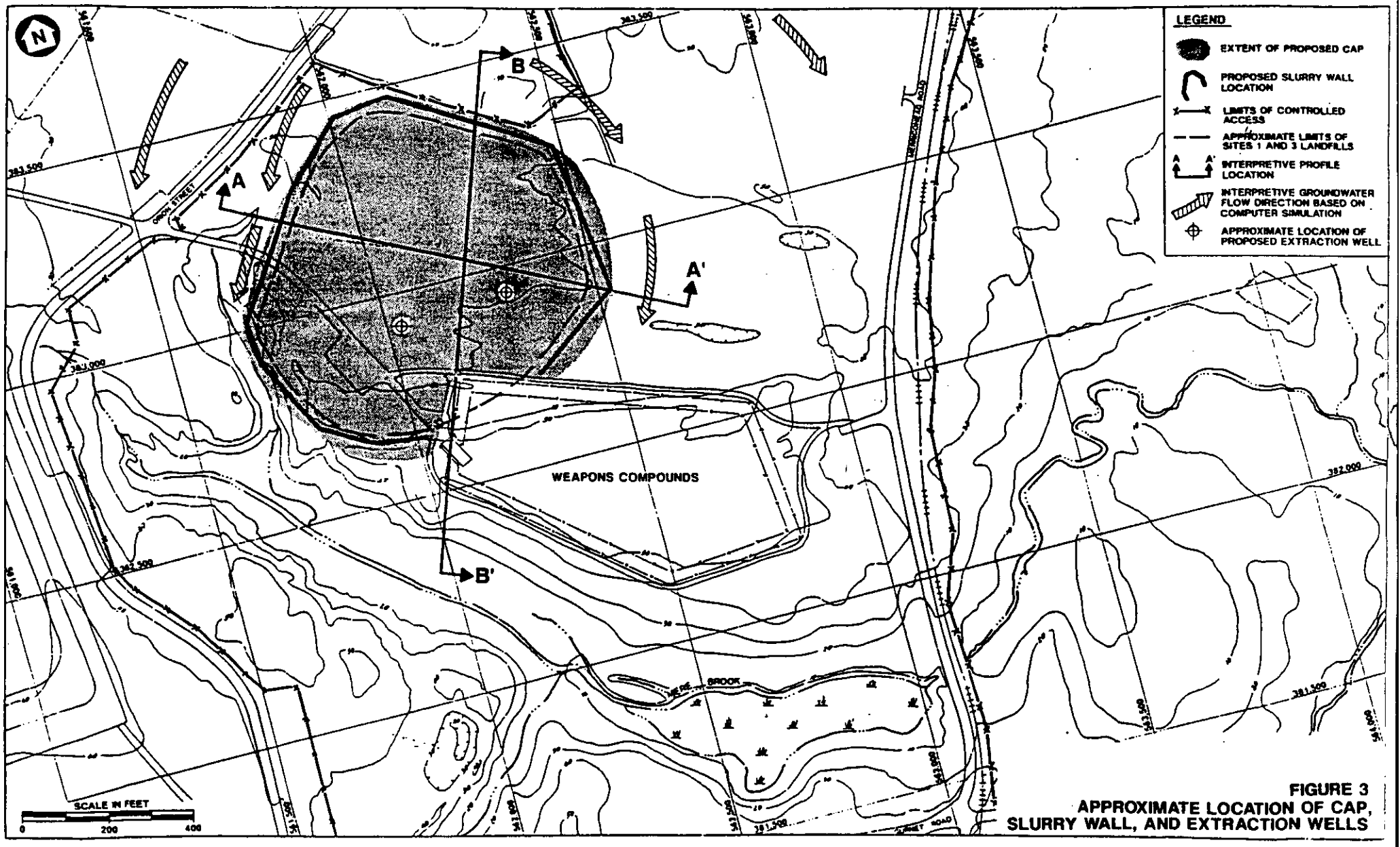
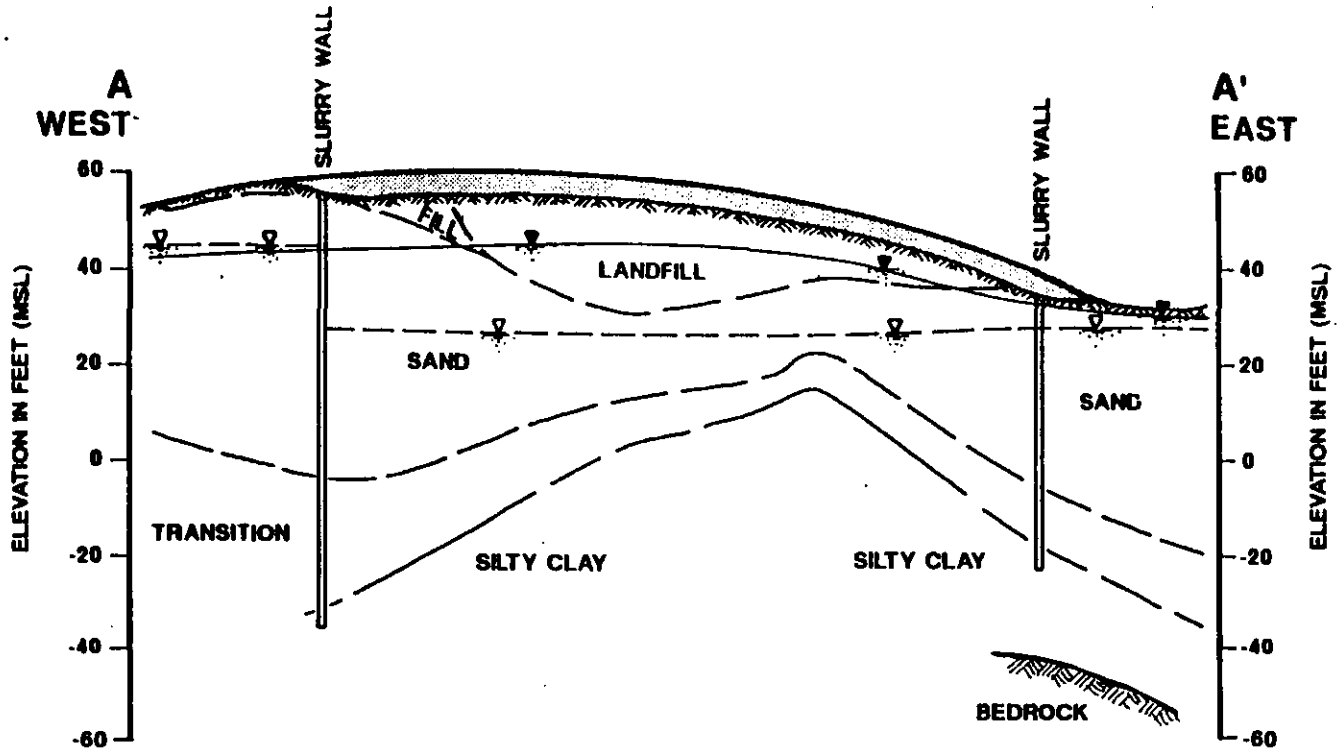


FIGURE 3
APPROXIMATE LOCATION OF CAP, SLURRY WALL, AND EXTRACTION WELLS



LEGEND

WATER LEVEL DATA FROM OCT. 1989

INTERPRETIVE GROUNDWATER TABLE BASED ON COMPUTER SIMULATION

PROPOSED CAP

NOTE: PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS MAY VARY FROM THOSE SHOWN.

GEOLOGIC DESCRIPTIONS:

SAND - TAN TO LIGHT BROWN FINE SAND, TRACE TO LITTLE MEDIUM SAND, TRACE SILT, POORLY GRADED, LOOSE TO MEDIUM DENSE, DRY TO SATURATED, SLIGHTLY STRATIFIED WITH DEPTH.

TRANSITION - BROWN TO GRAY FINE SAND AND SILTY, FINE SAND, TRACE CLAY, STRATIFIED WITH SILT AND CLAY LENSES, POORLY GRADED, NON TO SLIGHTLY PLASTIC, SOFT IN PLACES, SATURATED.

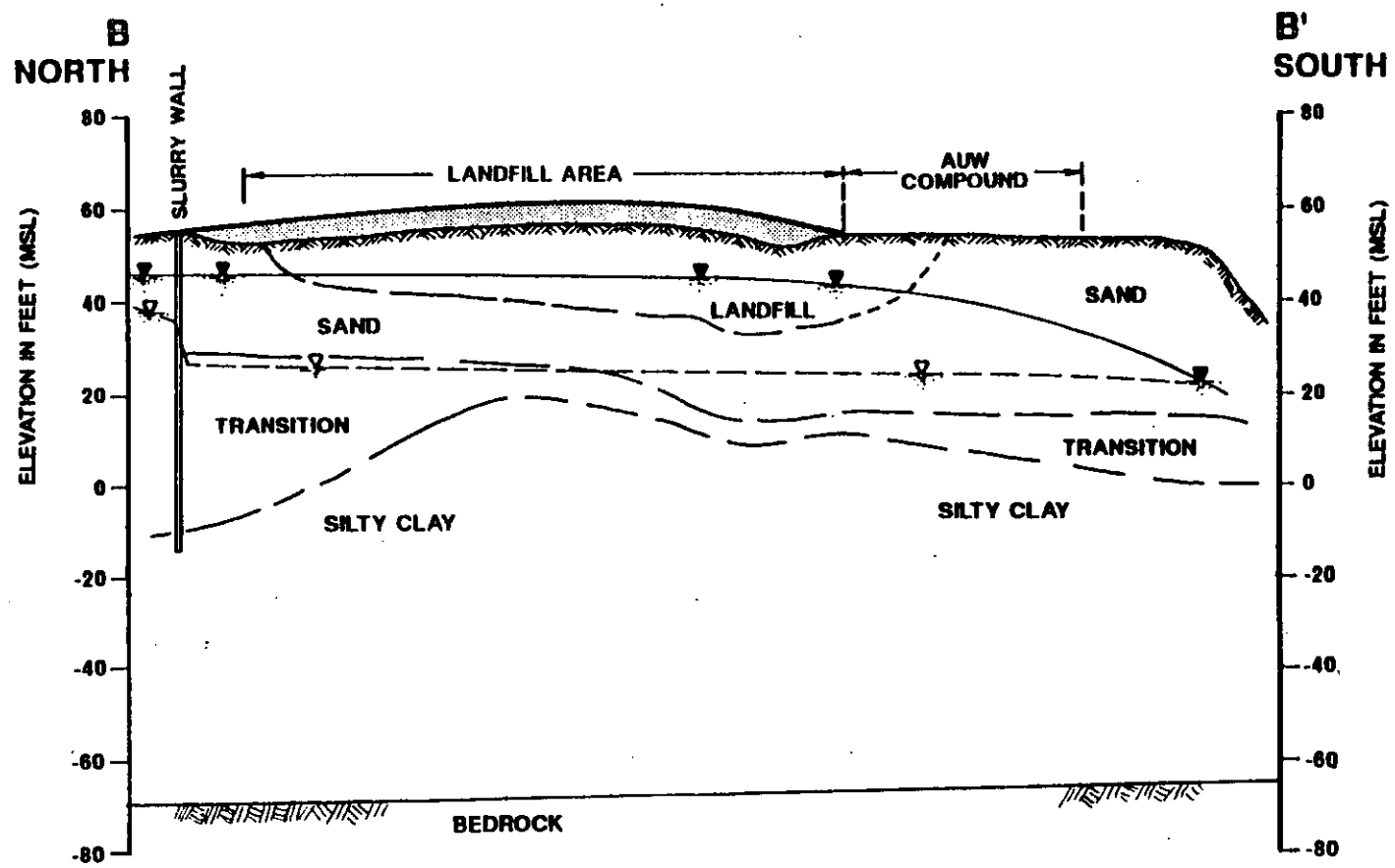
SILTY CLAY - GRAY, SILTY CLAY TO CLAYEY SILT (ROCK FLOUR), MEDIUM TO HIGH PLASTICITY, VERY SOFT, SATURATED.

SCALE IN FEET

200 400

VERTICAL EXAGGERATION 5:1

FIGURE 4
GEOLOGIC CROSS SECTION A-A'
FOR PROPOSED SLURRY WALL



LEGEND

- WATER LEVEL DATA FROM OCT. 1989
- INTERPRETIVE GROUNDWATER TABLE BASED ON COMPUTER SIMULATION
- PROPOSED CAP

NOTE: PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS MAY VARY FROM THOSE SHOWN.

GEOLOGIC DESCRIPTIONS:

SAND - TAN TO LIGHT BROWN FINE SAND, TRACE TO LITTLE MEDIUM SAND, TRACE SILT, POORLY GRADED, LOOSE TO MEDIUM DENSE, DRY TO SATURATED, SLIGHTLY STRATIFIED WITH DEPTH.

TRANSITION - BROWN TO GRAY FINE SAND AND SILTY, FINE SAND, TRACE CLAY, STRATIFIED WITH SILT AND CLAY LENSES, POORLY GRADED, NON TO SLIGHTLY PLASTIC, SOFT IN PLACES, SATURATED.

SILTY CLAY - GRAY, SILTY CLAY TO CLAYEY SILT (ROCK FLOUR), MEDIUM TO HIGH PLASTICITY, VERY SOFT, SATURATED.

SCALE IN FEET

0 200 400

VERTICAL EXAGGERATION 5:1

FIGURE 5
GEOLOGIC CROSS SECTION B-B' FOR PROPOSED SLURRY WALL

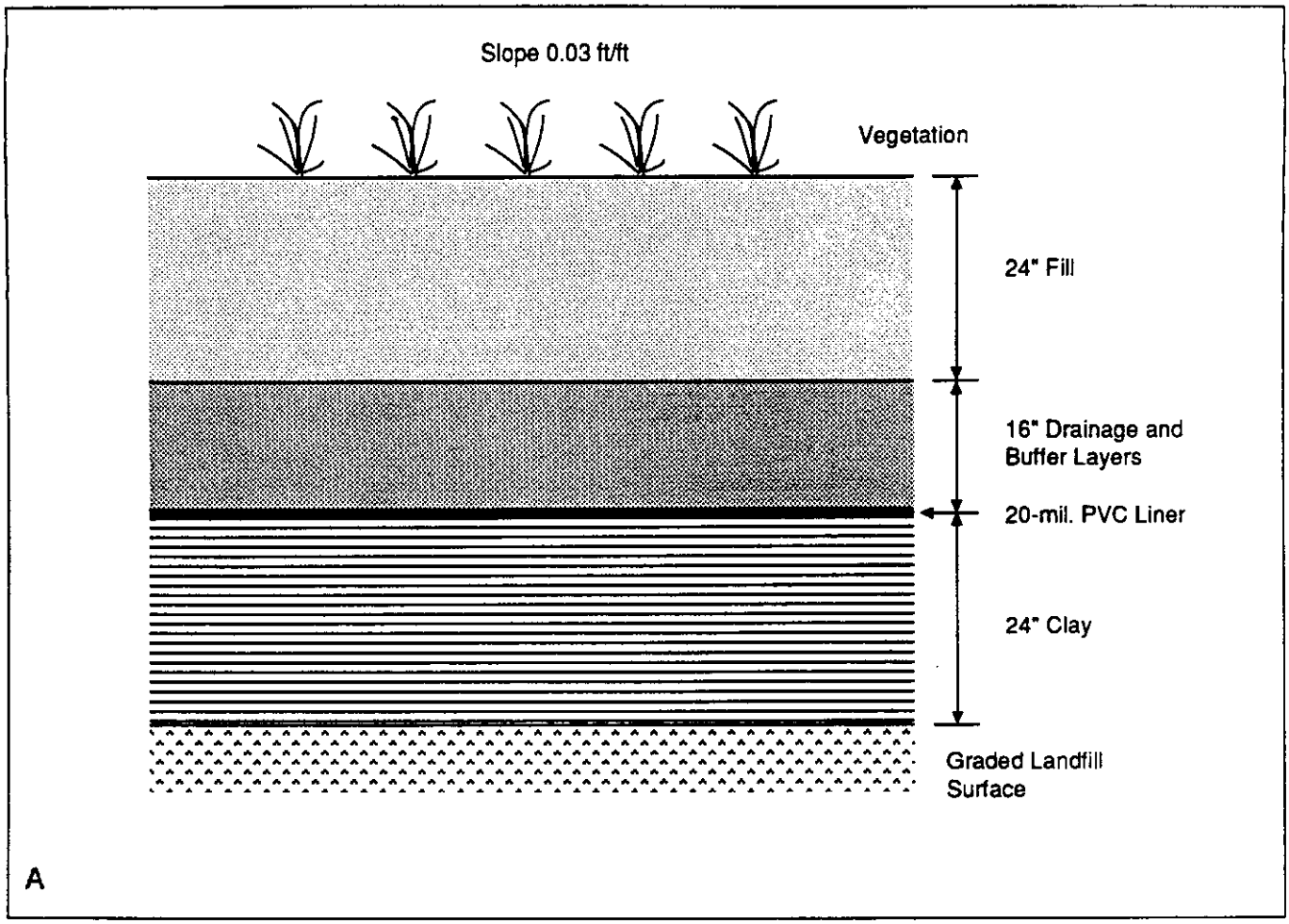
vegetative top cover layer, a drainage layer, and a bottom hydraulic barrier that can be either a 2-foot recompacted clay layer or a combined system of a 2-foot recompacted clay layer overlain by a synthetic membrane at least 20 mils thick. The cap described in this remedy, and used for cost-estimating purposes, is the latter composite cover system (Figure 6).

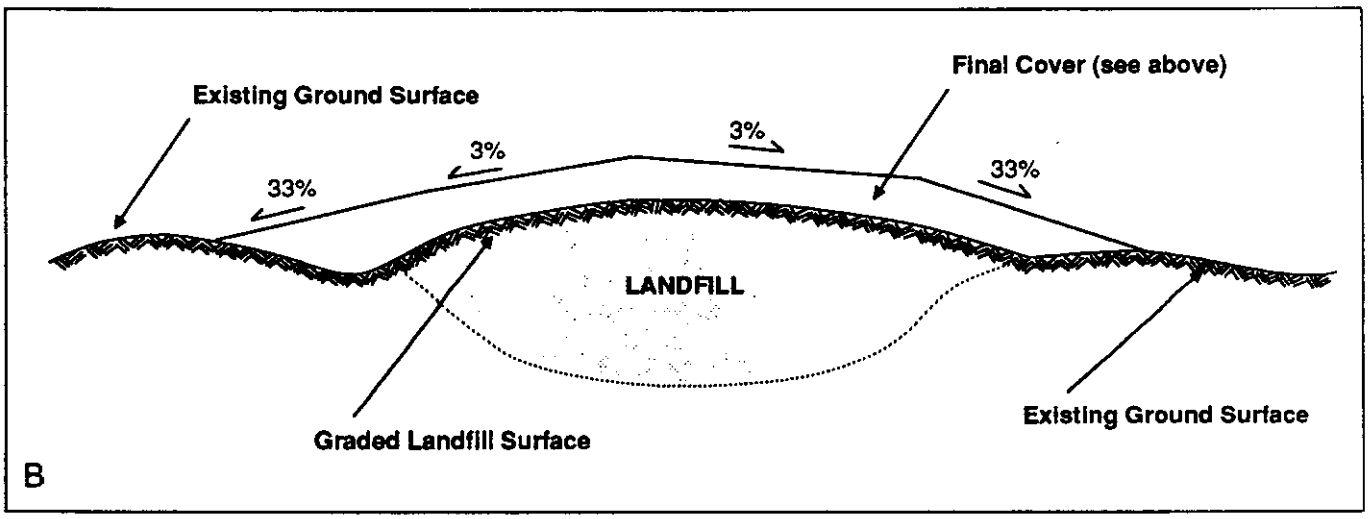
The proposed cap would cover approximately 12 acres, encompassing most of the area designated as Sites 1 and 3. A small portion (less than 0.3 acres) of Site 1 located within the Weapons Compound was not included in the cover system. Although waste has been uncovered in this area, much of it is assumed to have been removed during construction. Only a small area within the Weapons Compound is believed to contain waste and computer simulations of groundwater flow did not show a difference between the effects of a cap including or excluding this area. Therefore, the cap would not extend into the Weapons Compound, and would comply with the security regulations for this area of the base. Should the Weapons Compound be closed, the Navy would evaluate the need for extending the cap to include that portion of the Weapons Compound which is also part of the landfill area. In addition, the proximity of Site 3 to the steep bank of Mere Brook makes a complete cover system over the entire site infeasible. However, there is no evidence of disposal in or along the banks of Site 3; this area comprises natural undisturbed soils.

The combined effect of the cap and slurry wall would reduce the groundwater table to a level below the depth of waste. The cover system would require little maintenance and periodic post-closure inspections would be conducted to ensure proper integrity. All repairs to the cover system would be made, as necessary, based on these inspections. The grass would be mowed and reseeded as necessary. Periodic inspections and mowing could be performed by base personnel as part of the normal maintenance routine for the secured area. Inspection and maintenance of the cap system would be addressed in the operations and maintenance plan that would be developed by the Navy and reviewed and approved by appropriate regulatory agencies at the time of remedial design.

Groundwater Extraction Wells

A groundwater extraction system would be designed and installed to remove contaminated groundwater trapped beneath the cap and within the slurry wall (see Figure 3). Approximately 16 million gallons of water (i.e., one pore volume) would be removed and treated. Capturing this contaminated water would prevent it from discharging to Mere Brook. These extraction wells would decrease the time required for this water to drain naturally. The extraction wells included in the selected remedial alternative will facilitate the collection of the volume of contaminated





Not To Scale

FIGURE 6
RCRA GUIDANCE FINAL COVER SYSTEM

groundwater remaining beneath the landfill following installation of the slurry wall and reduce the time required to lower groundwater to levels located below the waste. The extraction wells will pump at relatively low flow rates to ensure sustainable flow rates. The pumping rates proposed for the extraction well system were developed using Theis equations and assumptions (Theis, 1935). Based on the location and proposed pumping rates for these extraction wells, the opening along the southern portion of the slurry wall is not expected to influence this component of the selected remedial alternative. The extraction well program will remove the volume of contaminated water remaining within the landfill area (i.e, one pore volume), which is estimated to be approximately 16 million gallons. The pore volume of water removed as part of the extraction well program represents the most significantly contaminated portion of the groundwater system and will prevent this contamination from discharging to Mere Brook. The selected remedial alternative will both lower the water table to levels located below the waste and remove the estimated one pore volume of water contained within the confines of the slurry wall and landfill cap. Groundwater extraction at the Sites 1 and 3 landfill is not expected to result in subsidence. Additional extraction of groundwater at this site is not anticipated or proposed, following the removal of the estimated one pore volume of water.

The final number of extraction wells will be determined based on data generated during the design phase modeling program. The exact number and location of the wells would be determined during remedial design. Actual pumping rates would be determined by pumping tests conducted after extraction well installation.

The extraction wells would be drilled to the underlying silty clay surface. The average depth to the silty clay in this portion of the landfill is estimated at approximately 40 feet bgs. Two 6-inch diameter wells with 30-foot screens would be installed in the borings. It is estimated that the entire aquifer-saturated thickness would be intercepted by the screens. The boreholes would be backfilled and sealed with bentonite. Protective casings would be installed and cemented in place. Each well would contain a submersible pump capable of extracting groundwater at a rate of up to 60 gallons per minute (gpm). The protective casing would not penetrate the hydraulic barrier layer. However, the well risers would and the geomembrane would be sealed to the risers using a geomembrane pipe boot. This well design has been assumed for cost-estimation purposes and may be altered during the remedial design.

Several piezometers would be installed in conjunction with the extraction wells to evaluate the hydraulic performance of the extraction well system. Piezometers would provide water level information during the pumping of extraction wells that would be used to estimate aquifer transmissivity, storage coefficients, and sustainable yields. The piezometers would be located both in the direction of and perpendicular to groundwater flow. The piezometers can be monitored after the pumps are shut off

to determine the effectiveness of the containment system in keeping water out of the waste.

Two types of aquifer testing would be performed at the site: (1) step-drawdown tests, and (2) constant-discharge tests. Step-drawdown tests provide data on well efficiency, contaminant capture, localized aquifer properties, and short-term well yields. Constant-discharge tests are used to evaluate drawdown effects, recharge boundaries, and large-scale aquifer properties that influence long-term contaminant-capture efficiency and operation of the groundwater extraction system.

Based on calculations, estimated flow rates, and analytical models, it is estimated that one pore volume (estimated to be 16 million gallons of water) may be removed in approximately 142 days (based on an estimated 78 gpm pumping rate). This time estimate would increase if the pumping rate is decreased. It should be noted that the time estimates are based on several assumed variables, in particular the fraction of organic carbon values, and that actual cleanup times may be considerably longer.

Groundwater Treatment

The extracted groundwater would be pumped to a central treatment plant located outside the Weapons Compound for the pretreatment of dissolved metals and treatment of VOCs. It is possible that contaminated groundwater from Sites 1 and 3 would be treated concurrently with groundwater from the Eastern Plume. This scenario is considered feasible because of the similar contaminants (i.e.,VOCs), the low flow rate of groundwater from Sites 1 and 3, and the short duration of time (estimated to be 142 days) that would be required to pump and treat the groundwater remaining beneath the cap and within the slurry wall.

An FS describing the alternatives for the Eastern Plume has been submitted to the regulatory agencies for review. A ROD for an Interim Remedial Action for the Eastern Plume has been submitted and also describes the concurrent water treatment scenario. The ROD for the Eastern Plume will be subject to the same public review and comment as this ROD.

A schematic flow diagram of the pretreatment process is shown in Figure 7. This system was developed for cost-estimating purposes to remove primarily iron and manganese. However, the final pretreatment system would be designed to remove inorganic compounds to the appropriate discharge limits (i.e., MCLs or pretreatment standards based on the POTW's NPDES permit) and concentrations that would not interfere with VOC treatment. A treatability test would be conducted prior to design

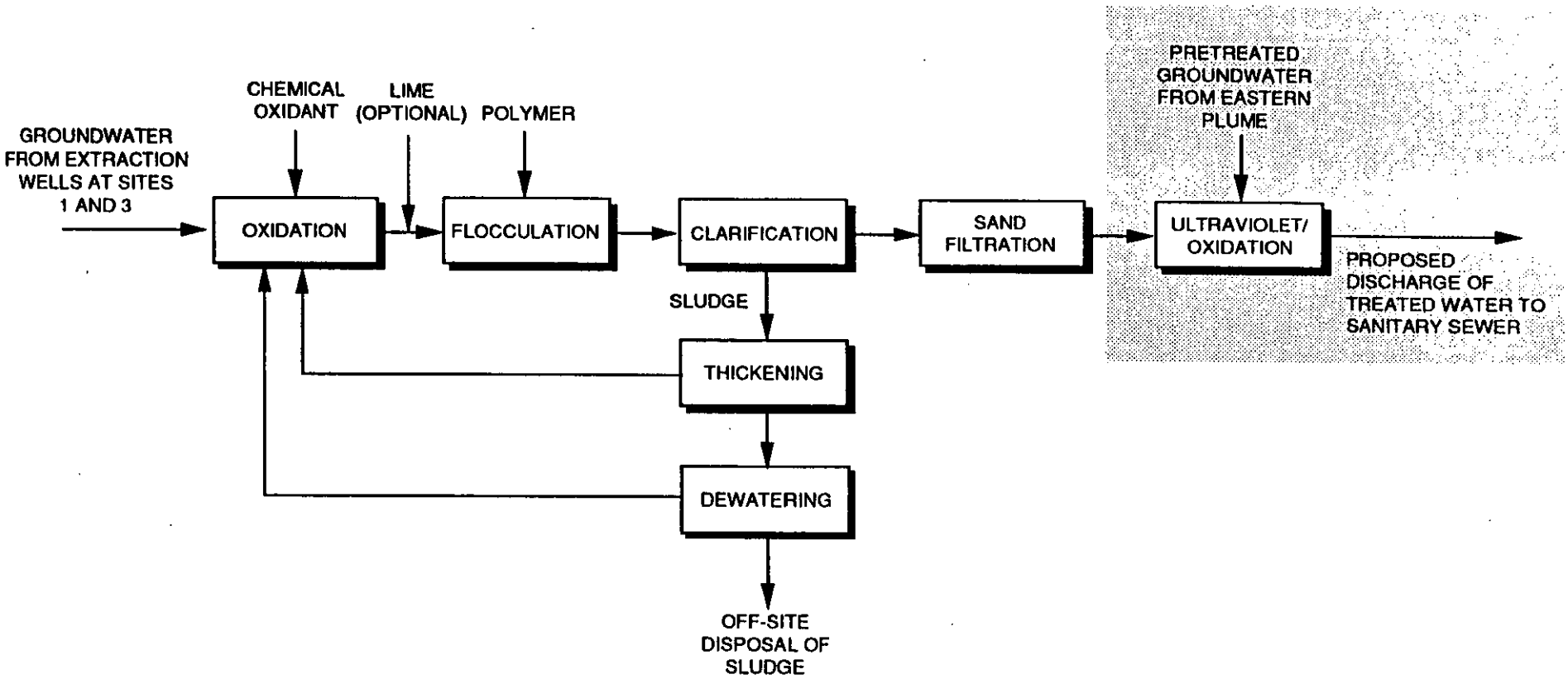


FIGURE 7
SCHEMATIC FLOW DIAGRAM FOR WATER TREATMENT

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to ensure the proper removal efficiency and/or the need for any modifications in the pretreatment process. If other inorganics such as arsenic and lead are present above their respective discharge limits, modifications to the system would be made. This may include adding pretreatment steps such as the addition of lime to reduce arsenic and lead concentrations to below discharge limits.

Once the metals are removed, the water would be treated to remove or reduce VOCs. The organic contaminants of concern would be destroyed using a technology known as UV/oxidation. This technology destroys organic compounds in water through chemical oxidation enhanced by exposure to UV light. Reagents typically used with UV/oxidation include ozone (O_3) and hydrogen peroxide (H_2O_2). (Some vendors use other proprietary oxidants.) Under these conditions, O_3 and H_2O_2 are rapidly converted to hydroxyl radicals. In addition, organic molecules absorb energy from the UV light, promoting reactions with hydroxyl radicals. The combined effects of UV light and concentrated hydroxyl radicals synergistically promote rapid breakdown of organic molecules. In the oxidation process, organic contaminants are broken down into simpler, nonhazardous substances such as carbon dioxide, water, salts, organic and inorganic acids, or other by-products. A treatability test would provide information on the compounds and concentrations likely to be present in the effluent.

Treatability studies would be required before full-scale design of a UV/oxidation system. These studies would determine which process option would provide better, more cost-effective treatment for the given conditions at Sites 1 and 3. Treatability tests would provide information on the by-products created, the need for polishing the treated water with activated carbon, and approximate process costs and operating conditions. The resulting effluent would be sampled to ensure that the water meets appropriate discharge standards.

Discharge of Treated Water

Several options were evaluated for discharge of treated water:

- surface water (e.g., Mere Brook)
- groundwater (e.g., infiltration)
- Brunswick Sewer District's POTW
- Town of Brunswick storm sewer system

The preferred option for discharge is piping the water to tie into the base sanitary sewer system (Brunswick Sewer District POTW). The Navy would need to obtain permission from the Brunswick Sewer District to discharge treated effluent to the system. The POTW's NPDES permit does not currently have pretreatment standards

for the compounds that may be detected in the treated water. Pretreatment standards are standards that apply to users of the POTW who contribute pollutants that interfere with or pass through the POTW. Pretreatment standards then become effluent limits on the user, in this case NAS Brunswick. These standards would be developed by the POTW to ensure that the POTW remains in compliance with its NPDES permit and sludge use and disposal practices. Regulations for land application of sludge have been set for the metals cadmium, chromium, copper, lead, mercury, nickel, and zinc for both maximum permissible concentrations and maximum loading limits (on a kilogram/hectare basis). A maximum permissible concentration level has also been set for PCBs.

The additional flow from the treatment plant would not cause the POTW to exceed its capacity. The design flow rate for the POTW is 3.85 million gallons per day (mgd). Average flows are currently 2.8 mgd, or about 73 percent of capacity. The cost of discharging treated water to the POTW cannot be estimated because pretreatment requirements are not yet known. Flow from NAS Brunswick is currently metered, and there would be a fee for the increased flow.

Institutional Controls and Land-Use Restrictions

This alternative requires institutional controls and land-use restrictions to prevent future use of the landfills or groundwater. Security is strictly enforced at Sites 1 and 3 because these sites are within the fenced area near the Weapons Compound. At Site 3, signs are posted warning of pesticides buried in the area. Additional warning signs would be posted around the landfill area and near leachate seeps. Restrictions on land use would be incorporated by NAS Brunswick to prevent future land use of the landfills and groundwater affected by the landfills.

Environmental Monitoring

The long-term environmental monitoring program would monitor groundwater flow and quality. Surface water, sediment, and leachate seeps would also be sampled and analyzed for the contaminants of concern. Data collected under this program would provide information necessary to assess the effectiveness of the cap and slurry wall at diverting clean water around the site and preventing further contamination of groundwater. In addition, the monitoring program would assess the dispersion and degradation of contamination that has already emanated from the landfill. The monitoring program would be submitted for regulatory review and would identify the sampling locations and sampling frequency. At a minimum, the environmental monitoring program would continue for 30 years.

Five-year reviews would also be required as part of the environmental monitoring program. In addition to making recommendations regarding future remedial actions, the five-year reviews would assess the performance of the containment system. The Navy would also conduct a risk assessment as part of the five-year review to ensure continued protection of public health and the environment. The results of the risk assessment would be used to determine the need for additional remedial actions.

XI. STATUTORY DETERMINATIONS

The remedial action selected for implementation at NAS Brunswick Sites 1 and 3 is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs, and is cost-effective. The selected remedy also satisfies the statutory preference for treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element. Additionally, the selected remedy uses alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

A. THE SELECTED REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT

The remedy at Sites 1 and 3 will permanently reduce the risks posed to human health and the environment by eliminating, reducing, or controlling exposures to human and environmental receptors through treatment, engineering controls, and institutional controls. The placement of a cap will eliminate direct contact and incidental ingestion exposure to residual soil contaminants and the implementation of institutional control on groundwater use will prevent exposure to contaminated groundwater during remediation. The cap and slurry wall will effectively lower the groundwater table, reducing the amount of contaminated groundwater discharging to Mere Brook and the leachate seep areas. Moreover, the selected remedy will result in human exposure levels that are within the 10^{-4} to 10^{-6} incremental cancer risk range and that are within the HI of 1.0 for noncarcinogens. Finally, implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts.

B. THE SELECTED REMEDY ATTAINS ARARS

This remedy will attain all the substantive, non-procedural portions of federal and state ARARs that apply to Sites 1 and 3. ARARs for Sites 1 and 3 were identified during both the RI and FFS. Appendix D presents tabular summaries of all ARARs previously identified, including the regulatory citation and a brief summary of the regulatory requirement and its consideration in the remedial process. The following narrative presents a summary of key ARARs and their applicability to the selected remedy.

Federal and state regulations identified for Sites 1 and 3 include:

Chemical-specific ARARs

- Safe Drinking Water Act (SDWA) - MCLs and non-zero MCLGs
- Resource Conservation and Recovery Act (RCRA) - MCLs
- Maine Drinking Water Rules
- Clean Water Act (CWA) - AWQC
- Maine Regulations Relating to Water Quality Criteria for Toxic Pollutants
- Clean Air Act - National Ambient Air Quality Standards
- Maine Ambient Air Quality Standards

The following chemical-specific policies, criteria, and guidelines were also considered:

- Maine Department of Human Services Rule 10-144A, CMR Chapter 233 - Maximum Exposure Guidelines (MEGs)
- USEPA RfDs
- USEPA Human Health Assessment Group Cancer Slope Factors (CSFs)

Location-Specific ARARs

- Maine Natural Resources Protection Act
- Natural Resources Protection Act
- Maine Standards for Classification of Minor Drainages
- Maine Standards for Classification of Groundwater
- Maine Site Location Development Law and Regulations

Action-Specific ARARs

- RCRA - General Facility Standards
- RCRA - Preparedness and Prevention
- RCRA - Contingency Plan and Emergency Procedures
- RCRA - Releases from Solid Waste Management Units
- RCRA - Closure and Post-closure
- RCRA - Miscellaneous Units
- Maine Hazardous Waste Management Rules
- Maine Landfill Disposal Regulations
- Occupational Safety and Health Administration (OSHA) - General Industry Standards
- OSHA - Safety and Health Regulations
- OSHA - Recordkeeping, Reporting, and Related Regulations
- CWA - Pretreatment Standards for POTW Discharge
- CWA - NPDES
- Maine Water Pollution Control Law: Conditions of Licenses
- Maine Water Pollution Control Law: Certain Deposits and Discharges Prohibited
- Underground Injection Control Program
- Maine Rules to Control the Subsurface Discharge of Pollutants by Well Injection

The following policies, criteria, and guidelines (i.e., TBCs) will also be considered during the implementation of the remedial action:

- MEDEP, Bureau of Water Quality Control, Policy Number 10: "The Discharge of Hazardous Substances to Groundwater of the State"

Federal and State Drinking Water Regulations. The chemical-specific ARARs identified for Sites 1 and 3 can be applied to the selected remedy in two manners. In the instance of drinking water standards, MCLs and other guidance and criteria to be considered (TBCs) were used in the development of target cleanup levels for the remediation of groundwater at the site. Drinking water standards may also be used separately, or in conjunction with surface water standards, in the development of discharge limits for treated groundwater.

In the development of groundwater cleanup levels, the groundwater in the aquifer underlying the site is classified by the state as GW-A, a drinking water source. The quality and safety of drinking water sources is regulated by the SDWA and Maine Drinking Water Rules. MCLs are enforceable standards under the SDWA that represent the maximum level of contaminants that is acceptable for users of public drinking water supplies. MCLs are relevant and appropriate because, while the groundwater on and off site is not currently used as a drinking water source, the groundwater underlying NAS Brunswick potentially could be used as a drinking water source in the future.

Target cleanup levels for groundwater at Sites 1 and 3 were developed based on the results of the baseline risk assessment. Federal and state MCLs were the first order of standards used in establishing cleanup levels. For those contaminants for which no MCLs were available, other criteria and guidelines (i.e., TBCs) were used. TBCs used during the risk assessment and in establishing cleanup levels included Maine MEGs, USEPA RfDs, and USEPA CSFs.

Chemical-specific ARARs and risk-based target cleanup levels will be met by extracting the contaminated groundwater within the landfill and reducing leachate generation by containing the waste. Contaminated groundwater currently discharges to Mere Brook, via leachate seeps, immediately downgradient of the landfill.

Federal and State Water Quality Criteria. In developing discharge limits for treated groundwater, drinking water standards and surface water standards identified under chemical-specific ARARs may be applicable to the selected remedy depending on the choice of discharge option. The selected remedy considers three options for discharge of treated groundwater. The Navy's preferred option is discharge of treated water to the Brunswick POTW. Under this option, discharge limits would be based on factors regulated by the POTW's NPDES permit, pretreatment regulations, and water pollution control laws, which will be discussed under action-specific ARARs. Because final discharge from the POTW would be to the

Androscoggin River, federal AWQC and Maine Water Quality Criteria are ultimately applicable to this discharge option.

Pretreatment standards are being developed with the Brunswick POTW. Both the Pretreatment Standards and CWA NPDES will be attained upon successful establishment of pretreatment standards for discharge from the groundwater treatment plant.

Another option for the discharge of treated groundwater would be groundwater reinjection. As required by Underground Injection Control Programs, to be discussed under action-specific ARARs, federal and state MCLs and MEGs would apply to the development of discharge limits. To reinject groundwater, MCLs and MEGs would be attained through treatment of contaminated groundwater.

The final option for discharge of treated groundwater would be directly to a surface water source on NAS Brunswick. This action would be governed by NPDES and Water Pollution Control Regulations, to be discussed under action-specific ARARs. However, these regulations would require development of discharge limits that comply with federal and state Water Quality Criteria. Compliance with NPDES and Water Pollution Control Regulations would be through treatment of contaminated groundwater to final discharge limits and regular monitoring of the effluent.

Federal and State Air Quality Regulations. The treatment technologies proposed in the selected remedy will not create any new sources of air emissions. Therefore, many federal and state regulations governing air quality do not apply to the selected remedy. The only air quality standards that are applicable are particulate standards promulgated under the Clean Air Act and Maine Ambient Air Quality Standards. The particulate standard would apply to remedial construction activities associated with the slurry wall and cap. These standards would be attained through monitoring and, if necessary, use of dust suppression techniques or engineering controls.

State Location-specific Regulations. All of the location-specific ARARs that apply to the selected remedy are based on the close proximity of the site to Mere Brook. The Maine Natural Resources Protection Act provides that removal of soils or other activities conducted adjacent to streams must not cause unreasonable soil erosion, cause unreasonable harm to significant wildlife habitats, unreasonably interfere with natural water flow, lower water quality, or unreasonably cause or increase flooding. Chapter 305 of the MEDEP regulations provides further standards for erosion control and soil excavation. Implementation of the selected remedy would not impact the drainage or natural flow of Mere Brook. Erosion control measures will be employed during construction to minimize soil/sediment from entering Mere Brook.

Portions of the Maine Site Location Development Law, and associated regulations, apply to this site. The law and regulations provide that new development, which handles hazardous waste, cannot have an adverse effect on the natural environment or pose an unreasonable risk of discharge to a significant groundwater aquifer. Portions of Chapter 375, which form the no adverse environmental effect standards regulation of natural drainageways, runoff, erosion, sedimentation control, and groundwater quality will be attained by the selected remedy. As previously mentioned, implementation of the selected remedy would not impact the drainage and flow of Mere Brook. Sedimentation and erosion controls will be employed to minimize soil/sediment entering Mere Brook. Components of the selected remedy will be designed to remediate groundwater and to prevent further impact to the environment.

Federal and State Hazardous Waste Regulations. The applicability of RCRA and Maine Hazardous Waste Regulations depends on whether the wastes are RCRA-hazardous wastes as defined under these regulations. To date, there is no information available (i.e., manifests) to indicate that RCRA-regulated materials were disposed of at Sites 1 and 3. However, because toxic constituents are present in the waste materials and groundwater at Sites 1 and 3, many portions of the federal and state hazardous waste regulations are relevant and appropriate to the selected remedy.

RCRA General Facility Standards, Preparedness and Prevention, and Contingency Plan and Emergency Procedures will be attained during construction and operation of the groundwater treatment plant. The treatment plant, which will be located outside the Weapons Compound Area, will be secured to prevent access by unauthorized personnel. The facility will be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment. During remedial construction, safety and communication equipment will be installed at the site, and local authorities will be familiarized with site operations. Contingency plans will be developed and implemented during site work and treatment plant operation. A program will be developed for handling, storage, and recordkeeping, in accordance with Maine Hazardous Management Rules.

A groundwater monitoring program will be developed for Sites 1 and 3 in accordance with RCRA Releases from Solid Waste Management Units and Closure and Post-Closure regulations.

During treatment of contaminated groundwater, sludges containing some toxic constituents will be produced. A component of groundwater treatment includes laboratory analysis of this sludge, including Toxicity Characteristic Leachate

Procedure (TCLP) testing. If the sludge fails TCLP testing, this material will be considered hazardous. As a characteristic hazardous waste, RCRA regulations including Land Disposal Restrictions, will apply and the sludge will be treated and disposed of in a RCRA Subtitle C facility.

Because toxic constituents are present on site, OSHA regulations protecting worker health and safety at hazardous waste sites are applicable to the implementation and long-term operation of the selected remedy. Site workers will have completed training requirements and will have appropriate health and safety equipment on site. Contractors and subcontractors working on site will follow health and safety procedures.

Federal and State NPDES, Water Pollution Control, and Underground Injection Regulations. As mentioned, many action-specific ARARs will regulate the discharge of treated groundwater. The three discharge options for the selected remedy include: (1) Brunswick POTW, (2) reinjection to groundwater, and (3) direct discharge to surface water. Discharge of treated groundwater to the Brunswick POTW is the Navy's preferred option; however, final approval has not been obtained from the POTW. CWA Pretreatment Standards for POTW Discharge would be attained through treatment of the groundwater to these standards. Indirectly, CWA NPDES is an applicable regulation, because the final discharge is to the Androscoggin River and the Brunswick POTW has a current NPDES permit.

If discharge to the POTW is not acceptable, a second alternative is to reinject treated water back to groundwater. The federal Underground Injection Control Program and Maine Rules to Control the Subsurface Discharge of Pollutants by Well Injection are applicable to this discharge option. These regulations would require and be attained through establishment of standards for the treatment of groundwater that attain federal and state drinking water standards and guidance values.

The third discharge option would be to send treated groundwater directly to a surface water source on NAS Brunswick. The CWA NPDES and Maine Water Pollution Control Laws would apply to this method of discharge. Under this option, an NPDES permit would need to be obtained. In the course of obtaining that permit, discharge limits for the treatment plant effluent would be established. Federal and state water quality criteria would be used in the development of final discharge limits.

C. THE SELECTED REMEDIAL ACTION IS COST-EFFECTIVE

The selected remedy is cost-effective; that is, the remedy affords overall effectiveness proportional to its costs. In selecting this remedy, once the Navy identified

alternatives that are protective of human health and the environment and that attain ARARs, the Navy evaluated the overall effectiveness of each alternative by assessing the relevant three criteria: (1) long-term effectiveness and permanence; (2) reduction in toxicity, mobility, and volume through treatment; and (3) short-term effectiveness, in combination. The relationship of the overall effectiveness of the selected remedial alternative was determined to be proportional to its costs. The costs of this remedial alternative are:

Estimated Capital Cost: $3,874,000
*Estimated Operation and Maintenance Cost (net present worth): $1,432,000**
*Estimated Total Cost (net present worth): $7,842,000**

* Net present worth costs are based on a 10 percent discount factor and 30 years of operation.

The least expensive alternative is clearly the No Action Alternative, estimated to cost nothing because it would not require any additional controls or monitoring. The Minimal Action Alternative is expected to cost approximately $1.1 million. The selected remedy is also relatively inexpensive at approximately $7.8 million.

The cost of the three flushing alternatives only differ by approximately 10 percent, even though they offer varying degrees of containment (i.e., cap or no cap) and different systems for groundwater collection (i.e., downgradient interceptor trench or extraction wells). For example, for Alternative 1,3-D, there is only a $1.2 million difference in the total present worth cost of the alternative because of the lower capital cost of installing eight extraction wells instead of a 2,300-foot-long interceptor trench (E.C. Jordan Co., 1991c).

Because the total costs of the groundwater collection and treatment alternatives are so similar, the alternatives should be compared on the basis of their effectiveness in meeting response objectives, compliance with federal and state ARARs, and the relative ease of implementing the alternative within the constraints imposed by the sites' location.

All the alternatives considered, except No Action and Minimal Action, are protective of human health and the environment, meet ARARs and response objectives, and have similar long-term effectiveness and permanence. While the selected remedy does not have the lowest estimated capital cost of the four treatment alternatives, it does have the lowest estimated operation and maintenance cost and estimated total cost. This is due to the fact that groundwater treatment would not have to be carried out for nearly as long in the selected remedy.

D. THE SELECTED REMEDY UTILIZES PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The Navy identified those alternatives that attain ARARs and that are protective of human health and the environment. The Navy also identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility, or volume through treatment, (3) short-term effectiveness, (4) implementability, and (5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility, and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and state acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

E. THE SELECTED REMEDY SATISFIES THE PREFERENCE FOR TREATMENT WHICH PERMANENTLY AND SIGNIFICANTLY REDUCES THE TOXICITY, MOBILITY, OR VOLUME OF THE HAZARDOUS SUBSTANCES AS A PRINCIPAL ELEMENT

The principal element of the selected remedy is the management of migration of contaminated groundwater. This element addresses the primary threat at Sites 1 and 3, contamination of groundwater under Sites 1 and 3, which expresses itself in surface water and leachate seeps on the banks of Mere Brook. The selected remedy satisfies the statutory preference for treatment as a principal element by pumping groundwater from Sites 1 and 3 and treating it with UV/oxidation, before discharging the treated water.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

The Navy presented a Proposed Plan for remediation of Sites 1 and 3 on December 12, 1991. The preferred alternative included constructing a cap over the landfills and a slurry wall around the waste to prevent clean water from entering the landfills. Contaminated groundwater contained by the cap and slurry wall will be pumped and treated by UV/oxidation to destroy the organic compounds before it is discharged. Because the design of the cap must consider site-specific conditions that will be identified during the pre-design studies, alternatives to the cap design identified in the Proposed Plan could be identified and should be evaluated.

The principal component of the selected remedy will be the placement of a multi-layered cap over those areas in or contiguous with Sites 1 and 3 and construction of a slurry wall around the sites. The cap and slurry wall will reduce the infiltration of water into the waste and thereby reduce the leaching of contaminants from the waste into groundwater.

The cap will be designed to meet or exceed the performance requirements set forth in 40 CFR Sections 264.111, 40 CFR 264.310, and the technical guidance document *Design and Construction of RCRA/CERCLA Final Covers* (EPA/625/4-91/025, May 1991b) or in a manner that achieves performance equivalent to that required by 40 CFR Sections 264.111, 264.310, and the technical guidance. Site-specific conditions will be considered in determining the most effective cap design. Alternative cap designs will be evaluated to expedite cap construction, minimize settlement, and minimize the use of nonrenewable resources (e.g., a hydraulic barrier design using a bentonite mat technology instead of a 24-inch layer of recompacted natural low-permeability soil, a drainage layer design using geosynthetics or geogrids instead of a 12-inch soil layer).

XIII. STATE ROLE

As a party to the FFA, MEDEP has reviewed the various alternatives and has indicated its support for the selected remedy. MEDEP concurs with the selected remedy for NAS Brunswick Sites 1 and 3. A copy of the letter of concurrence is presented in Appendix F of this ROD.

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substance and Disease Registry
AWQC	Ambient Water Quality Criteria
BACSE	Brunswick Area Citizens for a Safe Environment
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (the Superfund statute)
CSF	cancer slope factor
cm/sec	centimeters per second
CWA	Clean Water Act
cy	cubic yards
DCA	dichloroethane
DCE	dichloroethylene
DDT	dichlorodiphenyltrichloroethane
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
gpm	gallons per minute
HI	Hazard Index
H_2O_2	hydrogen peroxide
HQ	Hazard Quotient
IAS	Initial Assessment Study
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MEDEP	Maine Department of Environmental Protection
MEG	Maximum Exposure Guidelines
mgd	million gallons per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter

MSL	mean sea level
NAS	Naval Air Station
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OSHA	Occupational Safety and Health Administration
O_3	ozone
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
POTW	publicly owned treatment works
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RfD	risk reference dose
RI	Remedial Investigation
ROD	Record of Decision
SDWA	Safe Drinking Water Act
SVOC	semivolatile organic compound
TAG	Technical Assistance Grant
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethylene
TCLP	Toxicity Characteristic Leachate Procedure
TRC	Technical Review Committee
μg/L	micrograms per liter
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
VOC	volatile organic compound

E.C. Jordan Co., 1990a. "Draft Final Remedial Investigation Report NAS Brunswick"; Portland, Maine; August.

E.C. Jordan Co., 1990b. "Draft Final Phase I Feasibility Study Development and Screening of Alternatives NAS Brunswick"; Portland, Maine; August.

E.C. Jordan Co., 1991a. "Draft Final Supplemental Remedial Investigation Report NAS Brunswick"; Portland, Maine; August.

E.C. Jordan Co., 1991b. "Draft Final Supplemental Feasibility Study Sites 5, 6, and 12 NAS Brunswick"; Portland, Maine; July.

E.C. Jordan Co., 1991c. "Focused Feasibility Study Sites 1 and 3 NAS Brunswick"; Portland, Maine; October.

E.C. Jordan Co., 1991d. "Draft Final Focused Feasibility Study Site 8 NAS Brunswick"; Portland, Maine; October.

E.C. Jordan Co., 1991e. "Draft Final Feasibility Study NAS Brunswick"; Portland, Maine; November.

Theis, C.V., 1935. "The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage"; Transactions, American Geophysical Union, Vol. 16, pp. 519-524.

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

U.S. Environmental Protection Agency (USEPA), 1991a. "Drinking Water Regulations and Health Advisories"; Office of Water, Washington, D.C.; November.

U.S. Environmental Protection Agency (USEPA), 1991b. "Design and Construction of RCRA/CERCLA Final Covers". Office of Research and Development; Washington, D.C.; EPA/625/4-91/025. May.

APPENDIX A

MEDIA-SPECIFIC DATA SUMMARY TABLES

ANALYTICAL SUMMARY
SITES 1 AND 3
SOILS

COMPOUND	RANGE OF CONCENTRATIONS DETECTED		
	TEST PITS		SOIL BORINGS
	SURFACE	SUBSURFACE	SUBSURFACE
Fluoranthene	ND	ND-350	ND
Pyrene	ND	ND-460	ND
1,4-Dichlorobenzene	ND	ND-1100	ND
2-Methylnaphthalene	ND	ND-480	ND
Total PAHs	ND-16690	ND-23770	ND
Bis(2-Ethylhexyl)Phthalate	ND	ND-1700	ND-4600
4,4'-DDD	ND	ND-28	ND
4,4'-DDT	ND	ND-150	ND-71
Arochlor 1242	ND-470	ND-440	ND
Arochlor 1254	ND-630	ND	ND
Arochlor 1260	ND	ND-720	ND
Naphthalene	ND	ND-810	ND
Xylenes	ND	ND-33	ND-7
Acetone	ND	ND-11J	ND
Dieldrin	ND	ND-48	ND
Tetrachloroethene	ND	ND-6	ND
Alpha-Chlordane	ND	ND-800	ND
Gamma BHA	ND	ND-15	ND
Gamma Chlordane	ND	ND-1100	ND
Heptachlor	ND	ND-78	ND
Chrysene	ND	ND-470	ND
Vinyl Chloride	ND	ND	ND-16
1,2-Dichloroethene	ND	ND	ND-27
Endrin	ND	ND	ND-33
1,1-Dichloroethane	ND	ND	ND-7

NOTES:

All concentrations in μg/kg
J: Estimate concentration

ANALYTICAL SUMMARY
SITES 1 AND 3
GROUNDWATER

COMPOUND	RANGE OF CONCENTRATIONS DETECTED	MCL	MEG
Aluminum	ND-5200		1430
Arsenic	ND-107	50(1)	30
Barium	ND-327	2000(2)	1000
Cadmium	ND-13	5	5
Calcium	ND-128000		
Chromium	ND-11		5
Cobalt	ND-60		
Cyanide	ND-34		154
Iron	ND-286000J		
Lead	ND-60	at tap:15(3)	20
Magnesium	ND-22100		
Manganese	21-5400		
Mercury	ND-0.22J	2	2
Nickel	ND-78		150
Potassium	ND-24000		
Sodium	ND-540000		
Vanadium	ND-80		
Zinc	ND-297		
Bicarbonate	8.1-590		
Chloride	2.4-190		
Sulfate	ND-24		
Vinyl Chloride	ND-180	2	0.15
Chloroethane	ND-25		
Methylene Chloride	ND-460D		
1,1-Dichloroethane	ND-38		5
1,2-Dichloroethene (total)	ND-60	70(4)	70
Benzene	ND-6	5	5
4-Methyl-2-Pentanone	ND-13		
Toluene	ND-210	1000(5)	2000
Chlorobenzene	ND-32	100(5)	
Ethylbenzene	ND-200	700(5)	700
Xylenes(total)	ND-660E	10000(5)	600
Bis(2-Ethylhexyl)phthalate	ND-20		
Naphthalene	ND-21J		
1,4-Dichlorobenzene	ND-27J	75	
4-Methylphenol	ND-95		
Phenol	ND-230		
2-Methylphenol	ND-410D		
Benzoic Acid	ND-86		

NOTES:
All concentrations in $\mu g/L$
(1) Standard is under review.
(2) Standard goes into effect January 1, 1993.
(3) Standard goes into effect December 7, 1992.
(4) MCLs are separate for cis- and trans- 1,2-DCE. Standard listed is for cis, the lower of the two standards.
(5) Standard goes into effect July 30, 1992.
J: Estimate concentration
D: Concentration obtained via dilution
E: Analyte concentration exceeded calibration range of GC/MS

ANALYTICAL SUMMARY
SITES 1 AND 3
SURFACE SOILS, SURFACE WATER, SEDIMENTS, LEACHATES

COMPOUND	RANGE OF CONCENTRATIONS DETECTED			
	SURFACE SOILS	SURFACE WATER	SEDIMENTS	LEACHATE SEEPS
Aluminum	ND	ND-60500	ND-7460	497-199000
Antimony	ND	ND-122	ND	ND-384
Arsenic	ND	ND-70.9	ND-250	ND-3870J
Barium	ND	ND-1380	ND-313	ND-4130
Beryllium	ND	ND-9.5	ND	ND-99.5
Cadmium	ND	ND-12.1	ND-43	ND-180
Calcium	ND	ND-78200	ND-11900	20-144000
Chromium	ND	ND-68.7	ND-26	11-1190
Cobalt	ND	ND-223	ND-232	ND-1240
Copper	ND	ND-326	ND-58	ND-914
Cyanide	ND	ND-20.8	ND	ND-392
Iron	ND	214D-1910000	7000-420000J	10700-2510000
Lead	ND	ND-415	ND-123J	ND-1740
Magnesium	ND	ND	ND	ND-243000
Manganese	ND-65	ND-6880	ND-21000J	ND-50000
Mercury	ND-3.3	ND-1.1	ND-4.7	ND-9.3
Nickel	ND	ND	ND	ND-1050
Potassium	ND	ND-5420	ND	ND-112000
Silver	ND	ND	ND	ND-11.6
Sodium	ND	ND-24600	ND	ND-54400
Vanadium	ND	ND	ND	ND-2600
Zinc	ND	ND-6760J	ND-266J	26-2770
Vinyl Chloride	ND	ND	ND	ND-11
Methylene Chloride	ND	ND	ND-52J	ND
Acetone	ND	ND	ND-60J	ND
1,1-Dichloroethane	ND	ND	ND	ND-24
1,2-Dichloroethene	ND	ND	ND	ND-140
1,2-Dichloroethane	ND	ND	ND-78	ND
1,1,1-Trichloroethane	ND	ND-30	ND-76	ND
Trichloroethene	ND	ND-31	ND-10	ND-20
1,1,2-Trichloroethane	ND	ND	ND-440	ND
Tetrachloroethene	ND	ND-30	ND	ND
1,1,2,2-Tetrachloroethane	ND-100	ND-12	ND-3700	ND-1100
Toluene	ND	ND	ND	ND-5
Ethylbenzene	ND	ND	ND-110	ND-9J
Xylenes(total)	ND	ND	ND	ND-17J
Bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND-23
1,4-Dichlorobenzene	ND	ND	ND-6800	ND-36J
Dichlorobenzene	ND	ND	ND	ND-17J
4-Methylphenol	ND	ND	ND-4920	ND-57
Benzoic Acid	ND	ND	ND	ND-64
4,4'-DDE	ND	ND	ND	ND-0.400
4,4'-DDT	ND-52	ND	ND	ND-0.22
4,4'-DDD	ND	ND	ND	ND-0.360
Total PAHs	ND	ND	ND-18910	ND

NOTES:

All concentrations in ppb
J: Estimate concentration

APPENDIX B

RISK CALCULATIONS: BASELINE RISK ASSESSMENT

TABLE 1

INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL

SITES 1 AND 3

ADULT AND CHILD

Noncarcinogenic – Chronic

Compound	Maximum Concentration (ug/g)	Average Concentration (ug/g)	Reference Dose (mg/kg/day)	Adult (Resident) Hazard Index (Max.)	Adult (Resident) Hazard Index (Ave.)	Adult (Utility Worker) Hazard Index (Max.)	Adult (Utility Worker) Hazard Index (Ave.)
Arsenic	4.2	0.183	1.00E−03	4.73E−04	2.06E−05	5.75E−05	2.51E−06
Cadmium	1.5	0.0652	1.00E−03	3.10E−04	1.35E−05	3.52E−05	1.53E−06
Carcinogenic PAHs	7.65	0.4296	4.00E−03	1.08E−03	6.05E−05	1.87E−04	1.05E−05
Chromium III	13.68	6.732	1.00E+00	2.83E−06	1.39E−06	3.21E−07	1.58E−07
Chromium VI	1.52	0.748	5.00E−03	3.43E−05	1.69E−05	4.16E−06	2.05E−06
Copper	25.4	5.98	3.70E−02	7.74E−05	1.82E−05	9.40E−06	2.21E−06
Cyanide	1.2	0.0522	2.00E−02	3.38E−05	1.47E−06	4.70E−06	2.04E−07
4,4'−DDT	0.052	0.00441	5.00E−04	5.86E−05	8.95E−06	1.02E−05	1.80E−06
Lead	75.3	15.4	1.40E−04	1.01E−01	2.07E−02	1.16E−02	2.37E−03
Manganese	256	111	2.00E−01	1.44E−04	6.26E−05	1.75E−05	7.60E−06
Mercury	3.3	0.38	3.00E−04	1.24E−03	1.43E−04	1.51E−04	1.74E−05
Nickel	16.8	3.93	2.00E−02	1.74E−04	4.06E−05	1.97E−05	4.61E−06
Noncarcinogenic PAHs	4.365	0.33	4.00E−03	6.15E−04	4.65E−05	1.07E−04	8.07E−06
PCBs	0.47	0.0482	7.00E−06	3.78E−02	3.88E−03	6.57E−03	6.74E−04
Vanadium	37.7	15.5	7.00E−03	6.07E−04	2.50E−04	7.38E−05	3.03E−05
Zinc	159	43.6	2.00E−01	1.64E−04	4.51E−05	1.87E−05	5.12E−06
				1.44E−01	2.53E−02	1.88E−02	3.14E−03

Noncarcinogenic – Subchronic

Compound	Maximum Concentration (ug/g)	Average Concentration (ug/g)	Reference Dose (mg/kg/day)	Child (1−6) Hazard Index (Max.)	Child (1−6) Hazard Index (Ave.)
Lead	75.3	15.4	1.40E−04	8.40E−01	1.72E−01
				8.40E−01	1.72E−01

Carcinogenic

Compound	Maximum Concentration (ug/g)	Average Concentration (ug/g)	Cancer Slope Factor (mg/kg/day)^−1	Adult (Resident) Incremental Risk (Max.)	Adult (Resident) Incremental Risk (Ave.)	Adult (Utility Worker) Incremental Risk (Max.)	Adult (Utility Worker) Incremental Risk (Ave.)
Arsenic	4.2	0.183	1.75E+00	8.28E−07	3.61E−08	4.03E−08	1.75E−09
Carcinogenic PAHs	7.65	0.4296	1.15E+01	4.96E−05	2.78E−06	3.44E−06	1.93E−07
4,4'−DDT	0.052	0.00441	3.40E−01	9.96E−09	8.45E−10	6.92E−10	5.87E−11
PCBs	0.47	0.0482	7.70E+00	2.04E−06	2.09E−07	1.42E−07	1.45E−08
1,1,2,2−Tetrachloroethane	0.1	0.00619	2.00E−01	5.64E−09	3.49E−10	3.91E−10	2.42E−11
				5.25E−05	3.03E−06	3.63E−06	2.10E−07

TABLE 2

INGESTION OF AND DERMAL CONTACT WITH LEACHATE SURFACE WATER

SITES 1 AND 3

CHILD

Noncarcinogenic

Compound	Maximum Concentration (ug/L)	Average Concentration (ug/L)	Reference Dose (mg/kg/day)	Child (1–6) Hazard Index (Max.)	Child (1–6) Hazard Index (Ave.)	Child (7–12) Hazard Index (Max.)	Child (7–12) Hazard Index (Ave.)
Antimony	384	52.6	4.00E–04	9.73E–03	1.33E–03	1.21E–02	1.66E–03
Arsenic	3870	489	1.00E–03	3.92E–02	4.96E–03	4.87E–02	6.16E–03
Beryllium	55.6	6.28	5.00E–03	1.13E–04	1.27E–05	1.40E–04	1.58E–05
Cadmium	180	30.5	5.00E–04	3.65E–03	6.18E–04	4.53E–03	7.68E–04
Chromium	321	63.9	5.00E–03	6.51E–04	1.30E–04	8.08E–04	1.61E–04
Cyanide	26.9	5.07	2.00E–02	1.36E–05	2.57E–06	1.69E–05	3.19E–06
4,4'–DDD	0.36	0.0171	5.00E–04	7.30E–05	3.47E–06	9.06E–05	4.30E–06
4,4'–DDE	0.4	0.019	5.00E–04	8.11E–05	3.85E–06	1.01E–04	4.78E–06
4,4'–DDT	0.17	0.0081	5.00E–04	3.45E–05	1.64E–06	4.28E–05	2.04E–06
1,4–Dichlorobenzene	36	2.57	9.00E–02	4.05E–05	2.89E–06	5.03E–05	3.59E–06
1,2–Dichloroethylene	110	10	2.00E–02	5.58E–05	5.07E–06	6.92E–05	6.29E–06
Ethylbenzene	9	0.69	1.00E–01	9.12E–06	6.99E–07	1.13E–05	8.69E–07
Lead	1740	521	1.40E–04	1.26E–01	3.77E–02	1.56E–01	4.68E–02
Manganese	50000	11100	2.00E–01	2.53E–03	5.63E–04	3.15E–03	6.99E–04
Mercury	19.3	3.52	3.00E–04	6.52E–04	1.19E–04	8.10E–04	1.48[illegible]
Nickel	880	239	2.00E–02	4.46E–04	1.21E–04	5.54E–04	1.50[illegible]
Trichloroethylene	20	1.24	9.00E–03	2.25E–04	1.40E–05	2.80E–04	1.73E–05
Vanadium	2600	446	7.00E–03	3.77E–03	6.46E–04	4.68E–03	8.02E–04
Vinyl Chloride	11	0.524	6.00E–05	1.86E–03	8.85E–05	2.31E–03	1.10E–04
Xylenes	17	1.38	2.00E+00	8.62E–07	6.99E–08	1.07E–06	8.69E–08
Zinc	21200	1970	2.00E–01	1.07E–03	9.98E–05	1.33E–03	1.24E–04
1,1–Dichloroethane	24	4.29	1.00E–01	2.43E–06	4.35E–07	3.02E–06	5.40E–07
				1.90E–01	4.64E–02	2.36E–01	5.77E–02

Carcinogenic

Compound	Maximum Concentration (ug/L)	Average Concentration (ug/L)	Cancer Slope Factor (mg/kg/day)^–1	Child (1–6) Incremental Risk (Max.)	Child (1–6) Incremental Risk (Ave.)	Child (7–12) Incremental Risk (Max.)	Child (7–12) Incremental Risk (Ave.)
Arsenic	3870	489	1.75E+00	5.49E–06	6.04E–07	6.82E–06	8.62E–07
4,4'–DDD	0.36	0.0171	2.40E–01	7.01E–10	3.33E–11	8.70E–10	4.13E–11
4,4'–DDE	0.4	0.019	3.40E–01	1.10E–09	5.24E–11	1.37E–09	6.51E–11
4,4'–DDT	0.17	0.0081	3.40E–01	4.69E–10	2.23E–11	5.82E–10	2.77E–11
1,4–Dichlorobenzene	36	2.57	2.40E–02	7.01E–09	5.00E–10	8.70E–09	6.21E–10
1,1–Dichloroethane	24	4.29	9.10E–02	1.77E–09	3.17E–10	2.20E–09	3.93E–10
1,1,2,2–Tetrachloroethane	990	71.4	2.00E–01	1.61E–06	1.16E–07	1.99E–06	1.44[illegible]
Trichloroethylene	20	1.24	1.10E–02	1.78E–09	1.11E–10	2.22E–09	1.37[illegible]
Vinyl Chloride	11	0.524	2.30E+00	2.05E–08	9.77E–10	2.55E–08	1.21E–09
				7.13E–06	8.12E–07	8.85E–06	1.01E–06

TABLE 3

INGESTION OF AND DERMAL CONTACT WITH LEACHATE SEDIMENT

SITES 1 AND 3

CHILD

Noncarinogenic

Compound	Maximum Concentration (ug/g)	Average Concentration (ug/g)	Reference Dose (mg/kg/day)	Child (1-6) Hazard Index (Max.)	Child (1-6) Hazard Index (Ave.)	Child (7-12) Hazard Index (Max.)	Child (7-12) Hazard Index (Ave.)
Arsenic	71	12.7	1.00E-03	1.51E-02	2.70E-03	1.55E-02	2.77E-03
Cadmium	43	1.77	1.00E-03	1.28E-02	5.27E-04	1.19E-02	4.90E-04
Chromium III	39.6	9.18	1.00E+00	1.18E-05	2.74E-06	1.10E-05	2.54E-06
Chromium VI	4.4	1.02	5.00E-03	1.87E-04	4.33E-05	1.92E-04	4.46E-05
Copper	74	14.4	3.70E-02	4.25E-04	8.26E-05	4.37E-04	8.50E-05
1,4-Dichlorobenzene	6.8	0.348	9.00E-02	1.02E-04	5.23E-06	1.25E-04	6.40E-06
1,2-Dichloroethylene	0.078	0.00361	2.00E-02	5.28E-06	2.44E-07	6.46E-06	2.99E-07
Lead	113	16.6	1.40E-04	2.27E-01	3.33E-02	2.14E-01	3.15E-02
Manganese	21000	887	2.00E-01	2.23E-02	9.42E-04	2.29E-02	9.69E-04
Mercury	4.65	0.509	3.00E-04	3.29E-03	3.60E-04	3.39E-03	3.71E-04
Nickel	42	6.98	2.00E-02	6.26E-04	1.04E-04	5.82E-04	9.67E-05
1,1,2-Trichloroethane	0.44	0.0142	4.00E-03	1.49E-04	4.80E-06	1.82E-04	5.88E-06
Trichloroethylene	0.01	0.000323	9.00E-03	1.50E-06	4.85E-08	1.84E-06	5.94E-08
Vanadium	57	7.69	7.00E-03	1.73E-03	2.33E-04	1.78E-03	2.40E-04
Zinc	206	63	2.00E-01	3.07E-04	9.39E-05	2.85E-04	8.73E-05
				2.84E-01	3.84E-02	2.72E-01	3.66E-02

Carcinogenic

Compound	Maximum Concentration (ug/g)	Average Concentration (ug/g)	Cancer Slope Factor (mg/kg/day)^-1	Child (1-6) Incremental Risk (Max.)	Child (1-6) Incremental Risk (Ave.)	Child (7-12) Incremental Risk (Max.)	Child (7-12) Incremental Risk (Ave.)
Arsenic	71	12.7	1.75E+00	2.11E-06	3.78E-07	2.17E-06	3.88E-07
1,4-Dichlorobenzene	6.8	0.348	2.40E-02	1.77E-08	9.04E-10	2.16E-08	1.11E-09
1,1,2,2-Tetrachloroethane	3.7	0.137	2.00E-01	8.01E-08	2.97E-09	9.80E-08	3.63E-09
1,1,2-Trichloroethane	0.44	0.0142	5.70E-02	2.71E-09	8.76E-11	3.32E-09	1.07E-10
Trichloroethylene	0.01	0.000323	1.10E-02	1.19E-11	3.85E-13	1.46E-11	4.71E-13
				2.21E-06	3.81E-07	2.29E-06	3.93E-07

TABLE 4

INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER

SITES 1 AND 3

CHILD

Noncarcinogenic

Compound	Maximum Concentration (ug/L)	Average Concentration (ug/L)	Reference Dose (mg/kg/day)	Child (1-6) Hazard Index (Max.)	Child (1-6) Hazard Index (Ave.)	Child (7-12) Hazard Index (Max.)	Child (7-12) Hazard Index (Ave.)
Lead	8.3	0.377	1.40E-04	1.05E-02	4.78E-04	8.55E-03	3.89E-04
Manganese	2500	337	2.00E-01	2.22E-03	2.99E-04	1.80E-03	2.43E-04
Zinc	182	39.3	2.00E-01	2.86E-04	6.18E-05	2.17E-04	4.68E-05
				1.30E-02	8.39E-04	1.06E-02	6.78E-04

Carcinogenic

Compound	Maximum Concentration (ug/L)	Average Concentration (ug/L)	Cancer Slope Factor (mg/kg/day)^-1	Child (1-6) Incremental Risk (Max.)	Child (1-6) Incremental Risk (Ave.)	Child (7-12) Incremental Risk (Max.)	Child (7-12) Incremental Risk (Ave.)
1,1,2,2-Tetrachloroethane	20	1.1	2.00E-01	1.74E-07	9.55E-09	1.91E-07	1.05E-08
				1.74E-07	9.55E-09	1.91E-07	1.05E-08

TABLE 5

INGESTION OF AND DERMAL CONTACT WITH SEDIMENT

SITES 1 AND 3

CHILD

Noncarcinogenic

Compound	Maximum Concentration (ug/g)	Average Concentration (ug/g)	Reference Dose (mg/kg/day)	Child (1-6) Hazard Index (Max.)	Child (1-6) Hazard Index (Ave.)	Child (7-12) Hazard Index (Max.)	Child (7-12) Hazard Index (Ave.)
Arsenic	28	3.75	1.00E-03	5.95E-03	7.96E-04	6.12E-03	8.19E-04
BEHP	2.2	0.223	2.00E-02	2.98E-04	3.02E-05	3.64E-04	3.69E-05
Cadmium	3	0.355	1.00E-03	8.94E-04	1.06E-04	8.31E-04	9.84E-05
Chromium III	23.4	9.09	1.00E+00	6.97E-06	2.71E-06	6.48E-06	2.52E-06
Chromium VI	2.6	1.01	5.00E-03	1.10E-04	4.29E-05	1.14E-04	4.41E-05
Copper	31	9.1	3.70E-02	1.78E-04	5.22E-05	1.83E-04	5.37E-05
Carcinogenic PAHs	8.59	0.595	4.00E-03	5.81E-03	4.02E-04	7.11E-03	4.93E-04
Lead	130	19.9	1.40E-04	2.61E-01	3.99E-02	2.46E-01	3.77E-02
Manganese	3040	487	2.00E-01	3.23E-03	5.17E-04	3.32E-03	5.32E-04
Mercury	0.19	0.015	3.00E-04	1.34E-04	1.06E-05	1.38E-04	1.09E-05
Nickel	22	3.94	2.00E-02	3.28E-04	5.87E-05	3.05E-04	5.46E-05
Noncarinogenic PAHs	11.72	1.009	4.00E-03	7.93E-03	6.82E-04	9.70E-03	8.35E-04
Vanadium	38	7.91	7.00E-03	1.15E-03	2.40E-04	1.19E-03	2.47E-04
Zinc	179	66.3	2.00E-01	2.67E-04	9.88E-05	2.48E-04	9.19E-05
				2.87E-01	4.30E-02	2.76E-01	4.10E-02

Carcinogenic

Compound	Maximum Concentration (ug/g)	Average Concentration (ug/g)	Cancer Slope Factor (mg/kg/day)^-1	Child (1-6) Incremental Risk (Max.)	Child (1-6) Incremental Risk (Ave.)	Child (7-12) Incremental Risk (Max.)	Child (7-12) Incremental Risk (Ave.)
Arsenic	28	3.75	1.75E+00	8.32E-07	1.11E-07	8.56E-07	1.15E-07
BEHP	2.2	0.223	1.40E-02	6.67E-09	6.76E-10	8.16E-09	8.27E-10
1,1,2,2-Tetrachloroethane	0.012	0.00061	2.00E-01	2.60E-10	1.32E-11	3.18E-10	1.62E-11
Carcinogenic PAHs	8.59	0.595	1.15E+01	2.14E-05	1.48E-06	2.62E-05	1.81E-06
				2.22E-05	1.59E-06	2.70E-05	1.93E-06

APPENDIX C

RISK CALCULATIONS: FUTURE USE SCENARIO

DRINK	18-Feb-92

INGESTION OF GROUNDWATER
ADULTS –Average Concentrations
Sites 1 and 3
NAS Brunswick; Brunswick Maine

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW		mg/liter	
INGESTION RATE	IR	2	liters/day	USEPA
BODY WEIGHT	BW	70	kg	USEPA
EXPOSURE FREQUENCY	EF	350	days/year	USEPA
EXPOSURE DURATION	ED	30	years	USEPA
AVERAGING TIME		30		
CANCER	AT	70	years	
NONCANCER	AT	30	years	

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)^-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times RAF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

Note:
For noncarcinogenic effects: AT = ED

DRINK	18-Feb-92

INGESTION OF GROUNDWATER
ADULTS –Average Concentrations
Sites 1 and 3
NAS Brunswick; Brunswick Maine

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)			CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION		TOTAL CANCER RISK
Arsenic	0.0108	1	1.3E-04			1.75	2.2E-04		2.2E-04
Methylene Chloride	0.0153	1	1.8E-04			0.0075	1.3E-06		1.3E-06
Vinyl Chloride	0.0172	1	2.0E-04			1.9	3.8E-04		3.8E-04
1,1-Dichloroethane	0.00434	1	5.1E-05			NA			
Lead	0.008	1	9.4E-05			NA			
						SUMMARY CANCER RISK	6E-04	0E+00	6E-04

DRINK	18-Feb-92

INGESTION OF GROUNDWATER
ADULTS –Average Concentrations
Sites 1 and 3
NAS Brunswick; Brunswick Maine

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)			REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION		TOTAL HAZARD QUOTIENT
Chromium	0.036	1	9.9E-04			1	9.9E-04	0.0E+00	9.9E-04
Lead	0.008	1	2.2E-04			NA			
Xylene	0.106	1	2.9E-03			2	1.5E-03	0.0E+00	1.5E-03
Nickel	0.04	1	1.1E-03			0.002	5.5E-01	0.0E+00	5.5E-01
Chlorobenzene	0.0022	1	6.0E-05			0.02	3.0E-03	0.0E+00	3.0E-03
1,2-Dichloroethene	0.007	1	1.9E-04			0.01	1.9E-02	0.0E+00	1.9E-02
Ethylbenzene	0.021	1	5.8E-04			0.1	5.8E-03	0.0E+00	5.8E-03
Toluene	0.0287	1	7.9E-04			0.2	3.9E-03	0.0E+00	3.9E-03
						SUMMARY HAZARD INDEX	6E-01	0E+00	6E-01

DRINK	18-Feb-92

INGESTION OF GROUNDWATER
ADULTS -Average Concentrations
Sites 1 and 3
NAS Brunswick; Brunswick Maine

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW		mg/liter	
INGESTION RATE	IR	2	liters/day	USEPA
BODY WEIGHT	BW	70	kg	USEPA
EXPOSURE FREQUENCY	EF	350	days/year	USEPA
EXPOSURE DURATION	ED	30	years	USEPA
AVERAGING TIME		30		
CANCER	AT	70	years	
NONCANCER	AT	30	years	

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)^-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times RAF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

Note:
For noncarcinogenic effects: AT = ED

DRINK	18-Feb-92

INGESTION OF GROUNDWATER
ADULTS -Average Concentrations
Sites 1 and 3
NAS Brunswick; Brunswick Maine

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)			CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION		TOTAL CANCER RISK
Arsenic	0.107	1	1.3E-03			1.75	2.2E-03		2.2E-03
Methylene Chloride	0.46	1	5.4E-03			0.0075	4.1E-05		4.1E-05
Vinyl Chloride	0.14	1	1.6E-03			1.9	3.1E-03		3.1E-03
1,1-Dichloroethane	0.035	1	4.1E-04			NA			
Lead	0.203	1	2.4E-03			NA			
					SUMMARY CANCER RISK		5E-03	0E+00	5E-03

DRINK	18-Feb-92

INGESTION OF GROUNDWATER
ADULTS –Average Concentrations
Sites 1 and 3
NAS Brunswick; Brunswick Maine

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)			REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION		TOTAL HAZARD QUOTIENT
Chromium	1.04	1	2.8E-02			1	2.8E-02		2.8E-02
Lead	0.203	1	5.6E-03			NA			
Xylene	0.66	1	1.8E-02			2	9.0E-03		9.0E-03
Nickel	1.1	1	3.0E-02			0.002	1.5E+01		1.5E+01
Chlorobenzene	0.032	1	8.8E-04			0.02	4.4E-02		4.4E-02
1,2-Dichloroethene	0.051	1	1.4E-03			0.01	1.4E-01		1.4E-01
Ethylbenzene	0.2	1	5.5E-03			0.1	5.5E-02		5.5E-02
Toluene	0.22	1	6.0E-03			0.2	3.0E-02		3.0E-02
					SUMMARY HAZARD INDEX		2E+01	0E+00	2E+01

APPENDIX D

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

TABLE D-1

CHEMICAL-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: SITES 1 AND 3
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
GROUNDWATER/ SURFACE WATER				
Federal	SDWA - MCLs (40 CFR 141.11 - 141.16)	Relevant and Appropriate	MCLs have been promulgated for several common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	Groundwater at NAS Brunswick is not a current source of drinking water; therefore, MCLs are not applicable, but may be relevant and appropriate. To assess the potential risks to human health due to consumption of groundwater, contaminant concentrations were compared to their MCLs.
	SDWA - MCLGs (40 CFR 141.50 - 141.51)	Relevant and Appropriate	MCLGs are health-based criteria. As promulgated under SARA, MCLGs are to be considered for drinking water sources. MCLGs are available for several organic and inorganic contaminants.	The 1990 National Contingency Plan states that non-zero MCLGs are to be used as goals. Because groundwater at NAS Brunswick is not a current source of drinking water, MCLGs are not applicable, but may be relevant and appropriate. Contaminant concentrations in groundwater were compared to their MCLGs.
	RCRA - Subpart F Groundwater Protection Standards, Alternate Concentration Limits (40 CFR 264.94)	Relevant and Appropriate	This requirement outlines standards, in addition to background concentrations and MCLs, to be used in establishing clean-up levels for remediating groundwater contamination.	Most of the MCLs promulgated under RCRA are the same as SDWA MCLs. The standards set forth under RCRA do not reflect recent changes and additions to SDWA MCLs. Because groundwater is not a current source of drinking water; RCRA MCLs are not applicable, but may be relevant and appropriate.
	Federal AWQC	Applicable	Federal AWQC include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) water quality parameters. AWQC for the protection of human health provide levels for exposure from drinking water and consuming aquatic organisms, and from consuming fish alone. Remedial actions involving contaminated surface water or groundwater must consider the uses of the water and the circumstances of the release or threatened release; this determines whether AWQC are relevant and appropriate.	AWQC will be applicable if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW, although the Navy has not yet received approval from the POTW. AWQC may be considered during development of pretreatment standards because the POTW discharges its effluent to the Androscoggin River.
Federal Guidance and Criteria To Be Considered	USEPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are the levels considered unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Because there are only a limited number of promulgated standards for contaminants in soil and water, USEPA RfDs were used to characterize risks due to noncarcinogens in various media.

continued

TABLE D-1
CHEMICAL-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: SITES 1 AND 3
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
	USEPA Human Health Assessment Group Cancer Slope Factors (CSFs)	To Be Considered	Carcinogenic effects present the most up-to-date information on cancer risk potency derived from USEPA's Human Health Assessment Group.	Because there are only a limited number of promulgated standards for contaminants in soil and water, USEPA CSFs were used to compute the individual incremental cancer risk resulting from exposure to certain compounds.
State	Maine Drinking Water Rules (10-144A CMR Chapters 231-233)	Relevant and Appropriate	Maine's Primary Drinking Water Standards are equivalent to federal MCLs. When state levels are more stringent than federal levels, the state levels may be used.	Groundwater at NAS Brunswick is not a current source of drinking water; therefore, State Drinking Water Standards are relevant and appropriate. Contaminant concentrations in groundwater were compared to State standards to assess the potential risks to human health due to consumption of groundwater.
	Maine Regulations Relating to Water Quality Criteria for Toxic Pollutants (MEDEP Regs, Chapter 584)	Applicable	This rule limits the concentrations of certain materials allowed in Maine waters to prevent the occurrence of pollutants in toxic amounts as required by state and federal law. Except if naturally occurring, ambient levels of toxic pollutants shall not exceed the Clean Water Act AWQC. Where AWQC do not exist, the Board of Environmental Protection shall adopt site-specific numerical criteria.	This rule will be applicable if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW, although the Navy has not yet received approval from the POTW. AWQC will be considered during development of pretreatment standards. This rule is potentially applicable in development of pretreatment standards if AWQC do not exist for any contaminants present in groundwater.
State Criteria and Guidance To Be Considered	Rules Relating to Testing of Private Water Systems for Potentially Hazardous Contaminants (10-144A CMR Chapter 233, Appendix C)	To Be Considered	Appendix C outlines Maximum Exposure Guidelines (MEGs) for organic and inorganic compounds. MEGs include health advisories, which are maximum allowable concentrations of specific contaminants in drinking water.	MEGs have been considered for chemical compounds for which there are no promulgated standards. MEGs may be considered if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. MEGs may potentially be considered during development of discharge limits for reinjection of treated groundwater.
AIR				
Federal	Clean Air Act - National Primary and Secondary Ambient Air Quality Standards (40 CFR 50)	Applicable	Primary ambient air quality standards define levels of air quality to protect public health. Secondary ambient air quality standards protect public welfare from known or anticipated adverse effects from pollutants.	Particulate standard for matter less than 10 microns is 150 $\mu g/m^3$, 24-hour average concentration. This requirement is applicable to excavation and construction activities.

continue

TABLE D-1
CHEMICAL-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: SITES 1 AND 3
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
State	Maine Ambient Air Quality Standards (38 MRSA, Section 584; MEDEP Regs, Chapter 110)	Applicable	This Chapter establishes ambient air quality standards that are maximum levels of a particular pollutant permitted in the ambient air.	The standard for particulate matter is 150 $\mu g/m^3$, 24-hour average concentration. This standard is applicable to excavation and construction activities.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria
CFR = Code of Federal Regulations
CMR = Code of Maine Rules
CSF = cancer slope factor
FS = feasibility study
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MEG = Maximum Exposure Guidelines
MEDEP = Maine Department of Environmental Protection
MRSA = Maine Revised Statues Annotated
NAS = Naval Air Station
RI = remedial investigation
RCRA = Resource Conservation and Recovery Act
RfD = reference dose
SARA = Superfund Amendments and Reauthorization Act
SDWA = Safe Drinking Water Act
USEPA = U.S. Environmental Protection Agency
$\mu g/m^3$ = micrograms per cubic meter

TABLE D-2
LOCATION-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: SITES 1 AND 3
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
WETLANDS/FLOODPLAINS				
State	Maine Natural Resources Protection Act (38 MRSA, Section 480-A through S)	Applicable	This act outlines requirements for certain activities adjacent to any freshwater wetland greater than 10 acres or with an associated stream, brook, or pond or adjacent to a coastal wetland. The activities must not unreasonably interfere with certain natural features, such as natural flow or quality of any waters, nor harm significant aquatic habitat, freshwater fisheries, or other aquatic life.	Because construction of the slurry wall is within 100 feet of Mere Brook, this regulation is applicable. Remedial activities will need to meet the substantive requirements of this Act.
	Natural Resources Protection Act, Permit by Rule Standards (MEDEP Regs, Chapter 305)	Applicable	This rule outlines prescribed standards for specific activities that may take place in or adjacent to wetlands and water bodies.	This regulation is applicable to construction of the slurry wall. Activities involving disturbance of soil material within 100 feet of the normal high water line, will be designed to incorporate all applicable standards.
MERE BROOK				
State	Maine Standards for Classification of Minor Drainages (38 MRSA, Section 468)	Applicable	Mere Brook is classified as a Class B water under the state water quality standards. Class B waters are defined as suitable for drinking water (after treatment), fishing, recreation in and on the water, and as habitat for fish and other aquatic life.	These regulations apply to activities conducted adjacent to Mere Brook. Remedial construction should not result in the degradation of water quality classification. These regulations may also potentially apply if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. The designated uses of the waters receiving either direct discharge or POTW effluent must be considered and protected in developing either discharge limits or pretreatment standards.
	Maine Natural Resources Protection Act (38 MRSA, Section 480-A through S)	Applicable	A permit application must be submitted and approved by the Maine Bureau of Land Quality Control and Section 480-D performance standards met when conducting activities adjacent to any freshwater wetland greater than 10 acres or with an associated stream, brook, or pond.	Substantive requirements of this regulation apply to activities conducted adjacent to Mere Brook. However, a permit is not required for the selected remedy since administrative permit requirements are waived for remedial activities conducted on-site at federal Superfund sites.

continue

TABLE D-2
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: SITES 1 AND 3
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
OTHER NATURAL RESOURCES				
State	Maine Standards for Classification of Groundwater (38 MRSA, Section 470)	Applicable	This law requires the classification of the state's groundwater to protect, conserve, and maintain groundwater resources in the interest of the health, safety, and general welfare of the people of the state. Under the Maine standards, groundwater is classified as GW-A.	This regulation will apply if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If discharge to groundwater is employed, the classification and uses of groundwater will evaluated during development of discharge limits.
	Maine Site Location Development Law and Regulations (38 MRSA Sections 481-490; MEDEP Regs, Chapters 371-377)	Applicable	This act and associated regulations govern new developments, including those that handle hazardous waste. New developments cannot adversely affect existing uses, scenic character, or natural resources in the municipality or neighboring municipality.	Those regulations concerning No Adverse Environmental Impact (i.e., Chapter 375) are applicable to implementation of the selected remedy. In particular standards for protection of groundwater would apply to construction and groundwater treatment activities. However, any licenses required, by reference, will not need to be obtained since permits are not required for actions conducted on-site at federal Superfund sites.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirements
MRSA = Maine Revised Statutes Annotated
MEDEP = Maine Department of Environmental Protection
NAS = Naval Air Station
POTW = Publicly Owned Treatment Works
RI/FS = Remedial Investigation/Feasibility Study

TABLE D-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: SITES 1 AND 3
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
Federal			
RCRA - General Facility Standards (40 CFR 264.10-264.18)	Relevant and Appropriate	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	The waste material at Sites 1 and 3 has not been formally defined as a RCRA-regulated waste; therefore, only sections of the facility standards are relevant and appropriate. Because of Navy security concerns, Sites 1 and 3 are fenced and access to the waste is effectively restricted. All other relevant general requirements will be incorporated into the construction and operation of the groundwater treatment plant.
RCRA - Preparedness and Prevention (40 CFR 264.30-264.37)	Relevant and Appropriate	This regulation outlines requirements for safety equipment and spill-control for hazardous waste facilities. Part of the regulation includes a requirement that facilities be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment.	Because toxic constituents are present at Sites 1 and 3, preparedness and prevention requirements are relevant and appropriate to the implementation of the selected remedy. During the remedial construction safety and communication equipment will be installed at the site, and local authorities will be familiarized with site operations.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50-264.56)	Relevant and Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Because toxic constituents are present at Sites 1 and 3, contingency plans and emergency procedures are relevant and appropriate to the implementation of the selected remedy. Plans will be developed and implemented during site work including installation of extraction wells, and implementation of site remedies. Copies of the plans will be kept on-site.
RCRA - Releases from Solid Waste Management Units (40 CFR 264.90-264.109)	Relevant and Appropriate	This regulation details groundwater monitoring requirements for hazardous waste treatment facilities. The regulation outlines general groundwater monitoring standards, as well as standards for detection monitoring, compliance monitoring, and corrective action monitoring.	Because toxic constituents are present in the wastes at Sites 1 and 3, and since those wastes will be left in place, groundwater monitoring requirements are relevant and appropriate to the selected remedy. Long-term groundwater monitoring is included as part of the selected remedy proposed action.
RCRA - Closure and Post-closure (40 CFR 264.110-264.120)	Relevant and Appropriate	This regulation details general requirements for closure and post-closure of hazardous waste facilities, including installation of a groundwater monitoring program.	Because the waste materials at Sites 1 and 3 will be left in place, those parts of this regulation concerning long-term monitoring and maintenance of the site are relevant and appropriate to the selected remedy.

continued

TABLE D-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: SITES 1 AND 3
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
RCRA - Miscellaneous Units (40 CFR 264.600-264.999)	Relevant and Appropriate	These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, surface water, and wetlands that may have adverse effects on human health and the environment.	Because the selected remedy includes a groundwater treatment plant, the general design, performance, and operating requirements of Subpart X are relevant and appropriate. However, a permit is not required for remedial actions conducted on-site at federal Superfund sites.
RCRA Land Disposal Restrictions (40 CFR 268)	To be determined	Land disposal of RCRA hazardous wastes is restricted without specified treatment. It must be determined that the waste, beyond a reasonable doubt, meets the definition of one of the specified restricted wastes and the remedial action must constitute "placement" for the land disposal restrictions to be considered applicable. For each hazardous waste, the LDRs specify that the waste must be treated either by a treatment technology or to a concentration level prior to disposal in a RCRA Subtitle C permitted facility.	During treatment of groundwater, sludge containing hazardous constituents will be generated. The selected remedy includes provisions for analysis of this sludge, including Toxicity Characteristic Leachate Procedure (TCLP) testing. LDRs are potentially applicable if the sludge fails TCLP. The selected remedy does address handling and disposal of the sludge as a hazardous waste, if necessary.
OSHA - General Industry Standards (29 CFR Part 1910)	Applicable	These regulations specify the 8-hour time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous wastes operations are specified in 29 CFR 1910.120.	Because toxic constituents are present at Sites 1 and 3, OSHA regulations are applicable. Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below designated concentrations. Workers performing activities would be required to have completed specific training requirements.
OSHA - Safety and Health Standards (29 CFR Part 1926)	Applicable	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.	Because toxic constituents are present at Sites 1 and 3, OSHA regulations are applicable. All appropriate safety equipment will be on-site. In addition, safety procedures would be followed during on-site activities.
OSHA - Recordkeeping, Reporting, and Related Regulations (29 CFR 1904)	Applicable	This regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	Because toxic constituents are present at Sites 1 and 3, OSHA regulations are applicable. These requirements will apply to all site contractors and subcontractors, and must be followed during all site work.

continued

TABLE D-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: SITES 1 AND 3
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
CWA - NPDES Regulations (40 CFR Parts 122, 125)	Applicable	This requirement implements the NPDES program that specifies the applicable effluent standards, monitoring requirements, and standard and special conditions for direct discharge.	NPDES requirements will be applicable if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. Both on- and off-site discharges from CERCLA sites to surface waters are required to meet the substantive CWA NPDES requirements, including discharge limitations, monitoring requirements, and best management practices. Brunswick POTW has a current NPDES permit. A permit would be required if treated groundwater is discharged on-site.
Underground Injection Control Program (40 CFR 144, 146, 147, 1000)	Applicable	These regulations outline minimum program and performance standards for underground injection programs. Technical criteria and standards for siting, operation and maintenance, and reporting and recordkeeping as required for permitting are set forth in Part 146.	This regulation will be applicable if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. Discharge of treated groundwater, by well injection, must be in accordance with all the criteria and standards in these federal regulations, as well as meet all state Underground Injection Control Program requirements. Treated groundwater must meet all SDWA standards prior to well injection.
CWA - Pretreatment Standards for POTW Discharge (40 CFR Part 403)	Applicable	This regulation specifies pretreatment standards for discharges to a POTW. If treated groundwater is discharged to a POTW, the POTW must have mechanisms available to meet the requirements of the National Pretreatment Program - Introduction of Pollutants which cause pass through or interference are prohibited. Discharges must also comply with any local POTW regulations. If hazardous waste is discharged to the POTW, the POTW may be subject to RCRA permit-by-rule.	This regulation is applicable since the Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If treated groundwater is discharged to a POTW, the treated water must meet all discharge limitations imposed by the POTW.
State			
Maine Landfill Disposal Regulations (MEDEP Regs, Chapter 401)	Relevant and Appropriate	These regulations outline the permitting requirements for waste disposal by landfill. Chapter 401 specifies closure and post-closure maintenance requirements.	Because Sites 1 and 3 encompass a former landfill, these requirements are relevant and appropriate. Design of a cover system will have to meet minimum standards and specifications (401.7[c]).

continued

TABLE D-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: SITES 1 AND 3
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
Maine Rules to Control the Subsurface Discharge of Pollutants by Well Injection (MEDEP Regs, Chapter 543)	Applicable	This regulation prohibits the injection of hazardous waste into or above water-bearing formations via a new Class IV well. The subsurface discharge into or through a Class IV well that would cause or allow the movement of fluid into an underground source of drinking water that may result in a violation of any Maine Primary Drinking Water Standard, or which may otherwise adversely affect public health, is prohibited.	These regulations will be applicable if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. For discharge to the subsurface, groundwater must be treated to a target clean-up levels less than or equal to the Maine MEGs to be recharged to the aquifer.
Maine Hazardous Waste Management Rules (MEDEP Regs, Chapters 800-802, 850, 851, 853-857)	Relevant and Appropriate	The rules provide a comprehensive program for handling, storage, and recordkeeping at hazardous waste facilities. They supplement the RCRA regulations.	Because these requirements supplement RCRA hazardous waste regulations, they are relevant and appropriate.
Maine Water Pollution Control Law: Conditions of Licenses (38 MRSA, Section 414-A)	Applicable	Regulates the discharge of any pollutants. Specifies that the discharge, either by itself or combined with other discharges, will not lower the quality of any classified body of water below such classification. The discharge will be subject to effluent limitations that require application of the best practicable treatment.	The substantive requirements of this regulation will apply if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If treated water is discharged directly to surface water the effluent must receive the best practicable treatment before discharge.
Maine Water Pollution Control Law: Certain Deposits and Discharges Prohibited (38 MRSA, Section 420)	Applicable	No person, firm, corporation, or other legal entity shall place, deposit, discharge, or spill mercury or toxic or hazardous substances, either directly or indirectly, into the inland groundwater or surface waters, tidal waters, on the ice, or on the banks thereof, so that the same may flow or be washed into such waters, or in such manner that the drainage therefrom may flow into such waters.	This regulation will apply if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If discharge to surface water is employed, Best Management Practices will be used when handling wastes.

continued

TABLE D-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: SITES 1 AND 3
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
State Guidance and Criteria To Be Considered			
MEDEP, Bureau of Water Quality Control, Policy Number 10, "The Discharge of Hazardous Substances to Groundwaters of the State"	To Be Considered	The Bureau will deny applications for waste discharge licenses for the discharge to groundwaters of substances designated by the Board to be hazardous when such substances are present in concentrations exceeding groundwater levels which occur naturally in the area. Exemption may be granted if the groundwater is treated to reduce the concentrations of pollutants discharged to below the level considered safe for drinking water.	This policy will need to be considered if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If treated water is discharged to the subsurface, the minimum level of groundwater treatment would be required to provide adequate protection if no other means of disposal is feasible. This policy would only be considered after application of federal and state underground injection control regulations.

Notes:

CFR = Code of Federal Regulations
CWA = Clean Water Act
LDRs = Land Disposal Restrictions
MEDEP = Maine Department of Environmental Protection
MEG = Maximum Exposure Guidelines
MRSA = Maine Revised Statutes Annotated
NAS = Naval Air Station
NPDES = National Pollutant Discharge Elimination System
OSHA = Occupational Safety and Health Administration
POTW = publicly owned treatment works
RCRA = Resource Conservation and Recovery Act
SDWA = Safe Drinking Water Act
TCLP = Toxicity Characteristic Leachate Procedure

APPENDIX E

RESPONSIVENESS SUMMARY

APPENDIX E

RESPONSIVENESS SUMMARY

OVERVIEW

At the time of the public comment period, the U.S. Navy had selected a preferred alternative to address source control of landfill wastes and groundwater contamination at Sites 1 and 3 at NAS Brunswick. This preferred alternative was selected in coordination with the USEPA and the MEDEP. Other members of the TRC for this project were also involved in discussions and planning of the containment and groundwater extraction and treatment alternative. Technical details of the alternative have been discussed, and no fundamental objections to its selection have been raised.

The sections below describe the background of community involvement with the project and the U.S. Navy's responses to verbal and written comments received during the public comment period.

BACKGROUND OF COMMUNITY INVOLVEMENT

Prior to the public comment period, there were several presentations to the public regarding the RI/FS activities at NAS Brunswick. Two meetings to inform the public about the general status and process for the RI/FS occurred in February and March of 1990. A technical forum occurred in August 1990 where the status and understanding of site-specific studies were also presented to the public. In November 1991, newspaper announcements were placed for a public meeting presented by the U.S. Navy in Brunswick to discuss the results of the RI/FS and the Preferred Alternative.

Local input to the selection of the preferred remedy has come predominantly through the TRC, established by the U.S. Navy. Meetings held approximately quarterly since early 1988 have brought together local representatives of the towns of Brunswick, Harpswell, and Topsham. The TRC also has included representatives from the Brunswick-Topsham water district and a local citizens group (BACSE). This involvement has facilitated remedial planning by the U.S. Navy and has alerted affected local groups to the proposed activities.

SUMMARY OF COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD

During the public comment period, written comments were received from citizens and several special interest groups. At the public meeting on December 12, 1991, several questions and comments were also raised.

1. Comment (written): I am concerned over the mercury levels associated with the leachate seeps and the proposed remediation through natural degradation. What proof do you have that lowering the water levels will decrease mercury concentrations from 3.3 mg/kg to 1 mg/kg and in what time frame? Because mercury has the propensity to bioaccumulate and no source removal is anticipated, potential effects to the aquatic and terrestrial organisms should be monitored, including the taking of tissue samples.

Response: Mercury was detected in five of 37 soil/sediment samples from the leachate locations at concentrations ranging from ND (i.e., not detected) to 3.3 mg/kg. The average mercury concentration in these soils/sediments is 0.2 mg/kg. Mercury is present in these soils/sediments as a result of contaminated groundwater breaking out along the steep banks of Mere Brook. The mercury, transported in the groundwater, comes out of solution and is deposited on the sediment. Lowering the groundwater table through the use of the slurry wall and cap and removing the pore volume of contaminated groundwater will eliminate the leachate seeps and consequently the addition of mercury to the soils/sediments. Lowering the water table will not decrease the mercury concentrations; however, it will eliminate the additional contribution of mercury to these soils/sediments. The current concentrations of mercury will decrease through natural processes such as erosion, sedimentation, and degradation.

To monitor the effectiveness of the preferred alternative, a long-term Remedial Action Monitoring Plan will be developed and submitted to the regulatory agencies for review and approval. The proposed long-term monitoring for the Preferred Alternative includes surface water and sediment sampling locations along Mere Brook; soil/sediment sampling at the current leachate locations and groundwater sampling from locations downgradient

of the landfill areas. Analytical results from these samples will provide information regarding the transport of contaminants from the landfill to the Mere Brook environment, including the change in mercury concentrations over time, and the presence and location of leachate seeps. Current sampling results do not show the transport of contaminants beyond the region of Mere Brook directly downgradient of the landfill area (i.e., the area of Mere Brook between the southern runway and Merriconeag Road), and therefore, no contaminant migration is expected after the implementation of remedial actions. As stated in the Proposed Plan, the purpose of the long-term monitoring is to evaluate the effectiveness of the proposed remedial actions and determine the need for additional remedial actions. For example, if analytical data indicate the presence of mercury in previously uncontaminated areas or media, or an increase in mercury concentrations in the leachate soil/sediment location, tissue sampling may be warranted.

It is not possible to accurately predict the time required to attain the 1 mg/kg mercury target cleanup level at all seep locations. However, concentrations in the soil/sediment will be measured and monitored as part of the long-term Remedial Action Monitoring Plan.

2. Comment (written): I feel the slurry wall and cap should encompass the entire area of Sites 1 and 3, including the munitions complex. A break in the slurry wall, especially on the downgradient side of the site will cause leakage out of the landfill area. A slurry wall built around the fence of the munitions area is preferable to a gap in the wall in the munitions area. Also, the integrity of the slurry wall during an earthquake or other seismic event should be addressed.

Response: The portion of the slurry wall that does not encompass the weapons compound actually provides for a more effective long-term remedial alternative.

This opening allows for the movement of water, which is expected to seep through the slurry wall and cap and/or the underlying clay layer (at the slow rate of 10^{-7} to 10^{-6} cm/sec), preventing water from accumulating within the enclosed slurry wall system. Modeling results indicate that the cap/slurry wall/ groundwater extraction remedial alternative will lower groundwater to levels located below the landfill waste, thereby isolating the source. However, over time the small amounts of water which are expected to flow through the slurry wall, the silty clay layer, and the cap would eventually slightly increase groundwater levels beneath the landfill. If the slurry wall completely enclosed the landfill, periodic removal of groundwater may be required to continue to isolate the landfill wastes. The opening allows drainage of water before it saturates the landfill wastes.

Modeling indicates that hydraulic gradient to the south will be maintained with the gap in the slurry wall in the vicinity of the weapons compound. Given the above conditions, it was determined that it was advantageous to the overall Sites 1 and 3 remedial alternative to maintain the gap in the slurry wall in the area of the weapons compound. In addition, estimates of the amount of contamination that would migrate through the un-capped area were shown to be minimal.

The long-term Remedial Action Monitoring Plan will include groundwater monitoring, and water level monitoring both inside and outside the slurry wall. The Remedial Action Monitoring Plan will be submitted to the regulatory agencies for review and approval prior to implementation.

The integrity of the slurry is not expected to be adversely impacted by earthquakes of magnitudes typically experienced in this region. The consistency of the slurry wall is expected to be that of a medium to stiff clay and, therefore, the wall will have the

ability to experience 10 to 15 percent plastic deformation without cracking. This, coupled with the support of the surrounding soils, will minimize the effects of regional seismicity.

3. Comment (written): The effect of groundwater extraction and lowering of the groundwater table on Mere Brook should be addressed. How will this affect erosion of contaminated sediment, aquatic life, and water levels downstream?

Response: The effect of groundwater extraction and lowering of the groundwater table was determined to have a negligible effect on surface water levels in Mere Brook, based on model simulation. The steady-state model simulations indicated that surface water elevation in Mere Brook would remain relatively constant over time. The detailed results of the groundwater modeling are described in the Sites 1 and 3 FFS report. The groundwater extraction component of the remedial alternative is designed to remove only the volume of water enclosed by the slurry wall. Although the slurry wall will redirect groundwater flow around the landfill, the water will ultimately flow to Mere Brook as illustrated in the model results (Sites 1 and 3 FFS, 1991). Additional modeling will be conducted to support the final design of this remedial alternative and will allow further refinement of these relationships. Therefore, erosion of contaminated sediment, aquatic life, and water levels downstream are not anticipated to be adversely affected.

4. Comment (written): The target cleanup level for vinyl chloride is proposed at the MCL of 2.0 ppb instead of Maine's MEG of 0.2 ppb. I support the state's MEG value and request that you perform any risk assessment or other work required by the Maine DEP to insure that human health concerns are addressed.

Response: The target cleanup level for vinyl chloride was set at the federal MCL of 2 μg/L (or parts per billion).

The State of Maine has established a MEG for vinyl chloride of 0.2 μg/L and this concentration was considered in establishing target cleanup levels for Sites 1 and 3. However, using current analytical techniques, it is not possible to accurately detect vinyl chloride at a concentration of 0.2 μg/L. Therefore, it is not considered feasible to compare against the MEG for vinyl chloride. To address the concerns of the State of Maine and local residents, the Navy has agreed to perform a risk assessment at the completion of the groundwater extraction and treatment. The risk assessment will be used to determine if additional treatment or remedial alternatives are required to further lower the concentrations of vinyl chloride. The regulatory agencies, including the State of Maine, will be able to review and comment on the risk assessment.

5. Comment (written): Since the waste source is left in place, a 30-year monitoring program is proposed. However, at what intervals will samples be taken, what compounds will be analyzed, and where will the sampling points be? More details are needed to insure that any future leakage will be detected. Also, in the event the base is privatized, the town of Brunswick would like to have a land use plan with deed restrictions stating what areas around Sites 1 and 3 would be available for development.

Response: A long-term Remedial Action Monitoring Plan will be developed for the preferred alternative at Sites 1 and 3 at the completion of the remedial design. The Remedial Action Monitoring Plan will identify the media and locations and compounds to be sampled and the frequency of sampling events. The Remedial Action Monitoring Plan will be submitted for regulatory review and approval prior to implementation. The Remedial Action Monitoring Plan will not be finalized until the design effort is complete. This will allow the Remedial Action Monitoring Plan to incorporate the most appropriate

monitoring locations and criteria based on the actual design of the preferred alternative.

In the event the property is excessed or otherwise disposed of, the Navy will request that the Government Services Administration, the government disposal agent, place restrictions in the deed.

6. Comment (written): The "Eastern Plume" comments on groundwater cleanup levels prior to discharge, disposal of solid treatment residue, transfer of water from one watershed to another for discharge, and discharge options other than the POTW also apply to this report.

Response: The comments received on the "Eastern Plume" that are relevant to Sites 1 and 3 have been incorporated and addressed in this Responsiveness Summary.

7. Comment (written): While radioactive materials are not mentioned as having been disposed at either Site 1 or Site 3, it is not clear if the potential for radioactive wastes has been evaluated. It is our understanding that radioactive materials have been discovered in an unforeseen location at another military base in Maine. At a minimum, the two sites should be adequately screened in the field even if there are no written records indicating radioactive materials were handled at the sites.

Response: As indicated in the Records Search, radioactive wastes were not reportedly disposed of at Sites 1 and 3. Current studies have not directly focused on radioactivity, but field personnel did wear radiation detection badges during the field program, and no exposures were indicated. Further evaluation for the presence of radioactive wastes could be incorporated in pre-design field studies that will be part of the Design Work Plan.

8. Comment (written): The Plan indicates that the main potential effect of the proposed remedial action at Sites 1 and 3 on the Eastern Plume remediation will be the diversion of clean groundwater upgradient of the sites toward the southern portion of the Eastern Plume, and that design-level groundwater modeling studies will quantitatively evaluate this interaction. What if the model does not show this interaction? How and where will field data be gathered to test the potential effect?

Response: It is anticipated that the numerical modeling developed as part of the design program will provide for an evaluation of the Sites 1 and 3 and Eastern Plume. An evaluation of any impacts resulting from the diversion of clean groundwater from the Sites 1 and 3 area to the Eastern Plume area will also be evaluated through field monitoring. Any hydrogeologic impacts associated with the Sites 1 and 3 alternative would generally involve an alteration of the existing groundwater flow as evidenced by a significant change in groundwater levels between the two sites. The monitoring wells that will be selected, and the monitoring frequency, will be included as part of a methods and protocols for evaluating the performance of the selected remedies section in the design program. An evaluation of the fluctuation of groundwater levels in monitoring wells located between Sites 1 and 3 and the Eastern Plume will support the data developed from the design level numerical model.

9. Comment (written): There are not enough data points to substantiate that groundwater does not flow from the clay into the underlying bedrock at the facility. Furthermore, while the clay may have a relatively low permeability, it cannot be assumed to be a continuous impermeable barrier to contaminant migration. Additional hydrogeologic data is needed to better characterize the current clay-bedrock flow regime and how it will be affected by the proposed

remedial action at Sites 1 and 3 and the Eastern Plume.

Response: Extensive exploration have been conducted at the site to characterize the geology and hydrogeology, including the clay-bedrock flow regime. The site characterization included 55 cone penetrometer test explorations and 119 monitoring well/piezometer explorations. The data collected at the base indicate that an upward gradient exists between the bedrock aquifer and the overlying aquifer in the unconsolidated sediments. Although existing data indicate that an upward vertical component of flow may exist at the site, it is estimated to be minimal (Draft Final Supplemental RI Report, E.C. Jordan Co., 1991a). Investigations at the site indicate that the clay unit ranges in thickness from 20 to 60 feet and permeability tests conducted on shelby tube samples obtained from this unit indicate a hydraulic conductivity on the order of 10^{-7} cm/sec. Upward vertical gradients were also observed to exist between the overburden soils located above the clay and bedrock unit located below the clay. Although the bedrock has been shown to occur above the clay in two locations, the data indicate that this is the exception. The large extent and low permeability of the clay will minimize upward seepage. As part of the design-level groundwater modeling task, sensitivity analyses will be utilized to evaluate the amount of upward vertical seepage through the clay. However, given the very low hydraulic conductivity of the clay, potential seepage is anticipated to be only a very small fraction of the water available through surface recharge of precipitation and the total water mass balance.

10. Comment (written): Mercury has been detected in the sediments adjacent to leachate seeps. Given the concerns that exposure to mercury may have adversely impacted some organisms, tissue samples from appropriate representative organisms should be analyzed for mercury, rather than relying on risk assessment

alone. In addition, levels of mercury in sediments should be measured periodically once groundwater levels are lowered within the slurry wall to determine if mercury levels do indeed decrease over time. If levels do no drop significantly with time, alternative remedial measures may be necessary.

Response: The ecological risk assessment concluded that "exposure to mercury may cause chronic effects for some receptors." Based on this conclusion, remedial response objectives were developed to reduce the concentration of mercury in the leachate soil/sediment. The remedial actions are being implemented regardless of whether actual exposure by ecological receptors to mercury is occurring or has occurred. Results from tissue analysis would not provide additional information that would alter the preferred alternative. Tissue sampling would only support the "assumption" that ecological receptors may be exposed to mercury. The Navy has accepted the assumption that exposure is occurring and is proposing to reduce the levels of mercury discharging to the Mere Brook environment.

The proposed long-term Remedial Action Monitoring Plan for the preferred alternative includes surface water and sediment sampling locations along Mere Brook; soil/sediment sampling at the current leachate locations and groundwater sampling from locations downgradient of the landfill areas. If the analytical data show mercury to be present in previously uncontaminated areas or media or at increasing concentrations, tissue sampling may be warranted. The decision to include tissue sampling could be made during the five-year reviews or at other review periods established in the long-term Remedial Action Monitoring Plan.

11. Comment (written): The plan states that the proposed remedial action should indirectly reduce the contaminant concentrations in sediment at the current seep locations. How will altering the quantity of

groundwater entering Mere Brook affect its quality and flow?

Response: The proposed plan for Sites 1 and 3 indicates that the contaminant concentrations at the seep sediment locations will be reduced by lowering the groundwater to levels below the waste. These actions will reduce the flow of contaminated groundwater to the seep locations. The levels of contamination currently associated with the seep sediments will ultimately decrease through natural degradative, sedimentation, and erosive processes.

The effect of groundwater extraction and lowering of the groundwater table was determined to have a negligible effect on surface water levels in Mere Brook, based on model simulation. The steady-state model simulations indicated that surface water elevation in Mere Brook would remain relatively constant over time. The detailed results of the groundwater modeling are described in the Sites 1 and 3 FFS report.

12. Comment (written): While the permeability of the proposed slurry wall may be relatively low, there will likely be slow leakage of groundwater through the wall over time. The flux of water through the wall, as well as upward flux must also be monitored after installation. After groundwater is lowered to the desired level beneath the bottom of the landfilled waste, water levels within the capped landfill area should be checked periodically. If water levels rise significantly, removal and treatment of additional groundwater from the capped area may be necessary. The break in the slurry wall adjacent to the weapons compound fence may also affect the drawdown of groundwater within the landfill area. Once pumping is initiated to lower groundwater levels with the capped area, groundwater may be drawn back through the gap in the slurry wall. It would be preferable to completely isolate the waste by extending the wall around the entire area of Sites 1 and 3. If the slurry wall cannot

be extended through the weapons compound area for security reasons, then it should be constructed with a gap at the corner of the weapons compound, the number of long-term monitoring points should be increased to cover the incomplete containment.

Response: The flux of water through the slurry wall was simulated in the groundwater flow model using a hydraulic conductivity of 10^{-6} cm/sec, which allows for some flux of water through this barrier. The upward flux of water through the silty clay will be estimated as part of the design modeling study, although this amount of flux is interpreted to be relatively insignificant to the overall water balance at the site. Groundwater levels within the capped landfill will be checked periodically as part of the Remedial Action Monitoring Plan. If groundwater levels are shown to rise to levels contacting the waste material, additional remedial measures may be necessary. The need for alternative remedial action will be evaluated in the Remedial Action Monitoring Plan.

Preliminary modeling indicates that the extraction of water located within the slurry wall will be conducted at extraction rates that would not draw in groundwater through the slurry wall "gap" (Sites 1 and 3 FFS, E.C. Jordan Co., 1991c). The design-level modeling study will allow simultaneous evaluation of extraction rates and hydrogeologic impacts of slurry wall "gap."

Long-term monitoring of the slurry wall will be incorporated into the Remedial Action Monitoring Plan. The Remedial Action Monitoring Plan will not be finalized until the design effort is completed. Therefore, if the slurry wall is not extended through the weapons compound, specific monitoring locations in this area can be identified and incorporated into the plan.

13. Comment (written): There are a number of questions relating to the specific cap and slurry wall design and construction that must eventually be answered, such as: How will the integrity and permeability of the slurry wall be evaluated during and after construction? How will the slurry wall respond to earthquake activity? How will surface water runoff be controlled to prevent erosion of the cap? Where will the treated effluent be discharged? What will the effect of the quantity and quality of the discharge be on the receiving waters? How will air emissions from the treatment system be monitored?

Response: Many of the issues raised in this comment will be addressed during the pre-design activities and design phase of the project. However, the following responses are made to the specific questions raised.

- The integrity and permeability of the slurry wall will be evaluated as part of the long-term Remedial Action Monitoring Plan. The plan will identify the specific monitoring locations including monitoring wells and piezometers that will be routinely sampled, and the parameters to be sampled. The purpose of the Remedial Action Monitoring Plan is to evaluate the effectiveness of the remedial alternative.

- The proposed slurry wall is expected to withstand earthquake activities typical of this region. The slurry wall is a pliable structure that will yield to the earthen displacement of the type and magnitude generally experienced in this part of Maine.

- The cap will be designed to prevent erosion based on expected rainfall and surface runoff. The cap will be monitored continually and repaired, as necessary.

- The Navy is proposing to discharge the treated effluent to the Brunswick POTW; however, the

POTW has not yet agreed to accept this discharge.

- Minimal impact to the receiving waters is expected from the discharge of treated water. As stated in other comments, the final treatment standards for the groundwater are based on attaining appropriate environmental regulations for the receiving water.

- There are no point source air emissions from the UV/oxidation treatment system. A Health and Safety Plan (HASP) will be developed for all activities occurring within the treatment plant. This HASP will include monitoring for emissions and action levels set for various work activities. The treatment plant operators will be OSHA-trained in health and safety for work at hazardous waste sites. The treatment plant will operate in accordance with state and federal requirements. Therefore, the potential fugitive emissions from the treatment plant will not exceed the state's requirements for air quality.

14. Comment (written): Should the Weapons Compound be closed in the future, how will remediation activities at Sites 1 and 3 be revised?

Response: The Navy would assess whether remedial action is necessary for the portion of Sites 1 and 3 that is part of the Weapons Compound.

15. Comment (written): Five-year reviews are specified in the plan as required in the environmental monitoring program. When will the clock start ticking on the remedial actions at Sites 1 and 3 - five years after remedial action begins or five years after construction is completed? It would be preferable to review the remedial actions' effectiveness shortly after construction is completed in order to make adjustments as early

as possible in the remediation process. It is also unclear what the procedure will be if, during the five-year review, the remedial measures are found to be inadequate. The long-term monitoring process should also include consideration of alternative treatment technologies that may have evolved since remedial action began. A more cost-effective remediation method may become available down the road.

Response: The five-year review for Sites 1 and 3 will occur five years after the remedial action is initiated, and every five years thereafter. However, monitoring and review of these data will occur more frequently than every five years as implied in the term "five-year review." The Remedial Action Monitoring Plan will define the schedule and frequency for monitoring during the initial five-year period. The Remedial Action Monitoring Plan will be reviewed by the regulatory agencies before being implemented. Decisions and criteria for evaluating the effectiveness of the remedial action will be included in the Remedial Action Monitoring Plan and will occur, at a minimum, during the five-year review. The five-year review will be conducted jointly by the USEPA, MEDEP, and the Navy and will consider new options should they become available in the future.

16. Comment (written): The Navy should prepare a general land use plan to address what potential long-term activities would be allowable at the facility given the current extent of contamination and proposed remediation standards and schedules.

Response: Institutional controls and land use restrictions will be implemented by the Navy to prevent use of the landfill or groundwater at Sites 1 and 3.

17. Comment (written): Since groundwater cannot be effectively isolated between cleanup sites, and since there is evidence

that plumes from several sites are already merging, the treatment of all discharged groundwater should be based upon the presumptive presence of toxic materials currently identified as being present at <u>any</u> of the sites.

Response: The interaction between Sites 1 and 3 and the Eastern Plume will be evaluated with a design-level groundwater model. The current understanding of the interaction of contamination from Sites 1 and 3 and the Eastern Plume indicates that the two plumes do not interact. With the construction of the slurry wall at Sites 1 and 3 a potential exists for uncontaminated groundwater to flow into the southern portion of the Eastern Plume. This interaction will be evaluated with the groundwater model. Considerable time has been spent studying the nature and distribution of contamination at the various sites at NAS Brunswick. This information has been used to evaluate risk to human health and the environment, and to set target cleanup levels. This information is site-specific and will be used to set target cleanup levels, as appropriate, for each site at NAS Brunswick.

Because extracted groundwater from Sites 1 and 3 and the Eastern Plume will likely be combined in the treatment process, treatability studies will be conducted on the combined flows in order to design the system to treat contaminants from both plumes. The Remedial Air Monitoring Plan will include provisions for evaluating the performance of the treatment plant. Appropriate changes will be made as issues or concerns are identified.

18. Comment (written): We note with concern that the proposed treatment criteria are essentially based upon standards for drinking water (the EPA standard, which is less stringent than those of many states), although it is generally recognized that the

criteria for the protection of plant and animal life are more stringent. Since we know that toxic elements accumulate and become more dangerous as they move up the food chain, it is illogical to use drinking water standards. We do not drink the waters of the Androscoggin - they are used by simple and then increasingly complex organisms that reach us only much later in the food chain. Moreover, even minute quantities of some of the toxic materials, like DDT, can impair reproductive cycles of animal life and impair or destroy aquatic organisms. Because shellfish, as filter feeders, absorb the contents of large quantities of water every day, they are particularly sensitive to the presence of toxic substances in the water and should be used to establish the water treatment levels. Consideration should also be given to toxicity levels for other indicator organisms, such as daphnids and stoneflies which are a basic component of the wildlife food chain.

The State of Maine amended 38 MRSA section 420 to adopt EPA's national water quality criteria. Inasmuch as these criteria impose more restrictive standards than EPA drinking water standards, they appear to be the legal minimum requirements for discharge of water to the Androscoggin River at Brunswick, Maine.

Response:

The actual treatment criteria (i.e., cleanup levels) for contaminants in the groundwater from Sites 1 and 3 will be determined based on the final disposal of the treated water. Three discharge options were developed and discussed in the Proposed Plan and the Focused Feasibility Study for Sites 1 and 3 and include: upgradient recharge, discharge to surface water, or discharge to the POTW. Discharge to the Brunswick POTW is the preferred alternative for remediation at Sites 1 and 3; however, the POTW has not yet committed to accepting this discharge.

Each discharge option has specific requirements that must be met prior to the implementation of the preferred alternative and these are discussed in the following paragraphs.

If treated water is to be reinjected upgradient of the site, drinking water standards would apply. Because these concentrations are known, they were used on the target concentrations for purposes of providing costing information for each alternative. More specific requirements for the other discharge options are described below.

If the treated water is to be discharged to Mere Brook or the storm sewers, federal and state water regulations pertaining to discharge requirements and water quality standards would apply. Treated groundwater would have to comply with the limits set under the CWA NPDES permit program (40 CFR Parts 122 and 125), and Maine Regulations relating to Water Quality Criteria (MEDEP Regulations, Chapter 584) and Antidegradation (38 MRSA Section 464(4)). NPDES requirements and the Maine Antidegradation statute set the requirements that discharged waters must meet. However, these requirements are stated as limits and restrictions for various pollutants that will be incorporated into the final discharge permits. The regulations do not provide promulgated standards outlining allowable concentrations of contaminants in discharge waters. The limits of the Antidegradation policy and corresponding regulations allow the state to set site-specific discharge limits that address drainage areas of water sources, discharges that cause waters to be unsuitable for the designated use of their class, pH, color, and temperature of the receiving waters.

A definitive determination of the discharge requirements for this option cannot be made at

this time because the terms of the final discharge permit will be based on site-specific considerations and set by regulatory agencies in consideration of CWA, NPDES and state requirements. Final discharge standards cannot be predicted because they are established through a process that evaluates broad requirements that will address the resources attributed and related to Mere Brook.

If treated water is to be discharged to the Brunswick POTW, pretreatment standards under the CWA apply (40 CFR Part 403). CWA Section 307(b) authorized the National Pretreatment Program to regulate the introduction of pollutants from non-domestic sources into POTWs. The goal of the program is to prevent discharges to POTWs that would interfere with the operation, pass through, or be incompatible with the POTW. The POTW will first determine the effect the treated groundwater will have on the POTW's unit operations and processes and the need for a pretreatment program. This includes an evaluation of the change on flow rate to the POTW and the change in composition of the waste, if significant.

The POTW's current NPDES permit does not have effluent standards for many of the contaminants that will be in the NAS Brunswick treated water. For preliminary design and cost-estimating purposes, discharge limits equal to MCLs were assumed. However, to discharge to the POTW, pretreatment standards for a user such as a military installation (NAS Brunswick) will have to be established. These pretreatment standards are limitations that will be placed on the effluent from the NAS Brunswick treatment system such that the introduction of the NAS Brunswick effluent to the POTW waste stream will not cause the POTW to be in violation of its NPDES permit. The design of the treatment

plant will be determined by the pretreatment requirements (these pretreatment standards may be determined by AWQCs, MCLs, or some other appropriate rationale). The pretreatment standards will be developed to be protective of receptors in the Androscoggin River, human or environmental.

The POTW will be required to submit a pretreatment program as an amendment to its NPDES permit. This program (which will include the standards themselves and a compliance schedule) will be submitted to the Wastewater Management Branch of USEPA Region I and be subject to approval. Pretreatment standards may include limitations on such compounds such as acetone, sulphates, nitrates and any other possible by-products of the treatment system as well as the contaminants originating from Sites 1 and 3 groundwater. The process of applying for pretreatment standards and an amended NPDES permit will require cooperation between the Navy and POTW officials.

19. Comment (written): <u>Recommendations</u>

Recommendation A: Recharge water into ground on the base.

Response: Upgradient infiltration of groundwater has been considered as a potential discharge option. This option will be evaluated with the design-level groundwater model to determine the effectiveness of this discharge option. Discharge of treated water from Sites 1 and 3 will most likely occur with the discharge of treated water from the Eastern Plume.

Recommendation B: If A is not possible, and discharge to the Androscoggin is required, then accomplish the following:

Recommendation B-1:	Strengthen groundwater cleanup levels, based upon fish and wildlife species criteria. The environmental standards needed to protect the fish and wildlife in our rivers are no longer a matter of speculation; there is adequate documentation in the criteria used in many states; i.e., New Jersey, Maryland and EPA also promulgates minimum requirements. We would hope to see the NAS assume leadership in giving Maine waters the same level of protection.
Response:	See response to Comment 18.
Recommendation B-2:	Department of the Navy should fund (some?) of the services of an independent toxicologist to review the final requirements from the mission requirement point of view of Friends of Merrymeeting Bay, because the subject matter of toxicant levels for fish and wildlife habitat is too complex and beyond the normal expertise of informed sports enthusiasts.
Response:	Technical Assistance Grants (TAGs) through the USEPA are available for technical support to the public. The BACSE group has received such a grant and may have funds to support this study.
Recommendation B-3:	Identify the specific legal authority and enabling legislation that permits piping large quantities of water which normally flow to the Casco Bay estuary into the Kennebec/Sheepscott Bay estuary.
Response:	No specific legislation restricting or limiting the groundwater flow between watersheds were identified during the identification of ARARs. The Navy does not consider the discharge of treated water to the Kennebec/Sheepscott Bay estuary to be significant. An overall water balance for the Harpswell Cove watershed area was performed using a general area of the

watershed area (ft^2) x an average infiltration rate of 18-inches/year. Of the approximately 4,151 gallons per minute (gpm) flowing into this watershed, the Eastern Plume and Sites 1 and 3 extraction rates (approximately 130 gpm) represents less than 3 percent of the overall flux into the system. When the Sites 1 and 3 extraction is completed (approximately one to two years) the Eastern Plume extraction represents less than 2 percent for the overall flux. Given the significant area over which the Kennebec/Sheepscott bay watershed occurs, the addition of this volume of water is expected to be negligible compared to the overall flux through the watershed area.

Recommendation B-4: Prevent the intermixing of sludge from the NAS cleanup with domestic sludge. This is of concern to us if the NAS cleanup wastewater is discharged through the Brunswick Sewage Treatment Plant, because the domestic sludge is, at this time, used by farmers in the Merrymeeting Bay watershed as fertilizer. In addition to the obvious environmental questions raised by this issue, there is a question of legal responsibility. The intermixing of the two sources in sludge could generate a nightmare of legal entanglements should one of the NAS toxicants be the source of a lawsuit.

Response: Sludge from the POTW used as a soil additive is subject to the MEDEP Rules for Land Application of Sludge and Residuals. These standards have been developed for several inorganic elements and PCBs. The standards specify maximum permissible concentrations (mass of contaminant per mass of sludge applied) and maximum loading limits (mass of contaminant per area applied). The pretreatment standards will therefore be developed so that the maximum permissible concentrations in the sludge from the POTW are not exceeded.

Sludge from the POTW will be completely separate from and a much different composition than the sludge from the metals pretreatment processes proposed for Sites 1 and 3. The POTW sludge has a much higher organic content (making it useful to farmers) than the metals sludge and the two would not be mixed. The metals sludge from the pretreatment process will be tested for characteristics of RCRA hazardous waste. It will either be disposed of in a secure hazardous waste landfill or a landfill for non-hazardous solid waste depending on the results of the tests.

Recommendation C: We have received verbal assurance that there will be a pilot project for water treatment. We request that this pilot project be followed by a full-stop review and a public comment period.

Response: Pilot tests for the water treatment system will be developed during the pre-design phase. The specific pilot test results will be described in a design work plan that will receive regulatory and TRC review.

20. Comment (written): Recommendations

Recommendation 1: The groundwater treatment include all toxicants currently identified as being present at any site.

Response: The groundwater treatment for the Preferred Alternative for Sites 1 and 3 was designed to specifically treat or remove the constituents detected in the groundwater beneath the site. The Preferred Alternative includes treatment for metals and VOC contaminants. The treatment option will be designed to meet the final discharge requirements for all constituents detected in the effluent.

Designing a treatment system for contaminants that are not detected in or likely to be present in

the influent is not possible, as is suggested in the comment. Three areas of groundwater contamination have been detected at NAS Brunswick and include Sites 1 and 3, the Eastern Plume, and groundwater beneath Site 9. Similar contaminants of concern have been identified at Sites 1 and 3 and the Eastern Plume making it possible to design a single cost-effective and implementable groundwater treatment. However, the contaminants of concern at Site 9 include compounds that have different chemical and physical properties than those identified at Sites 1 and 3. This results from the different historical land use and disposal practices at these sites. Because of the different properties of the contaminants of concern, separate and different treatment technologies need to be considered. Each site must be evaluated separately to ensure proper treatment and/or removal of the site-specific contaminants of concern.

The final treatment of contaminated groundwater at Site 9 will be decided using the same Proposed Plan and ROD process as for Sites 1 and 3 and the Eastern Plume and the public will have the same opportunity to review and comment on the final plan.

Recommendation 2: The groundwater treatment levels be strengthened and be based upon fish and wildlife species criteria. The attached list (Table E-1) of monitoring elements contains sample recommended water treatment levels based on these criteria, incorporating drinking water standards where appropriate.

Response: See response to Comment 18.

21. Comment (written): It is our opinion that the proposed remedial action alternative (the "containment" option) is only a short-term action. Containment is not a remedial action but is instead a tactic for

TABLE E-1
FRIENDS OF MERRYMEETING BAY CLEANUP RECOMMENDATIONS

ROD: SITES 1 AND 3
NAS BRUNSWICK

MONITORING ELEMENT	MINIMUM CLEANUP LEVEL (micrograms per liter)	RATIONALE
Arsenic	5	1
Vinyl chloride	0.2	2
Methylene chloride	4.7	7
Chromium (total)	0.06	7
Lead	0.9	6
Nickel	0.04	7
Zinc	0.03	6
Mercury	0.03	7
1,1-DCE	6	4
1,1-DCA	0	5
1,1,1-TCA	200	2,3
1,2-DCE (cis)	70	2,3
1,2-DCE (trans)	100	2,3
Asbestos	10	5
PCE	0	5
TCE	0	5
Alcohol	data unavailable	--
PCB	0.014	7
2-Butanone	data unavailable	--
Xylene	0.8	8
DDD	0.01	8
DDE	0.0006	7
DDT	0.012	8
Cyanide	1	7
Oil	0.01	7
Solvents	data unavailable	--
pH	6-8.5	2
Oxygen	>7 ppm	2
temperature	ambient	2

Sources for rationale:

1. University of Maine Coop Extension Service
2. State of Maine recommended levels
3. MCL (USEPA)
4. Current levels shall not be exceeded
5. MCLG (EPA)
6. ISBN 0 521 22495 (Pg. 291, based on application factor for fish)
7. EPA Region IV, Toxic Substance Spreadsheet data as modified by the State of Maine
8. Handbook of Acute Toxicity of Chemicals, U.S. Department of the Interior (modified for chronic criteria)

postponement of a true and complete cleanup. Containment, as it has been proposed, does not lead us to a day when the site is clean and free of hazardous contaminants.

Response: The proposed remedial action for Sites 1 and 3 is a containment alternative that is considered by the Navy to be a final action. This alternative is consistent with the NCP and USEPA policy that recognizes that containment technologies are appropriate for waste that poses a relatively low long-term threat or where treatment is impracticable (Sec. 300.430(a)(1)(iii)(B); 55 FR 8846 (March 8, 1990). The conditions of Sites 1 and 3 meet both these criteria. There were no imminent risks to either human or ecological receptors identified and the only long-term risks resulted from the future potential ingestion of contaminated groundwater (human health risks) and ingestion of mercury-contaminated sediments (ecological risks). The large volume and heterogeneity of the wastes within the landfill makes any type of treatment option impractical. The containment alternative will effectively reduce the amount of contaminated groundwater generated and discharged into the Mere Brook environment. This alternative achieves the remedial response objectives established for the site. Consistent with the NCP, long-term monitoring and institutional controls will be in place to prevent future exposure to the waste material.

22. Comment (written): One favorable aspect of a containment action is that it does seal the hazardous materials and prevents dispersal until a day when a more effective cleanup technology becomes available, providing that the containment vessel remains intact. We can accept containment as a stop-gap method if: (i) the option is declared to be a temporary remedy and **not** a final action and that a regular review of available technologies be

incorporated into the plan; (ii) when an appropriate technology becomes available a new remedial plan be enacted by a process which invites citizen input; and (iii) the containment vessel, particularly the slurry wall and the interface between the wall and the cap and the wall and the clay bed, be upgraded to withstand predictable severe seismic activity.

Response: The proposed remedial action for Sites 1 and 3 includes containment of the wastes and is considered to be the final action for this site. A Remedial Action Monitoring Plan will be developed for Sites 1 and 3, and will be submitted for review and approval by the regulatory agencies before being implemented. The Remedial Action Monitoring Plan will be designed to obtain information necessary to evaluate the effectiveness of the remedial action. If the remedial action is not achieving the cleanup goals for the site, other remedial actions may be considered.

The integrity of the slurry is not expected to be adversely impacted by earthquakes of magnitudes typically experienced in this region. The consistency of the slurry wall is expected to be that of a medium or stiff clay and, therefore, the wall will have the ability to experience 10 to 15 percent plastic deformation without cracking. This coupled with the support of the surrounding soils will minimize the effects of regional seismicity.

23. Comment (written): If the above conditions cannot be incorporated into the containment option, we must express our preference for a groundwater collection/ extraction and treatment option. While considerably more expensive, these options insure a clean site when completed.

Response: The Navy recognizes the preference expressed in this comment. However, as stated in the above response to comments, the Navy's preferred alternative is considered to be a final action that will meet the target cleanup goals and is consistent with the requirements stated in the NCP.

24. Comment (written): Another specific concern is the problem of the secure weapons facility. It is irresponsible to exclude it due to the inconvenience of the security forces. We recommend that the cleanup of the entire site be the priority and that the possible disturbance and replacement of the fences be a secondary concern. We urge that the remedial plan include this small but important section.

Response: The cleanup of the entire Sites 1 and 3 area is the objective of the remedial alternative proposed for the site. Extensive remedial investigations have shown that the landfill wastes are located with the area enclosed by the slurry wall itself. The isolation of these landfill wastes using the proposed configuration of the slurry wall will provide for an effective long-term remediation at the site. See the response to Comment 2.

25. Comment (written): Our final interest concerns the overall biological and ecological threat posed by the sites. We applaud what appears to be a very thorough hydrogeological evaluation of the site but we believe the surface terrestrial and aquatic biotic components have been neglected. We wish to see a more complete analysis of the threat of dispersal of hazardous materials by biotic means through the food web and within and beyond the confines of the Mere Brook watershed and associated aquifers. An analysis of this sort is critical in evaluating the effectiveness of any containment or extraction/treatment remedial actions.

Response: The proposed long-term monitoring for the Preferred Alternative includes surface water and sediment sampling locations along Mere Brook, soil/sediment samples at the current leachate locations and groundwater samples from locations downgradient of the landfill areas. Analytical results from these samples will provide information regarding the transport of contaminants from the landfill to the Mere Brook environment. Current sampling results do not show the transport of contaminants beyond the region of Mere Brook directly downgradient of the landfill area (i.e., the region of Mere Brook between the southern runway and Merriconeag Road). Therefore, no contaminant migration is expected after the implementation of remedial actions.

A biological food chain model was used to provide an appropriate ecological cleanup level for mercury. This value (1 mg/kg) will be used as part of the Remedial Action Monitoring Plan to compare sampling results and evaluate the effectiveness of the remedial action and/or need for additional remedial actions.

26. Comment (verbal): Have you tested any mussels or clams for zinc or chromium or mercury?

Response: No tissue samples have been collected and analyzed for any contaminant including zinc, chromium, or mercury.

27. Comment (verbal): Did you test for zinc?

Response: Zinc was analyzed for and measured in surface water and sediment from Mere Brook adjacent to Sites 1 and 3.

28. Comment (verbal): I would recommend you take at least one sample for mercury.

	Response:	Mercury was sampled and analyzed for in leachate, leachate soil/sediment, sediment, surface water, and groundwater, and was only detected in leachate (0 to 19 μg/L) and leachate sediment (1 to 3 mg/kg).
29.	Comment (verbal):	You are treating groundwater to the EPA level but not the state level for vinyl chloride, and why is that?
	Response:	See the response to Comment 4.
30.	Comment (verbal):	Do you know the cost of cleaning up 0.2 μg/L of vinyl chloride?
	Response:	The cost for groundwater extraction and treatment to 2.0 μg/L is approximately $1.3 million. The incremental cost to achieve 0.2 μg/L is not known. Current analytical techniques are unable to consistently measure such a low concentration of vinyl chloride.
31.	Comment (verbal):	The proposal should try to get close to 0.2 μg/L of vinyl chloride. A concentration of 0.1 or 0.5 would be a reasonable goal.
	Response:	To address the concerns of the State of Maine and local residents, the Navy has agreed to perform a risk assessment at the completion of the groundwater extraction and treatment. The risk assessment will be used to determine if additional treatment or remedial alternatives are required to further lower the concentrations of vinyl chloride. The regulatory agencies, including the State of Maine will be able to review and comment on the risk assessment.
32.	Comment (verbal):	What happens should the Navy leave Brunswick.
	Response:	In the event the property is excessed or otherwise disposed of, the Navy will request that the General Services Administration, the government

disposal agent, place restrictions in the deed. The Navy will continue remediation until the target cleanup levels specified in the ROD are achieved.

33. Comment (verbal): How long will you be monitoring this site?

Response: Once we have a remedy selected and the final design of the system, the Navy will develop a Remedial Action Monitoring Plan. The purpose of this plan is to monitor the remedial action and make sure that the system is performing as expected.

The Remedial Action Monitoring Plan will establish a strategy to monitor the site over a long period of time. It will identify the location and frequency of monitoring and the compounds to be sampled. It will also identify how to determine when the cleanup goals have been reached. If the USEPA concurs that the cleanup goals have been met, the site delisting process begins. The monitoring of Sites 1 and 3 will continue until the sites are "clean," regardless of the duration. Monitoring is expected to continue for a minimum of 30 years.

34. Comment (verbal): Fifty years from now, 100 years from now, there may be cracks in the slurry wall. How will we know that? Will they still be monitoring that 50 years or 100 years from now?

Response: The Navy or other appropriate federal agencies will continue to monitor water levels and water quality until the cleanup goals, as stated in the ROD, are achieved, regardless of the duration.

35. Comment (verbal): How can we be assured that the system doesn't fail?

Response: The Remedial Action Monitoring Plan will provide a means of assessing whether the system

is a success or failure. Other remedial alternatives will be pursued if the proposed remedial action fails to achieve cleanup goals and/or experiences technical difficulties.

36. Comment (verbal): You talked about having a study that assumed there was a neighborhood around Sites 1 and 3. Was that neighborhood served by wells, bedrock wells, shallow wells, or public water supply?

Response: A future residential exposure scenario was evaluated and assumed the residents obtain drinking water from beneath the landfill. It is a very conservative exposure scenario and is consistent with USEPA guidance.

37. Comment (verbal): If the Navy were to leave, would somebody in Brunswick be able to find out how far away from Sites 1 and 3 it would be safe for residential development?

Response: The exact area that will be identified by a land and deed restriction would include the entire area where remedial actions occur. It is not possible to say if this land could ever be developed sometime in the future because this would depend on the results of the long-term monitoring.

A very extensive database will be developed as part of the Remedial Action Monitoring Plan; therefore, in 10 years, information may be available that can help answer this question. A risk assessment performed at the five-year review using the monitoring data will evaluate the area for residential land use.

38. Comment (verbal): Could you specifically discuss how you plan on remediating the mercury levels in the leachate and soil sediment.

Response: See the response to Comment 1.

39. Comment (verbal): Do you anticipate any problems with the groundwater treatment system, or the target cleanup levels that you proposed?

Response: The proposed technologies are fairly well-tested and very well-documented procedures. Treatability testing will be conducted as part of the pre-design effort to determine the optimal parameters that would be required to achieve target cleanup levels.

40. Comment (verbal): As a follow-up, in the event that the treatability test shows that you can't clean it up to MCLs prior to discharge, what would you do at that point?

Response: The MCLs are the target cleanup levels established in the ROD and therefore must be achieved or it is necessary to obtain regulatory approval for any change.

In the ROD, the stated goal is to clean up the groundwater to a certain level based on the proposed technology. The Navy feels confident that the water can be treated to levels consistent with drinking water standards. If not, the Navy would be required to consider other alternatives, revise the Proposed Plan and ROD, and reinstate the same public comment review process.

41. Comment (verbal): Have you evaluated removing the contaminants?

Response: Yes. There are approximately 300,000 cubic yards of fill material associated with Sites 1 and 3 that would require remediation. To excavate and/or treat this volume of material was considered to be very cost-prohibitive.

42. Comment (verbal): At the dump site with a slurry wall in Nashua, New Hampshire, they're recycling the water there. Why are you sending the water for further treatment in this case?

	Response:	The possibility of recycling the water through the use of upgradient recharge was evaluated. If it is not possible to discharge the treated water to the POTW, that would be a viable alternative. The POTW was chosen based on known cost and reliability.
43.	Comment (verbal):	Would you anticipate discharge to the POTW to be less expensive?
	Response:	Yes, however discharge into the POTW does incur a user fee.
44.	Comment (verbal):	You selected your target standards to be the maximum allowable contamination standard. I'm concerned that your choice of remediation action is a minimal choice. You can't do the no action, and you can't select the minimal action, and I think the next step down is probably the least expensive of the four that remain.
	Response:	The proposed target cleanup levels are set at the federal MCLs. These are promulgated standards established on part of the Safe Drinking Water Act to provide an adequate level of protection to human health from the consumption of groundwater.
45.	Comment (verbal):	I'm concerned that you've chosen to ignore the weapons facility. You indicated that the weapons facility was just a small chunk, and probably in the process of developing it, the contaminants were removed. If that's such an effective remedial action, why can't we do that for the whole site, perhaps. And I guess I would just say that in summary, that I wonder about the integrity of the cap and the slurry wall for the Sites 1 and 3. Are they really long-term as you've suggested? You mentioned the word forever. Geologically, that's not really a safe word to use.

Long-range, I think it would be perhaps safer to let the system flush out, if that's a feasible solution. It looks to me like it was maybe five times as expensive. Seventy-three years from now, conceivably there's no contamination left, you flushed it out and treated it, it's gone.

The alternative we're looking at is to cap it, build a wall and then just leave it there. And I wonder how permanent that solution is. We will have clean water coming down into the brook, no contamination of the estuary, but how long is that going to last? You know, if we're really looking to save money or if we're looking to do the best job we can do.

Response:

This containment alternative provides a means for immediately cutting off the source of contamination and stopping contaminated groundwater from migrating to Mere Brook. In addition, the landfill will be dewatered and the water treated to appropriate levels.

With the other alternatives, it's very difficult to determine how long it will actually take to clean up the site. It could take 25 years, it could take 200 years. The preferred alternative is a solution that addresses the problem now.

It is impractical to remove the material from the landfill and dispose of it elsewhere. There are approximately 300,000 cubic yards of fill material associated with Sites 1 and 3 that would require remediation. To excavate and/or treat this volume of material was considered to be very cost-prohibitive.

Perhaps in the future there will be a better way of dealing with it. This is the best alternative that can be developed at this time. If a better technology becomes available, it will be considered during the five-year review process.

The slurry wall technology has been well demonstrated. There are active slurry walls that are more than to 50 years old that still maintain their integrity. In addition, the conditions at Sites 1 and 3 are favorable for the placement of a slurry wall.

Caps also are extremely well demonstrated to be effective at isolating waste material. Caps are continually maintained and monitored and repaired as necessary.

46. Comment (verbal): Did you identify anything denser than water contaminants at 1 and 3 or the Eastern Plume?

Response: We did identified various solvent compounds that do have densities greater than water. However, we never identified them at concentrations that would be indicative of the formation of an immiscible phase that would then have a density greater than water.

A solubilized plume, that is, a plume that contains solvent concentrations at the saturated limit, does not have a density difference great enough to allow for downward migration. In all of the investigations, there was no evidence of a separate phase.

47. General Comment (verbal):

What is the risk for the children coming in contact with any of the carcinogens? Can asthma be developed from the toxic waste at that base?

Response: The risks to Girl Scouts and Boy Scouts coming on the site was evaluated. Sites 1 and 3 has a unique land use and anyone coming on base does not have access to this area.

Therefore, there is no exposure, and likely will never be any exposure in that area. We did look at that specific exposure scenario for other sites

on base including Site 8, and down by the Picnic Pond area.

There will always be some level of risk, because current USEPA policy is that there is no such thing as zero risk from exposure to a carcinogen.

USEPA has also developed a risk range that evaluates the significance of these risk numbers. The risk numbers that were generated based on these exposure assumptions were within the safe or acceptable range.

48. General Comment (verbal):

Have there been any studies done on the community to see if any diseases due to exposure to toxins at the base are developing in the city at a faster rate than surrounding areas?

Response:

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal agency that is involved in the Superfund program at NAS Brunswick. Representatives from ATSDR have attended a TRC meeting (April 11, 1991) and have toured the site.

The role of ATSDR is to develop toxicological profiles of chemicals found at Superfund sites and to determine if a large enough population has been exposed. If so, ATSDR would conduct health studies and report to the USEPA. The public would have the opportunity to comment on the report.

49. General Comment (verbal):

Has there been any testing done at the old radar station off Old Bath Road or in the Topsham Annex? Unauthorized dumping may have occurred there. Would you visit the site to see if anything is going on?

Response: To our knowledge and during the Initial Assessment Study, we did not receive or identify any reports or knowledge of dumping or other activity at the old radar station. To date, there have been no studies conducted at that site.

The Navy will discuss this area of concern with the activity.

50. Comment (verbal): I heard that this present contamination on the base was just individuals dumping things.

Response: Sites 1 and 3 and the Eastern Plume are specific sites where there was a clear indication that some sort of disposal or leakage had occurred, or some practice that gave rise to environmental contamination.

51. General Comment (verbal):

You keep on referring to the study at the library. I went to the Curtis Memorial Library on Tuesday, looked at the reference desk, and found no study. It was not readily available.

Response: You need to go to the front desk and ask to see the information repository for the Navy. The person in charge of reference materials will direct you to it.

52. General Comment (verbal):

Can we get an extension of time for comments?

Response: There is a legal and acceptable extension that's available. The comment period will be extended for one week.

APPENDIX F

MEDEP LETTER OF CONCURRENCE

STATE OF MAINE
Department of Environmental Protection

MAIN OFFICE: RAY BUILDING, HOSPITAL STREET, AUGUSTA
MAIL ADDRESS: State House Station 17, Augusta, 04333
207-289-7688

JOHN R. McKERNAN, JR.
GOVERNOR

DEAN C. MARRIOTT
COMMISSIONER

June 4, 1992

Thomas A. Dames
Captain, CEC, U.S. Navy
Commanding Officer
Department of the Navy, Northern Division
Naval Facilities Engineering Command
Building 77-L
Philadelphia Naval Shipyard
Philadelphia, PA 19112-5094

RE: Naval Air Station Brunswick Superfund Site, Brunswick, Maine

Dear Captain Dames:

The Maine Department of Environmental Protection (MEDEP) has reviewed the June 1992 Draft Record of Decision (ROD) regarding Sites 1 & 3 for the Naval Air Station Brunswick Superfund Site located in Brunswick, Maine.

Based on that draft the MEDEP concurs with the selected remedial action. This action consists of a multi-component approach for the containment of waste and remediation of groundwater as outlined in the following:

I. Slurry Wall

A. The soil/bentonite slurry wall will be placed around the landfill.
B. The wall will be keyed into natural clay formations.
C. Due to interference from the weapons compound, the wall will not be continuous around the landfill site.

II. Cap

A. A low-permeability cap will be constructed over the landfill area.
B. The cap will extend over the slurry wall.
C. The cap will not extend into the Weapons Compound Area.
D. Future closure of the Weapons Compound will result in a reevaluation of the cap construction.

III. Groundwater Extraction Wells

A. Groundwater extraction wells will be installed which will remove contaminated groundwater beneath the cap and within the slurry wall.
B. The number and placement of extraction wells will be determined during the design phase.
C. Pump tests will be conducted to determine pumping rates.

IV. Groundwater Treatment

A. Extracted groundwater will be pumped to a central treatment plant.
B. Groundwater will be pretreated to remove inorganic compounds.
C. Groundwater will be treated to reduce or eliminate volatile organic compounds through the use of UV/oxidation technology.
D. Treatment levels will be based on the Public Operated Treatment Work's (POTW) National Pollution Discharge Elimination System permit and/or MCLs.
E. Treatability studies will be conducted prior to full-scale design.

V. Discharge of Treated Water

A. Discharge of treated water will be to the base sanitary sewer system which connects to the Brunswick Sewer District, Public Operated Treatment Works (POTW). POTW approval will be required.
B. Flow from the NABS treatment facility will not cause the POTW to exceed its capacity.

VI. Clean-up levels

A. Groundwater clean-up levels for contaminants have been set at the MCL.
B. No soil clean-up levels were established.
C. Ecological target clean-up levels for leachate seeps and surface water have been set at the Ambient Water Quality Criteria or risk based levels.

VII. Institutional controls

A. Land use restrictions will be placed on future use of the landfill and groundwater affected by the landfill. These restrictions will prohibit disturbance of landfilled materials and extraction of groundwater for any use besides remediation.
B. Warning signs will be placed in appropriate locations.

VIII. Environmental monitoring

A. Groundwater flow and quality will be monitored.
B. Surface water, sediments, and leachate seeps will be monitored.
C. Dispersion and degradation of contamination already emanated from the landfill will be monitored.
D. At a minimum, environmental monitoring will continue for 30 years.
E. Five year reviews will be conducted.
F. A risk assessment will be part of the 5 year review.
G. The need for future remedial action will be assessed.

This concurrence is based upon the State's understanding that:

A. The MEDEP will continue to participate in the Federal Facilities Agreement dated October 19, 1990 and in the review and approval of operational designs and monitoring plans.

B. Groundwater extraction wells established within the slurry wall enclosure will be maintained. Groundwater elevation levels will be monitored within the landfill to determine the effectiveness of the slurry wall/cap. If groundwater levels rise, resulting in contact between contained waste and the groundwater, the extraction wells will be reactivated to maintain appropriate groundwater levels. Discharge water from any future pumping, beyond that anticipated in this ROD, will require treatment.

C. At the completion of the remedy, any residual risk at the site will fall within the risk range specified under the Federal National Contingency Plan (NCP). The MEDEP remains concerned that the groundwater clean-up standard for vinyl chloride is not consistent with the risk range specified in the

NCP. In particular, if vinyl chloride is reduced no lower than 2.0 ppb groundwater clean-up level specified in this ROD, the residual risk from this compound alone will exceed the worst case 10-4 cut off specified in the NCP. The MEDEP finds the specified groundwater clean-up goal for vinyl chloride, may not provide sufficient protection of public health. The State, however, anticipates that in reducing most compounds at the Site to their respective groundwater clean-up goals, vinyl chloride will be reduced to protective levels well below the clean-up goals stated in the ROD. Therefore our concurrence is based upon the understanding that the decision as to completion of the remedy for groundwater will be based on the total residual groundwater risk from the Site and that further remedial action will be required if the total site risk exceeds the 10^{-4} cutoff specified in the NCP.

D. Institutional controls must remain in place as part of the remedial alternative, if the calculated total excess cancer risk for the site exceeds 10^{-5}

E. The site conditions shall be reviewed within five(5) years from the conclusion of the remedial action to ensure that public health and the environment are not significantly impacted by the remedial contaminants. Of particular concern to the MEDEP is the potential for increased concentrations of vinyl chloride due to anaerobic degradation of residual chlorinated compounds in groundwater.

The MEDEP looks forward to working with the Department of the Navy and the USEPA to resolve the environmental problems posed by this site. If you need additional information, do not hesitate to contact myself or members of my staff.

Sincerely,

Dean Marriott

Dean C. Marriott
Commissioner

cc: Alan Prysunka, Director, BHMSWC
Michael Barden, Director, DSIR
Mark Hyland, Director, FFU

APPENDIX G

ADMINISTRATIVE RECORD INDEX
AND
GUIDANCE DOCUMENTS

NOTE

Since the issuance of this Record of Decision, the Administrative Record has been restructured and its contents updated. For the current location of the documents and correspondence which supported this Record of Decision, please refer to the Master Index which accompanies the Administrative Record.

Page Insert 3/15/93

SITES 1 AND 3 LANDFILL

ADMINISTRATIVE RECORD

INDEX

Prepared for:
Naval Air Station Brunswick
Brunswick, Maine

SECTION I

INTRODUCTION

This document is the Index to the Administrative Record for the Naval Air Station (NAS) Brunswick National Priorities List (NPL) site (Sites 1 and 3).

The Administrative Record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) at Section 113(k).

The Administrative Record is established to service two primary purposes. First, the basis for the remedial response selection is set forth in the record, and judicial review of any issue concerning the adequacy of a response selection is limited to the record. Second, the Administrative Record acts as a vehicle for public participation in the selection of the remedial response action.

The Administrative Record is available for public review at NAS Brunswick Public Works Office, Brunswick, Maine.

Section I of the Index cites the site-specific documents, which are included in the Administrative Record volumes. Section II cites the guidance documents used by Navy staff in selecting a remedial response action at the Site; these documents are not to be included in the Administrative Record volumes located at the NAS Brunswick Public Works Office but are available for review at EPA Region I Records Center.

Questions concerning the Administrative Record should be addressed to Lt. Cmdr. Michael J. L'Abbe at NAS Brunswick Public Affairs Office (207) 921-2340, Brunswick, Maine.

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
22-Sep-83	Site Inspection by NUS Corporation	C. Young NUS	D. Smith NUS	Trip Report	3	Pre-Remedial Correspond	
30-Oct-84	Schedule for Confirmation Study	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter	2	Pre-Remedial Correspond	
06-Nov-84	Progress Report (9-15-84 to 10-31-84)	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter	2	Pre-Remedial Correspond	
05-Dec-84	Progress Report (11-1-84 to 11-30-84)	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter	2	Pre-Remedial Correspond	
11-Dec-84	Update of Confirmation Study Work	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Phonecon	1	Pre-Remedial Correspond	
03-Jan-85	Preliminary Laboratory Results	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Phonecon	1	Pre-Remedial Correspond	
07-Jan-85	Progress Report (12-1-84 to 12-31-84)	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter	2	Pre-Remedial Correspond	
15-Jan-85	Laboratory Analysis Results	R. Kowalczyk NorthDiv	W. Fisher EC Jordan	Phonecon	1	Pre-Remedial Correspond	
15-Apr-85	Forward Comments on Confirmation Study	A. Rhoads NorthDiv	W. Fisher EC Jordan	Letter	1	Pre-Remedial Correspond	
May-85	Confirmation Study Meeting	R. Kowlaczyk NorthDiv	R. Gillespie NorthDiv	Trip Report	2	Pre-Remedial Correspond	
28-Jun-85	Transit Confirmation Study Report	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter Enclosure	1	Pre-Remedial Correspond	Enclosure in separate file
30-Jul-85	Progress Report (1-1-85 to 7-31-85)	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter	2	Pre-Remedial Correspond	
02-Aug-85	Transmit Comments on Confirmation Study	A. Rhoads NorthDiv	W. Fisher EC Jordan	Letter Enclosure	1 2	Pre-Remedial Correspond	
16-Aug-85	Transmit Confirmation Study	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter	1	Pre-Remedial Correspond	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
02-Dec-85	Forward Copy of Confirmation Study	L. Jones PWO NASB	R. Jackson EPA Reg I	Letter	1	Pre-Remedial Correspond	
13-Jan-86	Review Comments on Confirmation Study	R. Jackson EPA Reg I	L. Jones PWO NASB	Letter	3	Pre-Remedial Correspond	
24-Feb-86	Request for Review of Documents	C. Bertocci Maine DEP	R. Kowalczyk NorthDiv	Letter	1	Pre-Remedial Correspond	
25-Feb-86	POCs at Maine DEP	A. Leavitt Maine DEP	L. Jones PWO NASB	Letter	1	Pre-Remedial Correspond	
11-Mar-86	Request for Guidance on Regulatory Oversight	L. Jones PWO NASB	CO NorthDiv	Letter	1	Pre-Remedial Correspond	
07-Apr-86	Forward Guidance on Regulatory Oversight	A. Rhoads NorthDiv	CO NASB	Letter	2	Pre-Remedial Correspond	
May-86	Review Comments on Confirmation Study	A. Leavitt Maine DEP	L. Jones PWO NASB	Letter	2	Pre-Remedial Correspond	
01-Oct-86	Transmit Work Plan for Site Characterization	W. Fisher EC Jordan	R. Kowalczyk NorthDiv	Letter Enclosure	1	Pre-Remedial Correspond	
27-Oct-86	Request for Additional Info for Work Plan	M. Hoagland EPA Reg I	G. Apraham NASB	Letter	1	Pre-Remedial Correspond	
19-Nov-86	Comments on Work Plan	R. Kowalczyk NorthDiv	M. Hoagland EPA Reg I	Phonecon	1	Pre-Remedial Correspond	
24-Nov-86	Comments on Work Plan for Site Characterization	M. Hoagland EPA Reg I	L. Jones PWG NASB	Letter Enclosure	2 11	Pre-Remedial Correspond	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
30-Aug-84	Site Inspection Report	NUS Corporation		Report	43	Pre-Remedial Site Rpt	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
29-Jun-83	Initial Assessment Study of NASB	Roy F. Weston		Report		Pre-Remedial IAS	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
22-May-81	Notification of Hazardous Waste Site	R. Bersani PWO NASB	EPA	Forms	8	Pre-Remedial Site Discovery	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
22-May-91	Notification of Hazardous Waste Site	R. Bersani PWO NASB	EPA	Forms	8	Pre-Remedial Site Discovery	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
29-Jun-83	Initial Assessment Study of NASB	Roy F. Weston		Report		Pre-Remedial IAS	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
30-Aug-84	Site Inspection Report	NUS Corporation		Report	43	Pre-Remedial SI Rpt	
Oct 84	Work Plan Pollution Abatement Confirmation Study Step 1A Verification	EC Jordan		Work Plan Report		Confirmation Study	
June 85	Pollution Abatement Confirmation Study Step 1A Verification	EC Jordan		Report		Confirmation Study	

:AR2
rev 21 July 1990

Administrative Record Brunswick Naval Air Station
Sites 1 and 3

Health Assessment
Vol. 2

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
24-Nov-87	Request to coordinate Health Assessments	P. Yaroschak NAVFAC	D. Johnson ATSDR	Letter Enclosure	1 2	RI/FS HA	
30-Nov-87	Health Assessments at NPL Sites	D. Olson NAVFAC	CO NorthDiv	Letter Enclosure	2 9	RI/FS HA	
16-Feb-88	Status of Health Assess at NASB	R. Springfield NorthDiv	L. Dewess ATSDR	Phone Call		RI/FS HA	
24-Mar-88	Request for Health Assessment	T. Sheckles NorthDiv	M. Disirio ATSDR Reg I	Letter	1	RI/FS HA	
10-Apr-89	Preliminary Health Assessment for NAS Brunswick	ATSDR		Report	5	RI/FS HA	
28-Aug-89	Request Info on ATSDR Health Assessment	G. D. Cullison NAS Brunswick	M. F. Cassidy EPA Region I	Memo	1	RI/FS HA	
10-Jan-90	Comments on ATSDR Health Assessment	M. F. Cassidy EPA Reg I	G. D. Cullison NAS Brunswick	Letter	1	RI/FS HA	
26-Mar-90 Ser. 565	Forward Preliminary Health Assessment	G. D. Cullison NAS Brunswick	CO NorthDiv	Letter Enclosure Enclosure	1 5 2	RI/FS HA	see 10 Apr HA

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
22-Jul-87	Federal Register Listing					RI/FS Fed Reg	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
24-Feb-88	RI/FS Study Schedule	Press Herald Portland, Maine		News Article	3	RI/FS Schedule	
24-Feb-88	RI/FS Study Schedule	Brunswick Times Record Brunswick, Maine		News Article	6	RI/FS Schedule	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
20-Jan-88	RI/FS Schedule	K. J. Vasilik NorthDiv	D. Webster EPA Reg I	Letter	1	RI/FS Schedule	
24-Feb-88	RI/FS Study Schedule	Press Herald Portland, ME		Public Notice		RI/FS Schedule	
24-Feb-88	RI/FS Study Schedule	Brunswick Times Record Brunswick, ME		Public Notice		RI/FS Schedule	
19-Oct-89	RI/FS Schedule Time Extension	T. Sheckles NorthDiv	M. F. Cruise EPA Reg I	Letter	2	RI/FS Schedule	
28-Dec-89	Lack of mechanism to address schedule change	G. Cullison NASB	M. Cassidy EPA Reg I	Letter	2	RI/FS Schedule	
1-Feb-90	RI/FS Schedule	R. L. Gillespie NorthDiv	W. Adams EC Jordan	Letter	1	RI/FS Schedule	
12-Mar-90	Proposed revised RI/FS Schedule	M. F. Cassidy EPA Reg I	Ken Marriott NorthDiv	Letter Att.	2 5	RI/FS Schedule	
12-Mar-90	Approval of schedule change	M. F. Cassidy EPA Reg I	Ken Marriott NorthDiv	Letter	2	RI/FS Schedule	
27-Mar-90 Ser 574	Review of EPA proposed revised schedule	R. J. Figueras NAS Brunswick	CO NorthDiv	Letter Enclosure	1 2	RI/FS Schedule	
18-May-90	Request review time extension	K. Marriott NorthDiv	M. F. Cassidy EPA Reg I	Letter	2	RI/FS Schedule	
31-May-90	Request extension to RI/FS schedule	K. Marriott NorthDiv	M. Cassidy EPA Reg I	Letter Enclosure	2 1	RI/FS Schedule	
21-Jun-90	Notice to Proceed on FS	M. F. Cassidy EPA Reg I	J. Shafer NorthDiv	Letter	1	RI/FS Schedule	
25-Jun-90	Request review time extension	K. Marriott NorthDiv	M. F. Cassidy EPA Reg I	Letter	1	RI/FS Schedule	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
29-Nov-87	Invitation for TRC Meeting	T. Sheckels NorthDiv	C. Head EPA Reg I	Letter	1	RI/FS TRC	Sample letter
03-Dec-87	Minutes of TRC Meeting	R. Springfield NorthDiv	File	Memo	3	RI/FS TRC	
31-Dec-87	Invitation for TRC Meeting	T. Sheckels NorthDiv	C. Head EPA Reg I	Letter	1	RI/FS TRC	Sample letter
11-Jan-88	Minutes of TRC Meeting	J. Hoar EPA Contractor	C. Head EPA Reg I	Memo	9	RI/FS TRC	
03-Feb-88	Correction to Minutes of 11 Jan Meeting	G. Cullison PWO NASB	File	Memo	1	RI/FS TRC	
10-Feb-88	Minutes of TRC Meeting	J. Hoar EPA Contractor	C. Head EPA Reg I	Memo	11	RI/FS TRC	
29-Apr-88	Invitation for TRC Meeting	T. Sheckels NorthDiv	C. Head EPA Reg I	Letter	1	RI/FS TRC	Sample letter
17-May-88	Minutes of TRC Meeting	R. Springfield NorthDiv	File	Memo	3	RI/FS TRC	
27-Jun-88	Invitation for TRC Meeting	T. Sheckels NorthDiv	C. Head EPA Reg I	Letter	1	RI/FS TRC	Sample letter
[illegible]-Jul-88	Minutes of TRC Meeting	R. Springfield NorthDiv	File	Memo	7	RI/FS TRC	
08-Nov-88	Invitation for TRC Meeting	T. Sheckels NorthDiv	Distribution	Letter	1	RI/FS TRC	
22-Nov-88	Minutes of TRC Meeting	R. Springfield NorthDiv	File	Memo	2	RI/FS TRC	
18-Jan-89	Change of Representative	D. Boulter Maine DEP	T. Shackels NorthDiv	Letter	1	RI/FS TRC	
24-Jan-89	Invitation for TRC Meeting	T. Sheckels NorthDiv	Distribution	Letter	1	RI/FS TRC	
Feb-89	Minutes of TRC Meeting	R. Springfield NorthDiv	File	Memo Hand-out	6 22	RI/FS TRC	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
18-Jan-89	TRC Membership	D. Boulter Maine DEP	T. Sheckels NorthDiv	Letter	1	RI/FS Schedule	New DEP member on
24-Jan-89	Invitation for 22 Feb 89 Mtg	T. Sheckels NorthDiv	Distribution	Memo	1	RI/FS TRC	
updated 1989	Minutes of 22 Feb 89 TRC Mtg	J. Hoar EPA Contr	C. Head EPA Reg I	Memo	6 22	RI/FS TRC	
6-Mar-89	Invitation for 28 Mar 89 Mtg	T. Sheckels NorthDiv	Distribution	Memo	1	RI/FS TRC	
10-Apr-89	Minutes of 28 Mar 89 TRC meeting	T. Sheckels NorthDiv	File	Memo Handout	5 28	RI/FS TRC	
18-Apr-89	Request for information about TRC	L. Clark Sen Cohen's Office	E.B. Darsey NAS Brunswick	Letter	1	RI/FS TRC	
28-Apr-89	Information on TRC	E.B. Darsey NAS Brunswick	Sen Cohen	Letter	1	RI/FS TRC	
12-Jun-89	Invitation for 20 Jun 89 TRC Mtg	T. Sheckels	Distribution NorthDiv	Letter	1	RI/FS TRC	
27-Jun-89	Notes from 20 Jun 89 TRC Meeting	J. Hoar CDM Contractor to EPA	M. Cruise EPA Reg I	Memo	6	RI/FS TRC	
undated 1989	Minutes of 20 Jun 89 TRC meeting	unsigned NorthDiv	File	Memo	5	RI/FS TRC	
21-Jul-89	Invitation for 10 Aug TRC Mtg	T. Sheckels NorthDiv	Distribution	Letter	1	RI/FS TRC	
undated 1989	Minutes of 10 Aug 89 TRC meeting	unsigned NorthDiv	File	Memo Handout	4 16	RI/FS TRC	
8-Feb-90	Notification of Navy PM change	C. J. Mayer NorthDiv	EPA Reg I	Letter	1	RI/FS TRC	
22-Jan-90	Invitation to 13 Feb 90 TRC meeting	T. Sheckles NorthDiv	Distribution (all TRC members)	Letter	1	RI/FS TRC	
13-Feb-90	Minutes of 13 Feb TRC Meeting	K. Marriott	Distribution	Letter		RI/FS TRC	
24-May-90	Minutes of 22 May TRC Meeting	K. Marriott	Distribution	Letter		RI/FS TRC	
13-Sep-90	Minutes of 13 Sept. TRC Meeting	J. Shafer	Distribution	Letter		RI/FS TRC	
10-Jan-90	Minutes of 10 Jan TRC Meeting	J. Shafer	Distribution	Letter		RI/FS TRC	
11-Apr-91	Minutes of 11 Apr TRC Meeting	NorthDiv unsigned	Distribution	Letter		RI/FS TRC	
11-Jul-91	Minutes of 11 Jul TRC Meeting	NorthDiv unsigned	Distribution	Letter		RI/FS TRC	
3-Oct-91	Minutes of 3 Oct TRC Meeting	NorthDiv unsigned	Distribution	Letter		RI/FS TRC	
20-Feb-92	Minutes of 20 Feb TRC Meeting	ABB	Distribution	Letter		RI/FS TRC	
20-May-92	Minutes of 20 May TRC Meeting	ABB	Distribution	Letter		RI/FS TRC	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
8-Feb-88	Quality Assurance Program Plan	EC Jordan Co.		Plan		RI/FS Work Plan	
15-Mar-88	Review Comments on Work Plan	D.Webster EPA Reg I	Capt. Darsey NASB	Letter Enclosure	2 7	RI/FS Work Plan	
20-Apr-88	Transmittal of Work Plan	EC Jordan Co.		Work Plan		RI/FS Work Plan	
April 88	RI/FS Work Plan	EC Jordan Co.		Plan		RI/FS Work Plan	
17-Jun-88	Review Comments on Work Plan	D. Webster EPA Reg I	Capt Darsey NASB	Letter Enclosure	1 3	RI/FS Work Plan	
26-Oct-88	Transmittal of Revisions to RI/FS Work Plan	T. Sheckles NorthDiv	C. Head EPA Reg I	Letter Enclosure	1 40	RI/FS Work Plan	
Oct 88	Addendum to RI/FS Work Plan	EC Jordan Co.		Report		RI/FS Work Plan	
Aug 89	Additional Sampling Plan	EC Jordan Co.		Plan			

:AR4

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DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
Jan 89	Round 1 Sampling Data	EC Jordan		Report	398	RI/FS SampData	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
14-Apr-89	Comments on Additional Sampling Plan	K. Finklestein NOAA	C. Head EPA Reg I	Letter	1	RI/FS Work Plan	Provided as att. Letter 9 Jun 89
22-May-89	Comments on Additional Sampling Plan	D. Messier Maine DEP	R. Springfield NorthDiv	Letter	3	RI/FS Work Plan	
9-Jun-89	Approval of Additional Sampling Plan (ASP)	Dave Webster EPA Reg I	T. Sheckles NorthDiv	Letter Att(3)	1 5,2,1	RI/FS Work Plan	Also fwds NOA Letter 14 Apr 89
15-Jun-89	Approval of Draft ASP	D. Messier Maine DEP	R. Springfield NorthDiv	Letter	1	RI/FS Work Plan	
9-Aug-89	Submission of Final Version of ASP	M. Dickenson EC Jordan	R. Springfield NorthDiv	Letter	4	RI/FS Work Plan	
22-Aug-89	Clarification of EPA Position Regarding Navy Changes to ASP	M. Cruise EPA Reg I	R. Springfield NorthDiv	Letter	1	RI/FS Work Plan	
22-Aug-89	More Comments on ASP	D. Messier Maine DEP	R. Springfield NorthDiv	Letter	2	RI/FS Work Plan	
28-Aug-89	Comments on ASP	K. Finklestein NOAA	M. Cruise EPA Reg I	Letter	1	RI/FS Work Plan	
20-Sep-89	Summer 89 Field Work at NASB	NAS Brunswick	NorthDiv	Msg	1	RI/FS Work Plan	
[illegible]ep-89	Comments on ASP	D. Webster EPA Reg I	R. Springfield NorthDiv	Letter Enclosure	2 12	RI/FS Work Plan	Includes NOAA Letter 28 Aug 89

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
4-Oct-89	Comments on Round III Data Package	D. Webster EPA Reg I	R. Springfield NorthDiv	Letter	2	RI/FS Work Plan	Includes NOAA Comments
28-Dec-89	Comments on Additional Sampling Plan	D. Messier Maine DEP	R. Springfield NorthDiv	Letter	2	RI/FS Work Plan	
29-Mar-90	Submission of Draft Post Screening Work Plan and Draft RI Report	K. Marriott NorthDiv	M. Cassidy EPA Reg I	Letter	1	RI/FS Work Plan	
1-May-90	Comments on Draft Post Screening Work Plan	T. Wolfe Maine DEP	K. Marriott NorthDiv	Letter	3	RI/FS Work Plan	
17-May-90	Comments on Draft Post Screening Work Plan	D. Webster EPA Reg I	K. Marriott NorthDiv	Letter Enclosure Enclosure Enclosure Enclosure Enclosure Enclosure	3 2 32 9 7 6 7	RI/FS Work Plan	 NOA 1May90 USF&WS 8May90
23-May-90	Comments on Draft Post Screening Work Plan	S. Weddle TRC Member	K. Marriott NorthDiv	Letter	4	RI/FS Work Plan	
20-Jul-90	Transmittal of Post Screening Work Plan	M. Dickenson EC Jordan	J. Shafer NorthDiv	Letter Plan	1	RI/FS Work Plan	
Jul 90	Post Screening Work Plan			Plan		RI/FS Work Plan	
27-Jul-90	Comments on Post Screening Work Plan	Ted Wolfe Maine DEP	J. Shafer NorthDiv	Letter	2	RI/FS	
30-Aug-90	Comments on Post Screening Work Plan	D. Webster EPA Reg I	J. Shafer NorthDiv	Letter	9	RI/FS	
Nov 90	Addendum Post Screening Work Plan	EC Jordan	J. Shafer NorthDiv	Plan		RI/FS Work Plan	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
10-Mar-89	Round II Sampling Data	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter Enclosure	2 125	RI/FS Sampling Data	
13-Jul-89	Submission of Round III Data	M. Dickenson EC Jordan	R. Springfield NorthDiv	Letter Enclosure	1	RI/FS Sampling Data	Don't Have
Jul 89	Round III Sampling Data	EC Jordan		Data Package	72	RI/FS Sampling Data	
31-Aug-89	Comments on Round III Data Package	John Walker EPA Contractor	CDM Jack Jojokian EPA HQ	Letter Att	1 8	RI/FS Sampling Data	
28-Jul-89	Comments on Round III Data Package	K. Finkelstein NOAA	M. Cruise EPA Reg I	Letter	2	RI/FS Sampling Data	See Encl to 4Oct89 EPA Letter
4-Oct-89	Comments on Round III Data Package	D. Webster EPA Reg I	R. Springfield NorthDiv	Letter Enclosure Enclosure	2 9 2	RI/FS Sampling Data	NOAA Lt. 28 July 89

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
13-Jan-89	Transmission Round I Data	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter	4	RI/FS Sampling Data	
13-Mar-89	Comments on Round I Data	D. Webster EPA	T. Sheckles NorthDiv	Letter	2	RI/FS Sampling Data	
13-Mar-89	NOAA Comments Rounds I, II	K. Finkelstein NOAA	C. Head EPA	Letter	2	RI/FS Sampling Data	
27-Dec-89	Results of DEP Residential Sampling	Ted Wolfe Maine DEP	CDR Cullison NAS Brunswick	Letter Enclosure	1 2	RI/FS Sampling Data	
5-Jan-90	Submission of Round IV Sampling Data	M. Dickenson EC Jordan	R. Springfield NorthDiv	Letter Enclosure	1	RI/FS Sampling Data	
Jan 90	Round IV Data Package			Data Package		RI/FS Sampling Data	
11-Jan-90	Forwarding of Round IV Data Package	G.D. Cullison NAS Brunswick	Ms. Weddle Comnty TRC Mem	Letter	1	RI/FS Sampling Data	
11-Jan-90	Forwarding of Round IV Data Package	G.D. Cullison NAS Brunswick	D. Gerrish Bruns. Town Mgr.	Letter	1	RI/FS Sampling Data	
5-Mar-90	EPA Comments on Round IV Data Package	D. Webster EPA Reg I	K. Marroit NorthDiv	Letter Enclosure	2 20	RI/FS Sampling Data	
Mar 91	Round V Data Package			Data Package		RI/FS Sampling Data	

Date	Title	Author	Addressee	Doc Type	Pgs	File	Remarks
20-Jan-87	Commencement of RI/FS	K. Vasilik CO NorthDiv	D. Webster EPA Reg I	Letter	1	RI/FS Correspond	
21-Mar-87	Navy Response to EPA Comments	T. Sheckels NorthDiv	M. Hoagland EPA Reg I	Letter Enclosure	1 7	RI/FS Correspond	
08-May-87	Response to Navy's Comments on Work Plan	S. Christophers NOAA	C. Head EPA Reg I	Letter	2	RI/FS Correspond	
17-Jun-87	Minutes of Meeting to Discuss Work Plan	R. Kowalczyk NorthDiv	File	Trip Report	3	RI/FS Correspond	
29-Jun-87	Request Characterization Work Plan Meeting	C. Head EPA Reg I	R. Kowalczyk NorthDiv	Letter	2	RI/FS Correspond	
30-Jun-87	Meeting Summary (11 June 1987)	R. Wardwell EC Jordan	R. Kowalczyk NorthDiv	Memo	5	RI/FS Correspond	
08-Jul-87	Forward Meeting Minutes (11 June 1987)	J. Hoar EPA Contractor	R. Kowalczyk NorthDiv	Memo	7	RI/FS Correspond	
29-Jul-87	Request to Finalize Added Field Work	T. Sheckels NorthDiv	R. Wardwell EC Jordan	Letter Enclosure	1 2	RI/FS Correspond	
05-Aug-87	Finalize Added Field Work	R. Wardwell EC Jordan	T. Sheckels NorthDiv	Letter	1	RI/FS Correspond	
22-Oct-87	RI/FS Study for NASB	R. Gillespie NorthDiv	C. Head EPA Reg I	Letter	4	RI/FS Correspond	
[illegible]-Nov-87	NOAA's Concerns for RI/FS	K. Finkelstein NOAA	C. Head EPA Reg I	Letter	1	RI/FS Correspond	
20-Nov-87	Concerns Over RI/FS Work	D. Webster EPA Reg I	R. Gillespie NorthDiv	Letter	3	RI/FS Correspond	
17-Dec-87	Commence RI/FS; Work Plan	D. Webster EPA Reg I	T. Shackels NorthDiv	Letter	3	RI/FS Correspond	

Date	Title	Author	Addressee	Doc Type	Pgs	File	Remarks
17-Feb-88	RI/FS Program at NASB	E. Darsey CO NASB	M. Hohman EPA Reg I	Letter	4	RI/FS Correspond	
15-Mar-88	Notice to Proceed with RI/FS	M. Hohman EPA Reg I	E. Darsey CO NASB	Letter Enclosure	1	RI/FS Correspond	
07-Apr-88	DEP Comments on RI/FS Work Plan	C. Kuhns Maine DEP	R. Springfield NorthDiv	Letter	4	RI/FS Correspond	
18-Apr-88	Submission of RI/FS Work Plan	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter	2	RI/FS Correspond	
25-Apr-88	Additional Sites for Study	D. Webster EPA Reg I	G. Cullison PWO NASB	Letter	1	RI/FS Correspond	
25-Apr-88	Extent of QA/QC Data Validation	C. Head EPA Reg I	R. Springfield NorthDiv	Letter	1	RI/FS Correspond	
29-Apr-88	Additional Sites for Study	E. Darsey CO NASB	D. Webster EPA Reg I	Letter	1	RI/FS Correspond	
10-May-88	Comments on RI/FS Work Plan	G. Beckett F&WS	C. Head EPA Reg I	Letter	2	RI/FS Correspond	
13-May-88	NOAA Concerns on RI/FS Work Plan	K. Finkelstein NOAA	C. Head EPA Reg I	Letter	1	RI/FS Correspond	
02-Jun-88	Notice of Contract Award for Field Work	R. Springfield NorthDiv	C. Head EPA Reg I	Phonecon	1	RI/FS Correspond	
06-Jun-88	Comments on RI/FS Work Plan	C. Kuhns Maine DEP	E. Darsey CO NASB	Letter	3	RI/FS Correspond	
10-Jun-88	Confirmation of Award for Field Work	C. Mayer NorthDiv	C. Head EPA Reg I	Letter	1	RI/FS Correspond	
17-Jun-88	Conditional Approval Letter	D. Webster EPA Reg I	T. Sheckels NorthDiv	Letter Enclosure	1 6	RI/FS Correspond	
27-Jun-88	Notice of Commencement of Field Work	T. Sheckels NorthDiv	C. Head EPA Reg I	Letter	1	RI/FS Correspond	
19-Jul-88	Submit Addendum to RI/FS Work Plan	A. Ginder EC Jordan	R. Springfield NorthDiv	Letter Enclosure	1	RI/FS Correspond	Enclosure in RI/FS Work Plan Section
12-Aug-88	Use of Analytical Method	M. Aucoin NorthDiv	C. Porfort EPA Reg I	Phonecon	2	RI/FS Correspond	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
22-Aug-88	Laboratory Approval	A. Sturtzer NEESA	CO NorthDiv	Letter	1	RI/FS Correspond	
15-Sep-88	Data to be Used for Risk Assessment	D. Webster EPA Reg I	R. Springfield NorthDiv	Letter	1	RI/FS Correspond	
26-Oct-88	Changes to Work Plan During Field Work	T. Sheckels NorthDiv	C. Head EPA Reg I	Letter Enclosure	1	RI/FS Correspond	
13-Jan-89	Submission of Round I Data Package	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter Enclosure	4	RI/FS Correspond	Encl is in separate section
24-Feb-89	Submission of Alternatives Development	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter Enclosure	1	RI/FS Correspond	Encl is in separate section
24-Feb-89	Submission of Risk Assessment	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter Enclosure	1	RI/FS Correspond	Encl is in separate section
10-Mar-89	Submission of Round II Data Package	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter Enclosure	1	RI/FS Correspond	Encl is in separate section
13-Mar-89	Comments on Round I Data Package	D. Webster EPA Reg I	T. Sheckels NorthDiv	Letter	2	RI/FS Correspond	
13-Mar-89 Ser 574	Comments on Rounds I and II Data Packages	K. Finkelstein NOAA	C. Head EPA Reg I	Letter	2	RI/FS Correspond	
18-Dec-89	Workers in Site I	D. Webster EPA Reg I	G. Cullison NASB	Letter	2	RI/FS Correspond	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
20-Dec-89	Report of inadvertent excavation at Site 1	CDR Cullison NASB	M. Cassidy EPA Reg I	Letter	2	RI/FS Correspond	
18-Dec-89	Comments on inadvertent excavation at Site 1	D. Webster EPA Reg I	CDR Cullison NASB	Letter	2	RI/FS Correspond	
6-Mar-90	FOIA request	J. Katz BACSE	K. Marriott NorthDiv	Letter	2	RI/FS Correspond	
6-Mar-90	Request for Maine ARARs	T. Sheckles NorthDiv	A. Prysunka Maine DEP	Letter	1	RI/FS Correspond	
6-Apr-90	Response to FOIA request	T. Purul NorthDiv	J. Katz BACSE	Letter	1	RI/FS Correspond	
9-Apr-90	Delivery of Maine ARARs	A. Prysunka Maine DEP	T. Sheckles NorthDiv	Letter	9	RI/FS Correspond	
17-Apr-90	Quarterly Progress Report	K. Marriott NorthDiv	M. Cassidy EPA Reg I	Letter Enclosure	1 2	RI/FS Correspond	
23-Apr-90	Off site influences at NASB	CDR Cullison NASB	NPL File	Memo	1	RI/FS Correspond	
1-May-90	Comments on Draft RI Rpt	G. Beckett DOI USF&WS	M. Cassidy EPA Reg I	Letter	3 4	RI/FS RI	See EPA ltr of 17 May 90
8-May-90	Comments on Draft RI Rpt	K. Finkelstein NOAA	M. Cassidy EPA Reg I	Letter	5	RI/FS RI	see EPA ltr of 17 May 90
15-May-90	Comments on Draft RI Rpt	S. Weddle TRC mbr	K. Marriott NorthDiv	Letter	6	RI/FS RI	
17-May-90	Comments on Draft RI Rpt	T. Wolfe Maine DEP	K. Marriott NorthDiv	Letter	14	RI/FS RI	
17-May-90	Comments on Draft RI Report and PSWP	D. Webster EPA Reg I	K. Marriott NorthDiv	Letter Enclosure Enclosure Enclosure Enclosure Enclosure Enclosure	3 2 32 9 7 6 7	RI/FS RI	 NOAA 1 May 90 USF&WS 8 May 90

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
27-Sep-91	Revised Appendix B, ARAR's, Response Sites 1, 3, 8 Comments	ABB	NorthDiv	Trans	30	RI/FS	
14-Aug-91	Invoking Dispute Resolution on Draft Final FFS 1 & 3	MEDEP	NorthDiv	Letter		RI/FS	
Sep 91	Memo of Agreement	NorthDiv	EPA DEP	Memo	2	RI/FS	
Jul 91	Response to Comments FFS Sites 1, 3	ABB	EPA DEP	Letter	15	RI/FS	
14-Aug-91	EPA Comments on Draft Final Sites 1, 3	EPA	NorthDiv	Letter	11	RI/FS	
15-Aug-91	DEP Comments on Draft FFS Sites 1, 3	DEP	NorthDiv	Letter	8	RI/FS	
23-Sep-91	DEP Comments on Draft Proposed Plan Sites 1,3	DEP	NorthDiv	Letter	6	RI/FS	
26-Sep-91	EPA Comments on Draft Proposed Plan Sites 1,3	EPA	NorthDiv	Letter	10	Proposed Plan	
Mar 92	Draft ROD Sites 1 and 3	EC Jordan	NorthDiv	Report		ROD	
[illegible]pr-92	DEP Comments on Draft RODs 1&3 and EP	DEP	J. Shafer	Letter	3	ROD	
6-Apr-92	EPA Comments on Draft ROD 1&3	EPA	J. Shafer	Letter	26	ROD	
23-Apr-92	EPA Letter on Mere Brook	EPA	NASB	Letter			

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
February 1989	Preliminary Risk Assessment	EC Jordan		Report		RI/FS Risk Assess	
24-Feb-89	Trans of Prelim Risk Assessment	D. Gulick EC Jordan	R. Springfield NorthDiv	Letter	1	RI/FS Risk Assess	
5-May-89	Comments on Feasibility Study, Preliminary Development of Alternatives and Preliminary Risk Assessment	D. Webster Maine DEP	T. Sheckles NorthDiv	Letter	7	RI/FS Alts dev Risk Assess	
8-Feb-90	Comments on Preliminary Risk Assessment	D. Messier Maine DEP	K. Marriott NorthDiv	Letter	7	RI/FS Risk Assess	
17-May-90	Comments on Draft RI Risk Assessment	T. Wolfe Maine DEP	K. Marriott NorthDiv	Letter	14	RI/FS Risk Assess	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
VOLUME 7							
Aug 90	Draft Final RI, Volume I	EC Jordan	NorthDiv			RI/FS Report	
VOLUME 7A							
Aug 90	Draft Final RI, Volume 2	EC Jordan	NorthDiv			RI/FS Report	
VOLUME 7B							
Aug 90	Draft Final RI, Volume 3	EC Jordan	NorthDiv			RI/FS Report	
VOLUME 7C							
Aug 90	Draft Final RI, Volume 4	EC Jordan	NorthDiv			RI/FS Report	
VOLUME 7D							
Apr 91	Comments on Draft Final Remedial Investigation	EC Jordan	NorthDiv			RI/FS Report	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
VOLUME 8							
24-Feb-89	Preliminary Development of Alternatives	EC Jordan	NorthDiv	Report		RI/FS Report	
Aug 90	Draft Final Phase One Feasibility Study	EC Jordan	NorthDiv	Report		RI/FS Report	
VOLUME 8A						RI/FS Report	
Apr 91	Draft Focused Feasibility Study Sites 1,3	EC Jordan	NorthDiv	Report		RI/FS Report	
July 91	Draft Final Focused FFS 1,3	EC Jordan	NorthDiv	Report		RI/FS Report	
Oct 91	Final FFS Sites 1,3	EC Jordan	NorthDiv	Report		RI/FS Report	

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DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
Oct 91	Numeric Modeling Work Plan	EC Jordan	NorthDiv			Work Plan	
Dec 91	Proposed Plan Sites 1,3	EC Jordan	NorthDiv			Report	
Dec 91	Fact Sheet for Proposed Plans Sites 1,3 and Eastern Plume	EC Jordan	NorthDiv			Fact Sheet	
Dec 91	Public Hearing Newspaper Notification	EC Jordan	NorthDiv			Notice	
Dec 91	Public Hearing Transcript	EC Jordan	NorthDiv			Transcript	
Jan 92	Public Comment Letters		NorthDiv			Letters	

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
Sep 89	Federal Facilities Agreement - 2 party	NAVY/EPA		DOC			
Oct 90	Federal Facilities Agreement	NAVY/EPA/MEDEP		DOC			

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
Sep 88	Community Relations Plan	NASB	NASB	Report			

SECTION II

GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at EPA Region I, Boston, Massachusetts.

General and Site-Specific EPA Guidance Documents

1. "National Oil and Hazardous Substances Pollution Contingency Plan," Code of Federal Regulations (Title 40, Part 300), 1985.

2. U.S. Environmental Protection Agency. Superfund Public Health Evaluation Manual (OSWER 9285.4-1), October 1986.

3. U.S. Environmental Protection Agency. Comprehensive Environmental Response Compensation and Liability Act of 1980, as Amended October 17, 1986.

4. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (Interim Final) (EPA/540/G-89/004, OSWER Directive 9355.3-1), October 1988.

5. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites (EPA/540/G-88/003), December 1988.

6. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Interim Final Guidance on Preparing Superfund Decision Documents (OSWER Directive 9355.3-02), July 1989.

7. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Ground Water Issue - Performance Evaluation of Pump-and-Treat Remediations (EPA/540/4-89/005), October 1989.

8. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A - Interim Final) (EPA/540/1-89/002), December 1989.

9. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Technology Evaluation Report: SITE Program Demonstration of the Ultrox International Ultraviolet Radiation/Oxidation Technology (EPA/540/5-89/012), January 1990.

10. "National Oil and Hazardous Substances Pollution Contingency Plan," Federal Register (Vol. 55, No. 46), March 8, 1990.

11. U.S. Environmental Protection Agency. Office of Communications and Public Affairs. Glossary of Environmental Terms and Acronyms List. (EPA 19K-1002), December 1989.

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

13. U.S. Environmental Protection Agency. Office of Water. "Drinking Water Regulations and Health Advisories"; November 1991.

14. U.S. Environmental Protection Agency. Office of Research and Development. "Design and Construction of RCRA/CERCLA Final Covers". EPA/625/4-91/025. May 1991.

RECORD OF DECISION
FOR AN
INTERIM REMEDIAL ACTION
AT THE
EASTERN PLUME GROUNDWATER
OPERABLE UNIT
NAVAL AIR STATION BRUNSWICK, MAINE

June 1992

NAVAL AIR STATION BRUNSWICK
INTERIM RECORD OF DECISION

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INTERIM RECORD OF DECISION

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INTERIM RECORD OF DECISION

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DECLARATION

SITE NAME AND LOCATION

Naval Air Station (NAS) Brunswick, Eastern Plume
Brunswick, Maine

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for the hydraulic containment of contaminated groundwater referred to as the Eastern Plume at NAS Brunswick in Brunswick, Maine. This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act and, to the extent practicable, the National Contingency Plan. Through this document, the Navy plans to remedy, on a interim basis, by hydraulic containment, recovery, and treatment, the threat to human health and the environment posed by contaminated groundwater. This decision is based on the Administrative Record for the site. The Administrative Record for the site is located at the Public Works Office at NAS Brunswick.

The State of Maine Department of Environmental Protection (MEDEP) and the U.S. Environmental Protection Agency (USEPA) concur with the selected interim remedial action.

A final remedy for the site including both groundwater and source operable units is being developed through the Remedial Investigation/Feasibility Study process and a subsequent Record of Decision (ROD) will be issued to address the final site remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Eastern Plume, if not addressed by implementing the interim response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The interim remedial action will contain the Eastern Plume, preventing further migration of the plume and discharge of the plume to the Harpswell Cove estuary.

The interim remedial action consists of groundwater extraction, treatment, and discharge of treated groundwater. Wells will be positioned to hydraulically contain the Eastern Plume. Extracted groundwater will be combined with extracted groundwater from Sites 1 and 3 and treated together. Remediation of Sites 1 and 3 is addressed in a separate ROD. Iron and manganese will be removed from the extracted groundwater by precipitation and filtration processes to reduce their interference with treatment of the volatile organic compounds (VOCs). The VOCs will be removed from the water using the ultraviolet/oxidation treatment technology. The proposed discharge method is to the Brunswick publicly owned treatment works (POTW), however, another option may be used if approval for discharge to the POTW cannot be obtained. Ultimate discharge is to the Androscoggin River via a National Pollutant Discharge Elimination System Permit. Before designing the treatment system, treatability tests will be conducted to provide information on the compounds and concentrations likely to be present in the effluent.

Before startup of the extraction well network, the Navy will submit a monitoring program for approval by the MEDEP and the USEPA, to confirm that the containment system is effective.

The interim remedial action will address the principal threat of discharge of contaminated water to Harpswell Cove by containing the Eastern Plume before it reaches Harpswell Cove. The potential threat to human health is not an immediate threat because water from the contaminated plume is not currently used as a drinking water supply. The final site remedy to address both the source and groundwater operable units along with future threats to human health and the environment will be addressed in a subsequent ROD. This interim remedial action is expected to be consistent with the final remedy.

STATUTORY DETERMINATIONS

The selected interim remedial action is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements for this limited scope, and is cost-effective. Because this action does not constitute the final remedy for the Eastern Plume, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed in the final response action. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. Because this remedy may result in hazardous substances remaining in on-site groundwater above health-based cleanup levels, a review will be conducted by the Navy, the USEPA, and the MEDEP within five years after startup of the groundwater containment to ensure that the interim remedy continues to provide adequate protection of human health

and the environment. This review will be conducted at least every five years as long as hazardous substances remain in on-site groundwater above health-based cleanup levels or until the ROD for the final site remedy is signed and supersedes this ROD.

The foregoing represents the selection of an interim remedial action by the Department of the Navy and the U.S. Environmental Protection Agency, Region I, with concurrence of the Maine Department of Environmental Protection.

Concur and Recommend for immediate implementation:

By: _____ Date: 12 June 92

Thomas A. Dames

Title: Captain, CEC, U.S. Navy
Commanding Officer
Northern Division
Naval Facilities Engineering Command

By: _____ Date: 10 June 1992

H.M. Wilson

Title: Captain, U.S. Navy
Commanding Officer
Naval Air Station
Brunswick, Maine

The foregoing represents the selection of an interim remedial action by the Department of the Navy and the U.S. Environmental Protection Agency, Region I, with concurrence of the Maine Department of Environmental Protection.

By: Julie Belaga Date: June 16, 1992

Julie Belaga

Title: Regional Administrator, USEPA

DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

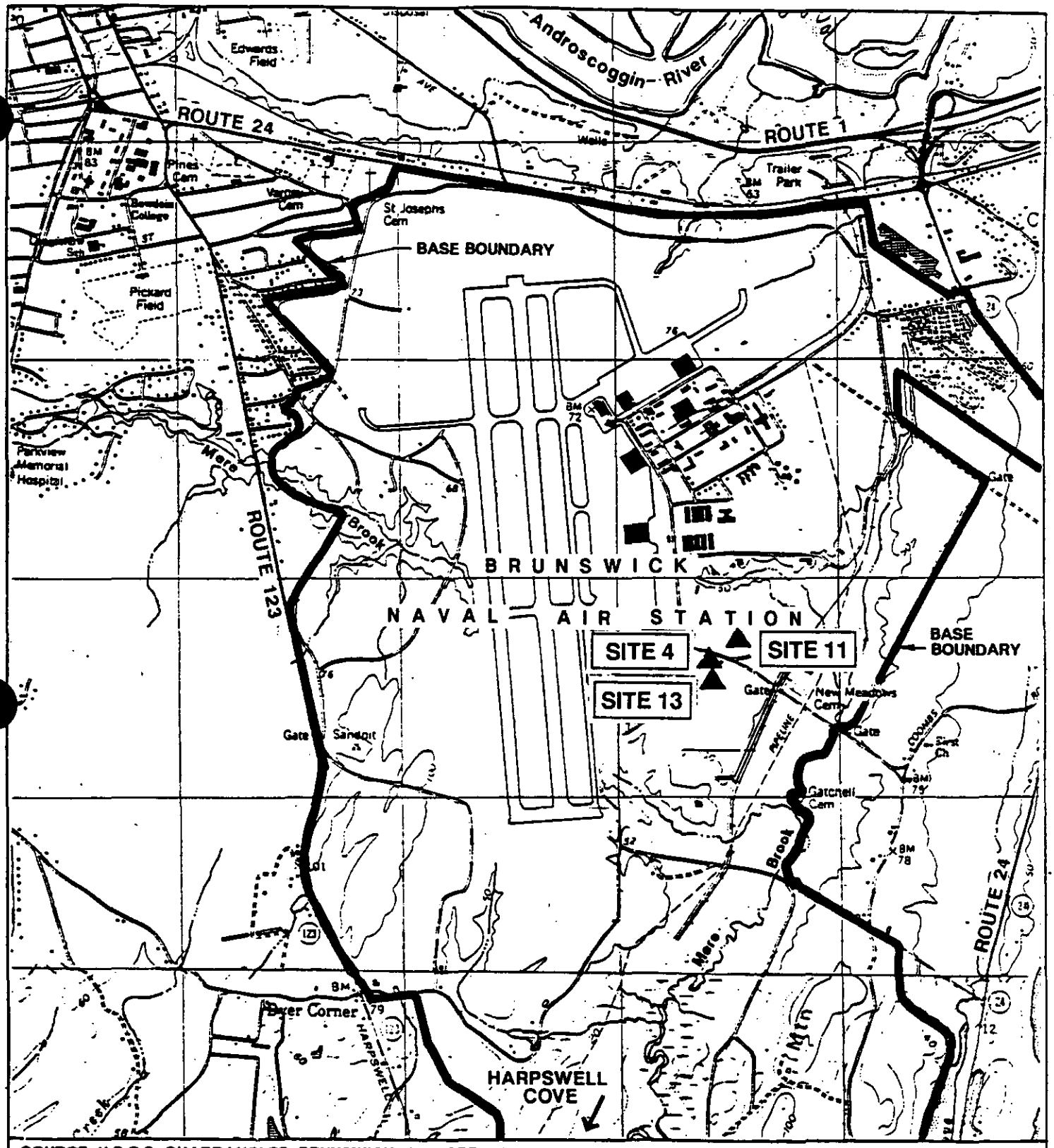
The U.S. Naval Air Station (NAS) Brunswick is a National Priorities List (NPL) site. There are currently 13 areas (Sites) within NAS Brunswick that are under investigation. This interim Record of Decision (ROD) relates to the groundwater plume, known as the Eastern Plume, which is the result of past or current contamination at Sites 4, 11, and 13.

NAS Brunswick is located south of the Androscoggin River between Brunswick and Bath, Maine, south of Route 1 and between Routes 24 and 123 (Figure 1). Undisturbed topography at the base is characterized by low, undulating hills with deeply incised brooks; ground surface elevations range from mean sea level (MSL) in lowland drainage areas and the Harpswell Cove estuary, to over 110 feet above MSL west and southeast of the southern end of the runways. Topography in the base's developed areas has been modified by construction, and ground surface elevations generally range from 50 to 75 feet above MSL.

NAS Brunswick is an active facility supporting the U.S. Navy's antisubmarine warfare operations in the Atlantic Ocean and Mediterranean Sea. The primary mission of the base is to operate and maintain P-3 Orion aircraft. NAS Brunswick first became active in the 1940s during World War II, and underwent major expansion in the 1950s.

NAS Brunswick is located on 3,094 acres. The operations area (138 acres), east of the two parallel runways, consists of numerous office buildings, a steam plant, fuel farm, barracks, recreational facilities, base housing, hangars, repair shops, and other facilities to support NAS Brunswick aircraft. Forested areas (approximately 48 percent), grasslands (approximately 28 percent), and paved areas (approximately 12 percent) comprise most of the base property. Paved areas are mostly flight ramps and runways. The remaining 12 percent of the base includes the operations area (approximately 5 percent) and miscellaneous shrubland, marsh, and open water. The southern edge of the base borders coves and estuaries of Harpswell Cove.

Property usage surrounding NAS Brunswick is primarily suburban and rural residential, with some commercial and light industrial uses along Routes 1, 24, and 123. An elementary school, college, and a hospital are located within 1 mile of the western base boundary.



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

QUADRANGLE LOCATION

SCALE IN FEET

0 2,000 4,000

FIGURE 1
SITE LOCATION MAP

6836-05

The Eastern Plume, the groundwater operable unit being addressed in this interim ROD, is the result of contamination at Sites 4, 11, and 13. Groundwater in the area of the plume is not currently used for drinking water or other purposes; therefore, there are no human receptors. The plume is predicted to discharge to Harpswell Cove in five years, potentially affecting many ecological receptors. The contamination of groundwater in the Eastern Plume has not affected the current use of natural resources. Use of groundwater and surface water in this area is very limited; however, the presence of contaminated groundwater does prevent the use of this natural resource in the future.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. LAND USE AND RESPONSE HISTORY

Extensive hydrogeological and analytical data collected during the 1990 field program delineated a plume of volatile organic compound (VOC)-contaminated groundwater extending north to south along the eastern boundary of NAS Brunswick. This VOC plume, the result of contamination at Sites 4 (the Acid/Caustic Pit), 11 (the former Fire Training Area), and 13 (the Defense Reutilization and Marketing Office [DRMO] Area), is known as the Eastern Plume (Figure 2). Groundwater in this plume flows south toward Harpswell Cove. The contaminated groundwater is not flowing toward residential areas east of the base, and it is currently not discharging to or impacting any surface water bodies. The southern limit of the plume is believed to be in the vicinity of New Gurnet Road. The predicted discharge zone for the Eastern Plume, the tidal area where Mere Brook flows into Harpswell Cove, is approximately 750 feet away from the southern extent of the Eastern Plume (E.C. Jordan Co., 1991b). Based on groundwater modeling, the plume is predicted to reach the discharge zone in about five years; however, this interim remedial action is intended to contain the plume and prevent it from reaching Harpswell Cove.

Surface water contamination has been detected in Mere Brook both above the southern part of the Eastern Plume and east of Site 11 in the Picnic Pond Area. The Eastern Plume flows beneath both of these surface waters; however, the presence of contaminants in these surface waters are related to other source areas (e.g., Sites 1 and 3 and surface runoff). Contaminants detected in the surface water differ from the contaminants detected in the Eastern Plume and the Eastern Plume is not believed to be hydraulically connected to these surface waters.

Off-base drinking water wells were tested for some residences on Coombs Road in Brunswick to determine if contaminated groundwater from the base had affected these wells. Contamination from the Eastern Plume was not expected to impact these wells and this was confirmed by the testing.

Sites 4, 11, and 13 at NAS Brunswick are believed to be current or past contributors to groundwater contamination in the Eastern Plume. Site 4, the Acid/Caustic Pit, was used from 1969 to 1974 for the disposal of liquid wastes. The wastes were poured into the pit, which was approximately 4 feet square and 3 feet deep. Investigations showed that subsurface soils around Site 4 were not contaminated and groundwater was only contaminated with low levels of trichloroethylene (TCE). Based on these results, it is believed that Site 4 no longer contributes to groundwater contamination in the Eastern Plume.

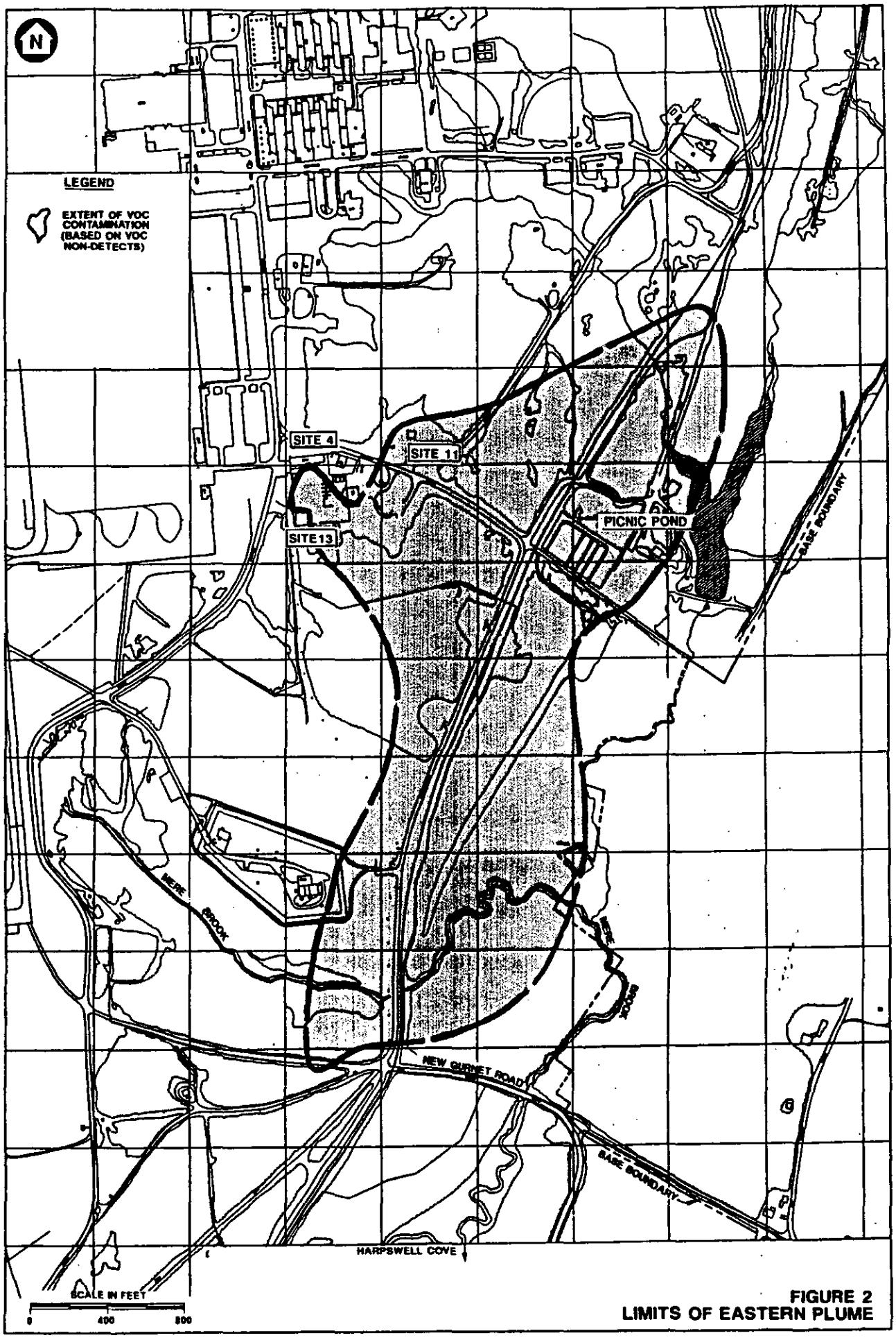


FIGURE 2
LIMITS OF EASTERN PLUME

Site 13, the DRMO Area, consisted of three underground storage tanks located south of Site 4. One tank was used for diesel fuel. The other tanks reportedly were used for storage of waste fuels, oils, and degreasing solvents (R.F. Weston, Inc., 1983). All three tanks were removed during the late 1980s and a new fiberglass diesel underground storage tank was installed. Groundwater sampling downgradient of Site 13 has shown decreasing VOC contamination since removal of the tanks. The most recent groundwater samples from this area contained only low levels of contamination, indicating that Site 13 is no longer acting as a source of contamination for the Eastern Plume.

Site 11 is a former Fire Training Area that was used regularly over a 30-year period until it was closed in the fall of 1990. Waste liquids including fuels, oils, and degreasing solvents were used as fuel for the fire training exercises. The most prevalent contaminants in groundwater (i.e., 1,1,1-trichloroethane [TCA] and TCE) are consistent with the wastes used at the Fire Training Area and the soil contamination at the Fire Training Area. Site 11 is believed to be the primary continuing source of groundwater contamination in the Eastern Plume. The Fire Training Area is no longer in use.

A more detailed description of the history of Sites 4, 11, and 13 can be found in the Remedial Investigation Report in Subsections 8.1, 12.1, and 13.1 (E.C. Jordan Co., 1990a).

B. Enforcement History

The Navy's cleanup of hazardous wastes at NAS Brunswick falls under the Navy's Installation Restoration Program (IRP) and meets the requirements of the Comprehensive Environmental Response, Compensation and Liability Act and the Superfund Amendments and Reauthorization Act (CERCLA). The program was conducted in several stages:

- In 1983, an Initial Assessment Study (IAS) detailed historical hazardous material usage and waste disposal practices at NAS Brunswick.

- In 1984, a Pollution Abatement Confirmation Study was conducted. These studies recommended further investigation of seven of the nine hazardous waste sites originally identified.

- In 1987, NAS Brunswick was placed on the U.S. Environmental Protection Agency's (USEPA's) NPL.

- The Remedial Investigation/Feasibility Study (RI/FS) process began in 1987 for seven sites.

- In February 1988, the first Technical Review Committee (TRC) meeting was held. The TRC meetings have been held quarterly since that initial meeting.

- Two sites were added to the RI/FS program in 1989, as well as the two additional sites originally identified in the IAS.

- Two other sites were added to the program in 1990. Currently, the Navy is studying 13 sites under the IRP.

- In 1990, the Navy entered into a Federal Facility Agreement (FFA) with the USEPA and the Maine Department of Environmental Protection (MEDEP) regarding the cleanup of environmental contamination at NAS Brunswick. The FFA sets forth the roles and responsibilities of each agency, contains deadlines for the investigation and cleanup of hazardous waste sites, and establishes a mechanism to resolve disputes among the agencies.

- In August 1990, the Navy completed Draft Final RI and Phase I FS Reports (E.C. Jordan Co., 1990a and 1990b). The RI described field sampling investigations, geology, and hydrogeology, and presented contamination and risk assessments. The Phase I FS identified remedial action objectives, and developed and screened remedial alternatives for the nine original sites studied in the Draft Final RI.

- The Navy submitted Draft Final Supplemental RI and FS reports for an additional four sites in August and July of 1991, respectively. The Draft Final Supplemental RI also contained additional field sampling results for Site 11 and the Eastern Plume.

Each of the stages and documents listed above pertain to Sites 4, 11, and 13 and the Eastern Plume. Information on many of the other sites at NAS Brunswick is also included in these reports.

Because the Navy is committed to providing a timely response to environmental contamination at NAS Brunswick, a strategy was developed to expedite the RI/FS process. This strategy involves identifying the sites for which enough information currently exists to proceed to the ROD and design phases of the process. Separate timetables have been established for completing the Final FS reports and RODs for

these sites. The Navy has identified Sites 1 and 3, and the groundwater associated with Sites 4, 11, and 13 (i.e., the Eastern Plume) as distinct areas of contamination and believes the remedial process can be initiated. Focused Feasibility Studies for Sites 1 and 3 and Site 8, and an FS for nine other sites (Sites 2, 4, 5, 6, 7, 9, 11, 12, and 13) have been submitted to the regulatory agencies for review (E.C. Jordan Co., 1991b, 1992a, and 1992b).

III. COMMUNITY PARTICIPATION

Throughout the site's history, the community has been active and involved. The Navy has kept the community and other interested parties abreast of site activities through informational meetings, fact sheets, press releases, public meetings, and TRC meetings.

In August 1987, the Navy established an information repository for public review of site-related documents at the Curtis Memorial Library in Brunswick. On December 3, 1991, the Navy placed the Proposed Plan for the Eastern Plume in the information repository at the Curtis Memorial Library. The Administrative Record for the Eastern Plume is available for public review at NAS Brunswick in the Public Works office. A notice and brief analysis of the Proposed Plan was published in the local newspaper, *The Times Record* on December 3 and 10, 1991.

The TRC has been an important vehicle for community participation. The TRC was established in early 1988 and is made up of Navy, USEPA, MEDEP, and various community representatives. The community members of the TRC include representatives from Brunswick, Harpswell, and Topsham as well as the Brunswick Area Citizens for a Safe Environment (BACSE). The TRC also has representatives from the Brunswick-Topsham Water District. The TRC meets quarterly, reviews the technical aspects of the program, and provides community input to the program.

In September 1988, the Navy released a Community Relations Plan outlining a program to address community concerns and keep citizens informed about and involved in remedial activities. On August 16, 1990, the Navy held an informational meeting at the Jordan Acres School in Brunswick, Maine, to discuss the results of the RI.

On December 12, 1991, the Navy held an informational meeting to discuss the results of the RI and the Navy's Proposed Plan for the interim remedial action for the Eastern Plume. During this meeting, the Navy, its consultants, and regulatory representatives answered questions from the public and accepted formal comments. From December 6, 1991, through January 24, 1992, a public comment period was held to accept public comments regarding the proposed interim action for the Eastern Plume, and on any other documents previously made public. The public comments and the responses to the comments are included in Appendix B, Responsiveness Summary.

IV. SCOPE AND ROLE OF OPERABLE UNIT

An interim remedial action for the groundwater operable unit for Sites 4, 11, and 13, referred to as the Eastern Plume, was developed to control and prevent further migration of contaminated groundwater off the NAS Brunswick property and into Harpswell Cove and to begin to reduce the concentration of contaminants in the groundwater until a final remedy can be chosen. The interim remedial action is not intended to be a final remedy but should be consistent with the final remedy that is chosen. This management of migration option is also part of the remedial alternatives being evaluated in the FS, and will be consistent with the final remedy chosen for the Eastern Plume and Sites 4, 11, and 13. The final ROD, which includes the Eastern Plume, may be based in part on the data collected during the design, operation, and monitoring of the interim remedy. Additional interim remedial action(s) may be proposed if data collected before the final ROD warrants such actions.

The interim remedy manages migration of the Eastern Plume by extracting, treating, and discharging contaminated groundwater from the Eastern Plume. Extraction wells will be installed to pump contaminated groundwater from the subsurface where it will be piped to a treatment plant. The water will be treated using oxidation/filtration and ultraviolet (UV) light/oxidation and discharged to the public sewer system for conveyance to the local publicly owned treatment works (POTW). Discharge to the POTW is the preferred discharge option but has not yet been approved. This remedial action will hydraulically contain the Eastern Plume and prevent future discharge of contaminated groundwater to Harpswell Cove. It is also anticipated that groundwater from Sites 1 and 3 will be treated together with groundwater from the Eastern Plume. Sites 1 and 3 are being addressed in a separate ROD.

V. SUMMARY OF SITE CHARACTERISTICS

A focused field investigation of groundwater contamination associated with Sites 4, 11, and 13 (i.e., the Eastern Plume) was conducted as part of the Post-Screening Work Plan between August and November of 1990. This program was developed to supplement existing information at these sites and presented in the Draft Final RI Report (E.C. Jordan Co., 1990a). The Post-Screening Field Program consisted of a piezometric cone penetrometer survey, installation of monitoring wells, aquifer permeability testing, and groundwater sampling and analysis. The results of the field investigation are presented in the Draft Final Supplemental RI Report (E.C. Jordan Co., 1991a). The specific objectives of the Eastern Plume field program include:

- characterize the hydrogeologic regime, including the geologic deposits underlying the study area, the direction and rate of groundwater flow, and possible discharge to Mere Brook, and Harpswell Cove;
- assess the nature, distribution, and migration of contaminants in shallow and bedrock aquifers;
- assess the degree to which future migration of contaminants may pose a threat to public health, welfare, and the environment; and
- obtain groundwater quality data to assess the applicability of groundwater treatment technologies for the FS.

The information obtained from the field investigation is summarized in the following sections.

A. GROUNDWATER FLOW AND SUBSURFACE GEOLOGY

Groundwater in the Eastern Plume occurs in the overburden soil and bedrock formations. The overburden soil at NAS Brunswick is a stratified formation consisting of a sand layer, a transition layer, and a clay layer. The transition layer is made up of interbedded silt, sand, and a clay layer. The sand, transition, and clay soil layers are all part of the Presumpscot Formation, which was deposited during the late glacial marine submergence of southern Maine. The variability of soil types in the Presumpscot Formation was caused by the glacial retreat and sea level changes that occurred when the soils were deposited. The saturated thickness of the Presumpscot Formation, or thickness of the overburden saturated with groundwater, varies from 10 to 90 feet across the Eastern Plume area, and generally spans the sand and transition layers.

RI data (E.C. Jordan Co., 1991a) indicate that groundwater flows radially from Site 11 to the northeast, east, and southeast, and flows southeast from Sites 4 and 13 (Figures 3 and 4). Shallow groundwater from Sites 4, 11, and 13 flows toward and discharges to Mere Brook and its tributaries (see Figure 3). The deep groundwater flows in a more southerly direction (see Figure 4), and is largely constrained by the presence of sand lenses at depth and the eastern limb of the clay trough. The clay trough observed at the site is influenced by an observed bedrock trough also interpreted to exist at the site. Figure 5 shows a schematic representation of a typical west-to-east cross section of the trough south of New Gurnet Road. Bedrock along the eastern boundary of the base forms the eastern limb of a trough. The bedrock trough is also bounded by a bedrock high to the west (see Figure 5). The clay layer of the Presumpscot Formation lies on top of the bedrock and a deep sand layer occurs below the transition sediments and above the clay.

Figure 6 shows a schematic north-to-south profile illustrating how the geologic formation influences deep groundwater flow. The deep sand layer within the trough acts to channel groundwater (and contaminant) flow to the south, because the sandy zones are more permeable than the more silty layers of the formation above and below the deep sand layer, which may act as a preferred path for groundwater and contaminant movement within the aquifer (see Figure 6). Groundwater does not flow through the clay layer on top of bedrock due to the clay's low permeability; however, groundwater does flow in the fractures and joints of the bedrock (E.C. Jordan Co., 1991a).

The groundwater flow system located within the Eastern Plume area is interpreted to discharge to the upper portions of the Harpswell Cove watershed area, based on data presented in the Draft Final Supplemental RI Report (E.C. Jordan Co., 1991a), and shown in Figures 8-14 and 8-18 of that report. Based on groundwater surface contour maps, hydraulic conductivity data, current groundwater chemical data, and hydraulic gradients, the southern edge of the Eastern Plume is interpreted to discharge to the Harpswell Cove area in approximately five years.

B. GROUNDWATER QUALITY

Groundwater contamination is encountered in deep, sand-rich zones above the clay layer, and in shallow groundwater near the source areas. Shallow groundwater away from the source area where it discharges to Mere Brook is not contaminated.

Groundwater contamination has not been detected east of the eastern boundary of the base, or in water samples collected from monitoring wells in the bedrock aquifer (E.C. Jordan Co., 1991b).

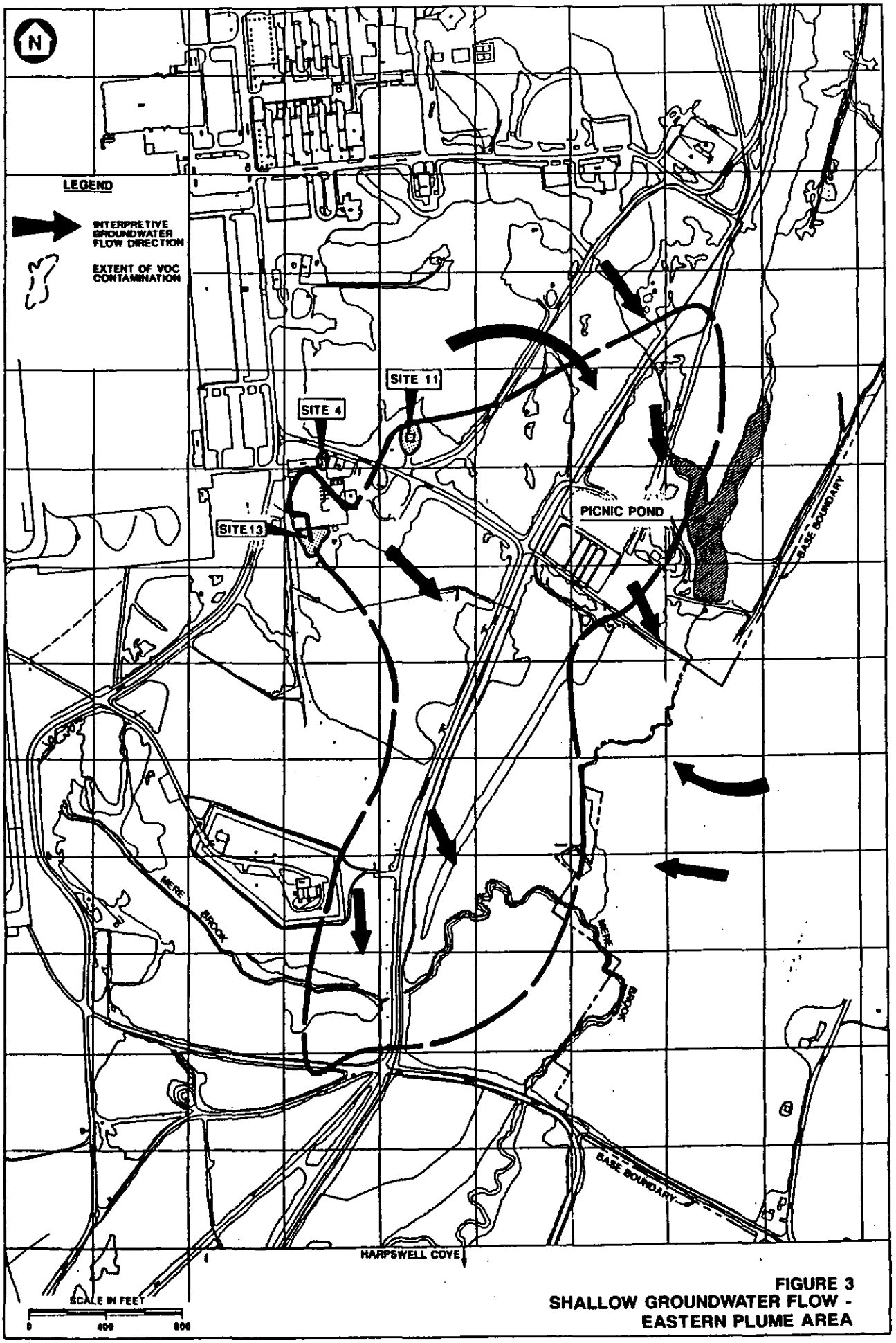


FIGURE 3
SHALLOW GROUNDWATER FLOW - EASTERN PLUME AREA

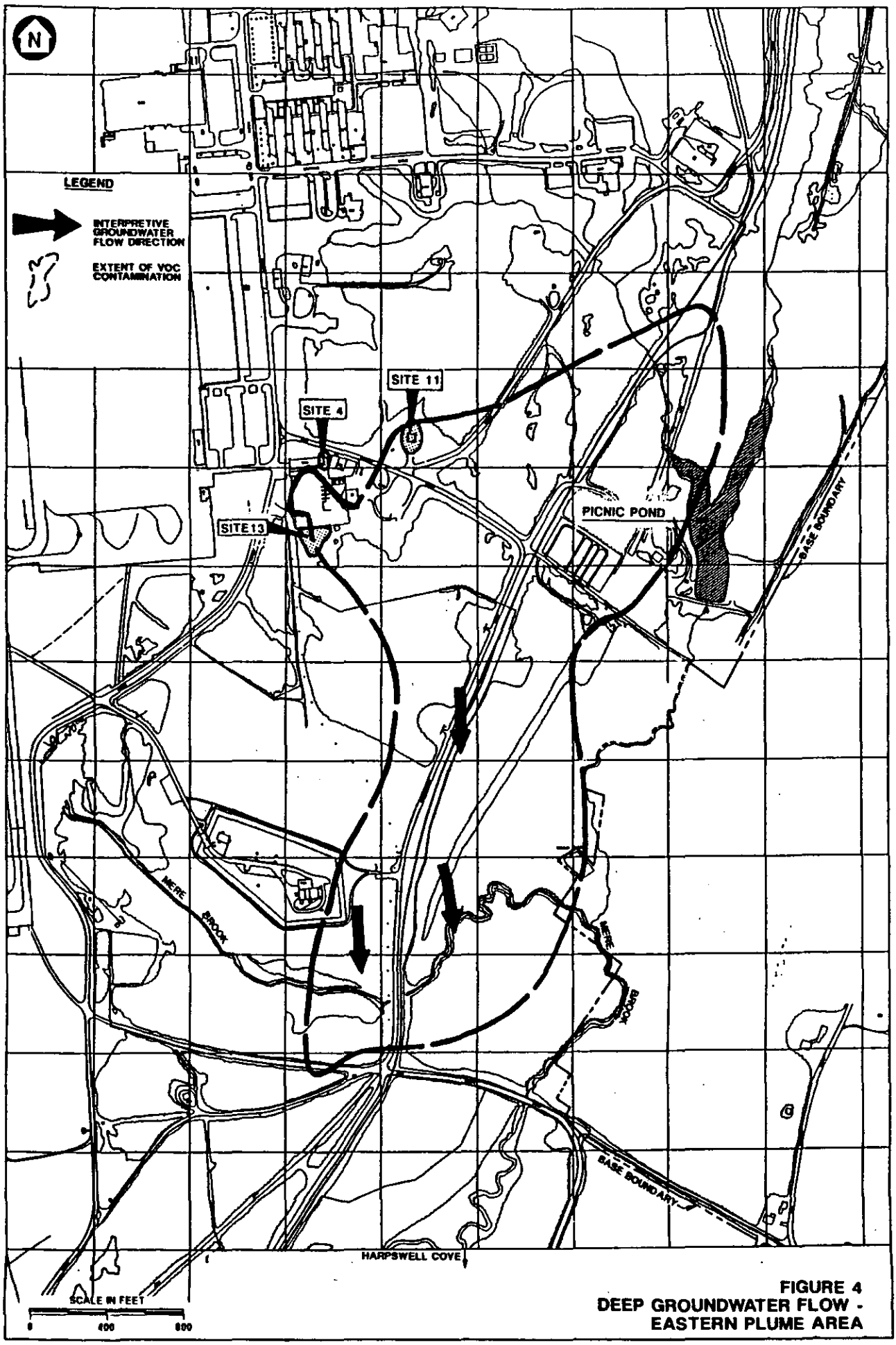
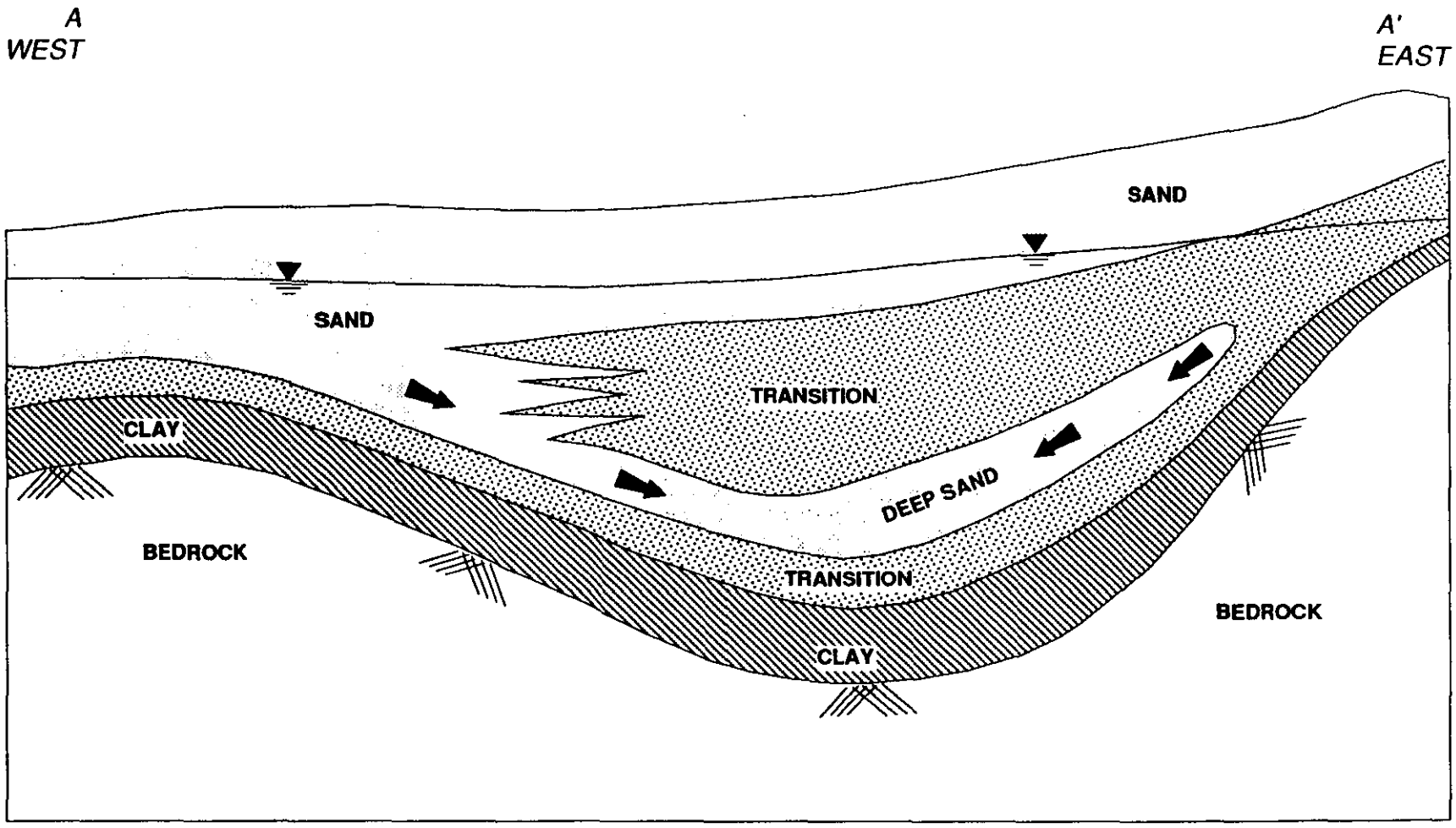


FIGURE 4
DEEP GROUNDWATER FLOW - EASTERN PLUME AREA

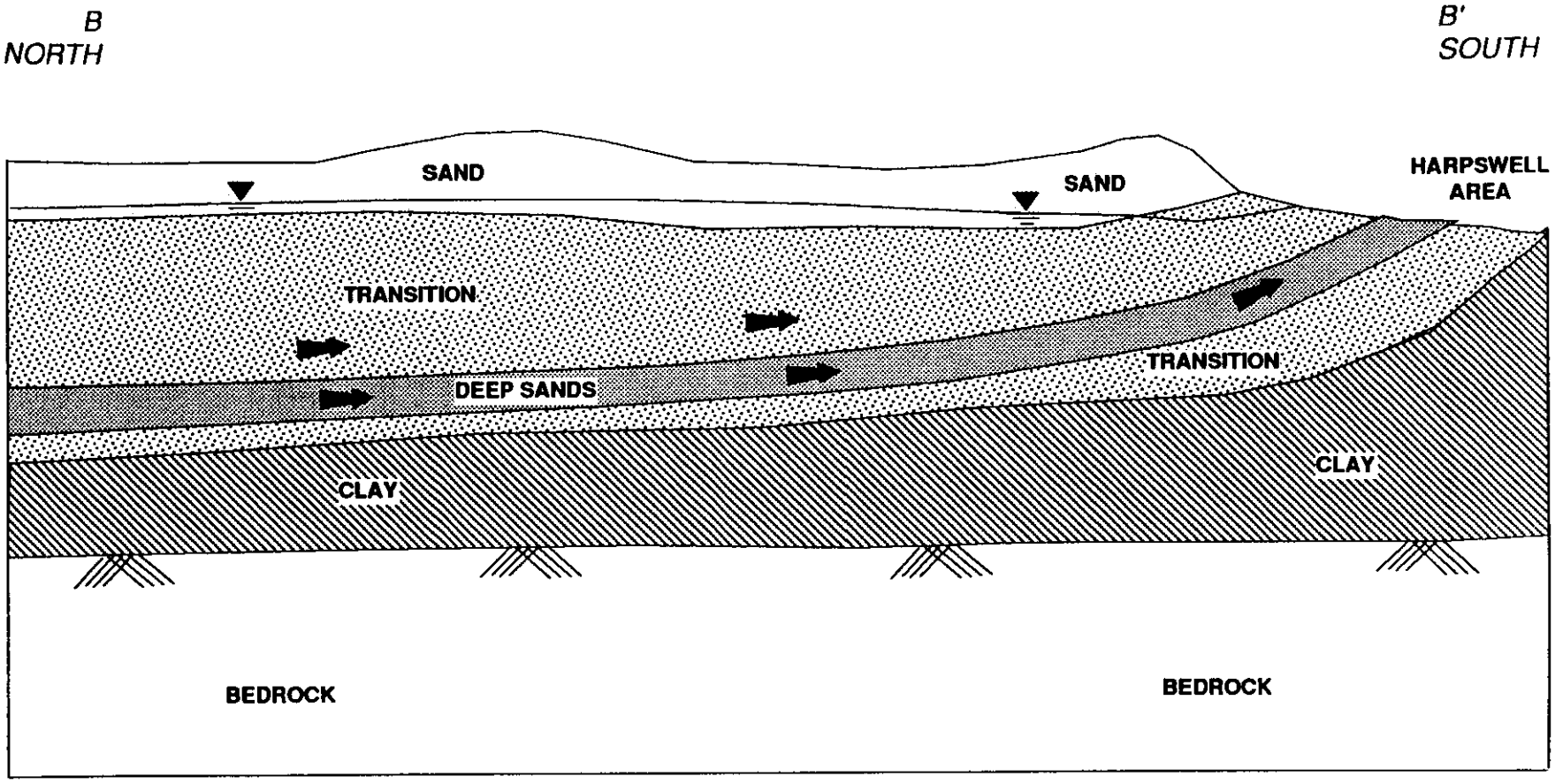


KEY

- INTERPRETIVE GROUNDWATER FLOW DIRECTION
- INTERPRETIVE GROUNDWATER LEVEL
- SAND
- TRANSITION
- CLAY
- BEDROCK

FIGURE 5
SCHEMATIC EAST-WEST CROSS SECTION OF GEOLOGY OF EASTERN PLUME

91070



KEY

- INTERPRETIVE GROUNDWATER FLOW DIRECTION
- INTERPRETIVE GROUNDWATER LEVEL
- SAND
- TRANSITION
- CLAY
- BEDROCK

FIGURE 6
SCHEMATIC NORTH-SOUTH CROSS SECTION OF GEOLOGY OF EASTERN PLUME

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Data indicate that TCA is the most prevalent contaminant in the Eastern Plume, although other VOCs (i.e., tetrachloroethylene, TCE, 1,1-dichloroethylene [1,1-DCE], 1,2-dichloroethylene [1,2-DCE], and 1,1-dichloroethane [1,1-DCA]) were also detected (E.C. Jordan Co., 1991a). The highest concentrations of several compounds detected in the Eastern Plume exceed the Maximum Contaminant Levels (MCLs) established by the USEPA under the 1986 Federal Safe Drinking Water Act and the Maximum Exposure Guidelines (MEGs) outlined in the Maine Drinking Water Rules. A summary of these groundwater data are presented in Table 1.

A complete discussion of site characteristics can be found in the Draft Final Supplemental RI Report in Section 8.0 (E.C. Jordan Co., 1991a).

C. Known or Potential Routes of Migration of Contamination

Shallow groundwater contamination is present in the vicinity of the source areas of Sites 4, 11, and 13 and downgradient of Sites 4 and 13. Although the highest levels of groundwater contamination generally occur in the northwestern portions of the Eastern Plume, contamination observed in the remaining portions of the Eastern Plume area occurs with a deep, sand-rich layer located within the transition zone. Therefore, contaminated groundwater flowing from the source areas initially flows southeast, and when it becomes entrained in the deeper portions of the aquifer, a more southerly flow occurs. The ultimate entrainment of groundwater contaminants in the deep groundwater (located within sand-rich strata) is further emphasized by the lack of shallow groundwater contamination in the downgradient portion of the plume. The contaminant migration pathway for groundwater contamination at the Eastern Plume site is generally within a deep sand-rich strata and it is within this unit that VOCs will migrate to the Harpswell Cove watershed.

TABLE 1
VOC CONTAMINANT CONCENTRATIONS

ROD: EASTERN PLUME
NAS BRUNSWICK

CONSTITUENT	MCL	MEG	RANGE OF CONCENTRATIONS DETECTED		
			SHALLOW WELLS (NEAR SOURCE)	DEEP WELLS (DOWNGRADIENT)	OFF-SITE WELLS
TCA	200	200	13 - 1200	11 - 2300	ND
TCE	5	5	5 - 770	6 - 1200	ND
PCE	5	5	ND - 42	ND - 9	ND
1,1-DCE	7	7	ND - 6	ND - 110	ND
1,2-DCE	70/100(1)	70/100(1)	63 - 680(2)	ND - 98(2)	ND
1,1-DCA	NA	NA	ND - 130	ND - 170	ND

Notes:

(1) 70/100 denotes the MCL and MEG for cis-1,2-DCE and trans-1,2-DCE, respectively
(2) Total 1,2-DCE
ND = Not Detected
MCL = Maximum Contaminant Level (Federal Safe Drinking Water Act)
MEG = Maximum Exposure Guideline (State of Maine Drinking Water Rules)
TCA = trichloroethane
TCE = trichloroethylene
PCE = tetrachloroethylene
DCE = dichloroethylene
DCA = dichloroethane
NA = not available

VI. SUMMARY OF SITE RISKS

A risk evaluation estimated the potential for adverse human health effects from exposure to contaminants associated with the Eastern Plume. The potential risks were qualitatively evaluated and determined based on a comparison of the concentration of each contaminant detected at least once in groundwater to federal MCL and Maine MEG concentrations. MCLs and MEGs represent contaminant concentrations in water considered to be acceptable to human exposure. Therefore, those contaminants detected above their respective standard and criteria values were considered to present a potential risk to human health.

The risk evaluation identified several contaminants in the Eastern Plume at concentrations exceeding their respective MCLs. The MCLs are promulgated federal drinking water standards and the Maine MEGs are established guidance levels. The federal MCL and state MEG values are the same for the contaminants of concern in the Eastern Plume (Table 2). There is currently no risk of exposure to the Eastern Plume groundwater; it is not currently used as a water supply on base, and the plume has not been found to affect off-base private drinking water wells. If, in the future, residents were to use the groundwater within the Eastern Plume as a drinking water supply, that usage could pose long-term risks to human health. The Eastern Plume is not currently discharging to Harpswell Cove; however, if contaminated groundwater were allowed to flow into Harpswell Cove, there would be potential for adverse ecological effects.

Actual or threatened releases of hazardous substances from the Eastern Plume, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to human health, welfare, or the environment. The interim action for hydraulic containment and recovery of groundwater will prevent future migration and reduce contaminant concentrations in groundwater from the Eastern Plume.

TABLE 2
LIST OF CONTAMINANTS OF CONCERN

ROD: EASTERN PLUME
NAS BRUNSWICK

CONTAMINANT	MAXIMUM CONCENTRATION (μg/L)	MCL (μg/L)	MEG (μg/L)
1,1-DCE	110	7	7
1,1-DCA	170	N/A	N/A
cis-1,2-DCE	680*	70	70
trans-1,2-DCE	*	100	100
1,1,1-TCA	2,300	200	200
PCE	42	5	5
TCE	1,200	5	5

Notes:

MCL	=	Maximum Contaminant Level (Federal Safe Drinking Water Act)
MEG	=	Maximum Exposure Guideline (State of Maine Drinking Water Rules)
N/A	=	Not Available
*	=	1,2-DCE was reported by the laboratory as total (i.e., there was no distinction between the cis- and trans-isomer).
μg/L	=	micrograms per liter
DCA	=	dichloroethane
DCE	=	dichloroethylene
PCE	=	tetrachloroethylene
TCA	=	trichloroethane
TCE	=	trichloroethylene

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VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. STATUTORY REQUIREMENTS/RESPONSE OBJECTIVES

The primary goal at NPL and similar sites is to undertake remedial actions that are protective of human health and the environment. Sections 120 and 121 of CERCLA establish several statutory requirements and preferences, including: a requirement that the remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that the remedial action is cost-effective and uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these congressional mandates.

Based on types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were developed to mitigate existing and future potential threats to human health and the environment. These response objectives were:

1. To minimize further migration of the Eastern Plume.
2. To minimize any future negative impact to the Harpswell Cove estuary resulting from discharge of contaminated groundwater.
3. To reduce the potential risk associated with ingestion of contaminated groundwater to acceptable levels.
4. To reduce the time required for restoration of the aquifer.

B. TECHNOLOGY AND ALTERNATIVE DEVELOPMENT AND SCREENING

Because the actions described in this ROD are for an interim remedial action, development and screening of remedial action alternatives was not conducted. A single alternative to address the Eastern Plume on an interim basis was developed. The Navy's selection of the interim remedial action is the result of a comprehensive evaluation of different groundwater treatment options. The Draft FS for the site was conducted to identify and analyze the alternatives considered for addressing both source and groundwater contamination. The FS report describes and evaluates five alternatives: an alternative that offers no action; an alternative that only considers groundwater extraction and treatment; and three alternatives that each evaluate a different source control option in conjunction with groundwater treatment. For each treatment alternative, the groundwater extraction and treatment strategy is the same.

The interim remedial action is consistent with the alternatives developed and screened in the FS for the final site remedy, and it provides a timely response to contamination in the Eastern Plume until a final remedy can be chosen.

VIII. DESCRIPTION OF ALTERNATIVE

This section summarizes the interim remedial action developed and evaluated for the Eastern Plume. The proposed interim remedial action consists of extraction, treatment, and discharge of treated groundwater. The extraction system will consist of groundwater extraction wells that will hydraulically contain the plume and reduce contamination throughout the plume. A monitoring program will be developed to ensure that the interim remedial action obtains hydraulic capture of the Eastern Plume. Changes to the interim remedial action would be made if the monitoring results determine that the interim remedial action does not achieve hydraulic capture of the plume.

Extracted groundwater will first be treated to remove iron and manganese. If iron and manganese are not removed, they will interfere with the VOC treatment processes. The VOC treatment technology proposed for the interim action is UV/oxidation. The effluent will be sampled to ensure that the water meets appropriate discharge requirements.

Discharge of the treated water will be through a new sewer connection from the on-site treatment building to the public sewer system for conveyance to the local POTW. Final treatment and disposal will occur at the POTW. A discharge permit will be required from the Brunswick POTW that will outline specific discharge limitations. The Brunswick POTW has not yet agreed to accept treated groundwater from the Eastern Plume. If they do not accept the treated groundwater, an alternative discharge option (e.g., surface water, groundwater, or the storm sewer system) will be used.

Estimated Time For Design and Construction: 2 years 5 months
Estimated Time for Operation: 5 years
Estimated Capital Cost: $1,223,000
*Estimated Operation and Maintenance Cost (net present worth): $1,845,000**
*Estimated Total Cost (net present worth): $4,223,000**

*Net present worth costs are based on a 10 percent discount factor and five years of operation.

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum must be considered in the assessment of alternatives. Building upon these specific statutory mandates the National Contingency Plan articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

For a final remedy, several alternatives are usually developed and evaluated for a site or operable unit. Because this ROD is for an interim remedial action, only one alternative was developed and its evaluation with respect to the nine criteria is presented below. A full range of alternatives for Sites 4, 11, and 13 which contribute to the Eastern Plume was developed in the FS and will be presented in the final ROD for the final remedy.

A. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Overall Protection of Human Health and the Environment addresses how an alternative as a whole will protect human health and the environment. This includes an assessment of how human health and environmental risks are properly eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

The interim remedial action for addressing groundwater contamination will provide overall protection of human health and the environment. Protection is provided by containment of the plume to prevent the migration of contaminated groundwater to currently uncontaminated areas, and by permanent reduction of contaminant concentrations in the water through treatment and off-site disposal of the sludge produced by metals pretreatment.

B. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy complies with all state and federal environmental and public health laws and/or provides grounds for invoking a waiver. For interim actions, it is appropriate to analyze compliance with only those laws and regulations that are applicable or relevant and appropriate to the limited scope of the interim action. However, the interim remedial action proposed for the Eastern Plume will be designed to meet action- and chemical-specific ARARs for the discharge of treated groundwater and disposal of sludge resulting from the pretreatment process. All location-specific ARARs will also be met. In addition, the interim remedial action proposed for the Eastern Plume will be designed to treat the water to MCLs

so that this interim action will be consistent with the groundwater component of the final site remedy.

C. Long-term Effectiveness and Permanence

Long-term Effectiveness and Permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals are met.

The interim remedial action is expected to meet the cleanup objectives by preventing migration of the plume and by removing and treating the water. Residual risk will remain because the source of contamination would not be remediated by the interim remedial action. The final remedy for the site may contain a source control component to expedite groundwater treatment.

D. Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of Toxicity, Mobility, or Volume Through Treatment are three principal measures of the overall performance of an alternative. The 1986 amendments to the Superfund statute emphasize that, whenever possible, the USEPA should select a remedy that uses a treatment process to permanently reduce the level of toxicity of contaminants at a site, the spread of contaminants away from the source of contamination, and the volume or amount of contamination at a site.

The purpose of the interim groundwater extraction and treatment for the Eastern Plume is to prevent the further migration of contaminants. Preventing the spread of contaminants by pumping to contain the plume may reduce the volume of contaminated groundwater. The plume will be contained by controlling migration with extraction wells. Extraction wells will also be placed in the northern portion of the plume to reduce groundwater contaminant levels. These wells are included to help make the interim action consistent with the final remedy for the site and begin to reduce the overall level of contamination of the Eastern Plume. These wells will be located at the deepest points of the Eastern Plume. Groundwater from the extraction wells will be treated using UV/oxidation. Treating the extracted water will permanently and significantly reduce the toxicity and mobility of contaminants in the extracted water.

E. Short-term Effectiveness

Short-term Effectiveness refers to the likelihood of adverse impacts on human health or the environment that may be posed during the construction and implementation of an alternative until cleanup goals are achieved.

The community and the environment are not expected to be adversely affected during implementation of this action. Workers installing the groundwater extraction system and treatment plant operators will wear protective clothing, follow appropriate safety procedures to minimize the chance of exposure to contaminants as outlined in a site-specific health and safety plan, and meet Occupational Safety and Health Act (OSHA) training requirements.

F. IMPLEMENTABILITY

Implementability refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the alternative. The extraction and treatment technologies proposed for the interim action are implementable and have been successfully demonstrated at other sites. The preferred option of discharging treated water to the POTW must be approved by the Brunswick Sewer District before it can be implemented. If the application for discharge to the POTW is not approved, another discharge option would be required. Other discharge options include recycling the water back into the aquifer by upgradient recharge or discharge to surface water on base.

G. COST

Cost includes the capital (up-front) cost of implementing an alternative as well as the cost of operating and maintaining the alternative over a five-year period, and net present worth of both capital and operation and maintenance costs. The capital, operation and maintenance, and total cost of the interim action are presented in Section VIII of this ROD.

H. STATE ACCEPTANCE

State Acceptance addresses whether, based on its review of the RI/FS and Proposed Plan, the state concurs with, opposes, or has no comment on the alternative the Navy proposes for the interim action.

As a party to the FFA, the State of Maine has provided comments on the proposed plan and has documented its concurrence with the interim remedial action as stated in Section XIII of this ROD. A copy of the letter of concurrence is presented in Appendix C of this ROD.

I. COMMUNITY ACCEPTANCE

Community Acceptance addresses whether the public concurs with the Navy's Proposed Plan. Community acceptance of the Proposed Plan was evaluated based

on comments received at the public meetings and during the public comment period. This is documented in the Responsiveness Summary presented in Appendix B of this ROD.

X. THE SELECTED REMEDY

The interim action for the Eastern Plume addresses only the management of migration of contaminants in groundwater. The action does not address the source of contamination, and a final remedy for groundwater that will be presented upon completion of the FS.

A. CLEANUP LEVELS

Cleanup levels have been established for contaminants of concern identified in the risk evaluation. Cleanup levels have been set equivalent to the appropriate ARARs (e.g., drinking water Maximum Contaminant Levels Goals and MCLs) if available. In the absence of a chemical-specific ARAR, or other suitable criteria to be considered, a concentration corresponding to a 10^{-6} excess cancer risk level for carcinogenic effects or a Hazard Quotient of 1.0 for noncarcinogenic effects was used to set cleanup levels. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and until a final remedy is chosen to replace the interim action.

Table 3 summarizes the cleanup levels derived based on carcinogenic and noncarcinogenic effects for the contaminants of concern identified in groundwater.

These cleanup levels are consistent with ARARs for groundwater and attain USEPA's risk management goal for remedial actions (carcinogenic risk level between 10^{-4} and 10^{-6}).

B. DESCRIPTION OF REMEDIAL COMPONENTS

The interim remedial action consists of extraction, treatment, and discharge of treated groundwater with groundwater and effluent monitoring. The extraction system would be constructed within the plume to maximize the collection of contaminated groundwater. Groundwater extraction wells will contain the southern end of the plume and collect contaminated water from the northern part of the plume (Figure 7). A minimum of one well would be placed at the southern end of the plume to prevent contaminated groundwater from migrating further. Additional extraction wells would be placed in the deepest parts of the aquifer to ensure that contamination in the deep sands is collected. The actual number of wells, pumping rates, and configuration of the extraction well network will be determined during the remedial design. Monitoring wells will be sampled during the interim remedial action to confirm the capture of contaminated groundwater. Additional monitoring wells may be installed to supplement the existing monitoring well network.

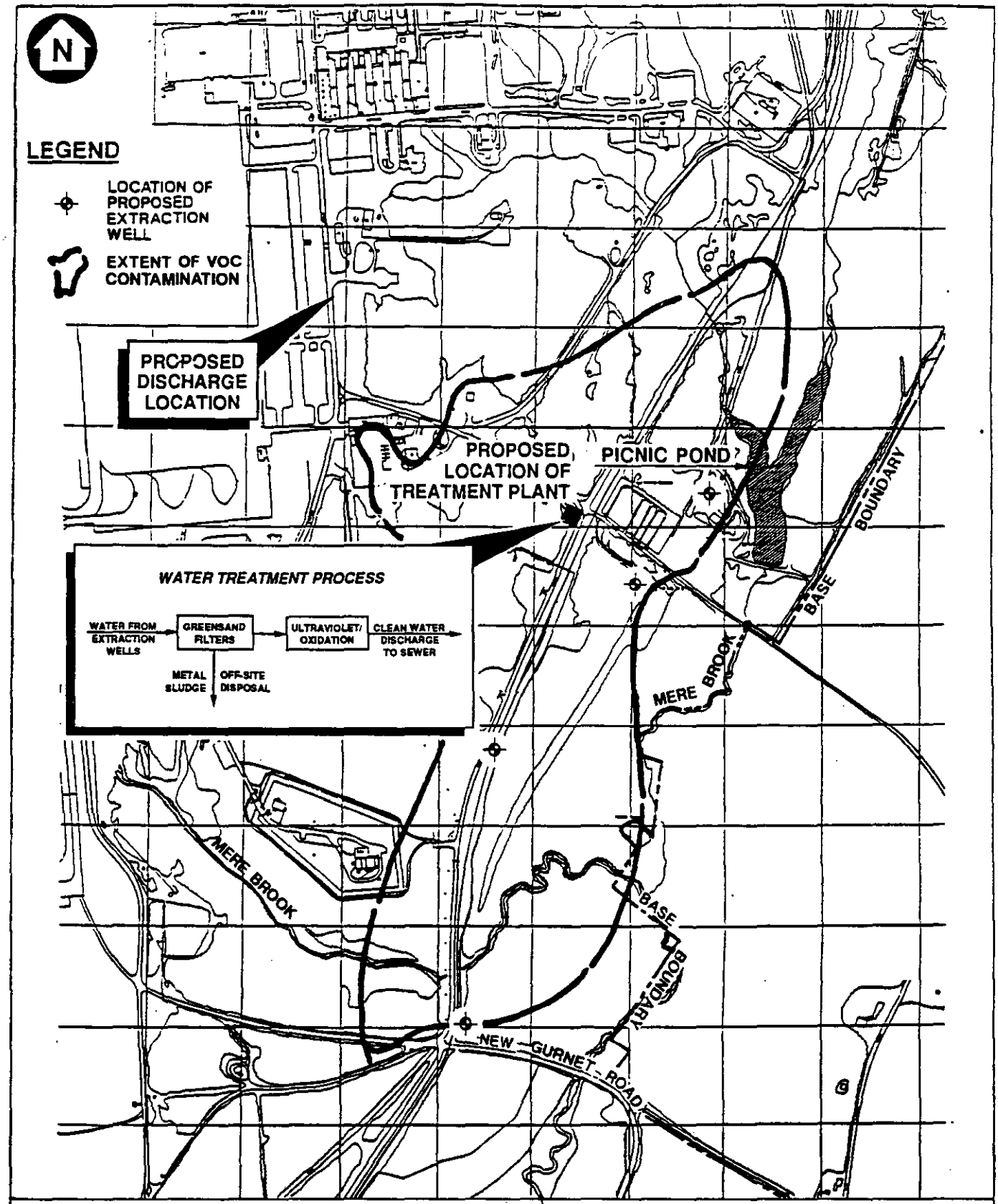
TABLE 3
TARGET CLEANUP LEVELS

ROD: EASTERN PLUME
NAS BRUNSWICK

CONTAMINANT	MAXIMUM CONCENTRATION (µg/L)	MCL (µg/L)	MEG (µg/L)	TARGET CLEANUP LEVEL (µg/L)	RESIDUAL RISK[3]
1,1-DCE	110	7	7	7	$5x10^{-5}$(c)
1,1-DCA	170	N/A	N/A	3,500[2]	0.9 (nc)
cis-1,2-DCE	680[1]	70	70	70	0.2 (nc)
trans-1,2-DCE	[1]	100	100	100	0.1 (nc)
1,1,1-TCA	2,300	200	200	200	0.06 (nc)
PCE	42	5	5	5	$3x10^{-6}$(c)
TCE	1,200	5	5	5	$6x10^{-7}$(c)

Notes:

MCL = Maximum Contaminant Level (Federal Safe Drinking Water Act)
MEG = Maximum Exposure Guideline (State of Maine Drinking Water Rules)
N/A = Not Available
µg/L = micrograms per liter
DCA = dichloroethane
DCE = dichloroethylene
PCE = tetrachloroethylene
TCA = trichloroethane
TCE = trichloroethylene
(1) = 1,2-DCE was reported by the laboratory as total (i.e., there was no distinction between the cis- and trans-isomer).
(2) = The Target Cleanup Level for 1,1-DCA is based on attaining the Reference Dose (RfD) of 0.1 mg/kg-day and assumes a 70 kg adult ingests 2 liters of water per day.
(3) = (c) indicates carcinogenic compound (nc) indicates noncarcinogenic compound



SCALE IN FEET

0 400 800

FIGURE 7
EXTRACTION WELLS
WATER TREATMENT PLANT
LOCATION AND PROCESS

A monitoring program will be developed during the design of the interim remedial action and submitted for regulatory approval. This monitoring program will specify the number and location of wells to be sampled, the frequency of sampling, and the compounds to be analyzed. The monitoring program will be developed to ensure that the interim remedial action is obtaining hydraulic containment of the Eastern Plume. Changes to the interim remedial actions would be made if indicated by the monitoring results.

Contaminated groundwater from base landfills (Sites 1 and 3) will be pumped to the groundwater treatment system for the Eastern Plume and treated concurrently for VOC contamination (see Figure 7). A separate proposed remedial action program has been prepared for Sites 1 and 3. This scenario is considered feasible because of the similar contaminants, the low flow rate of groundwater from Sites 1 and 3, and the short duration (estimated to be 370 days based on the containment alternative proposed as the preferred alternative) required to pump and treat the groundwater from Sites 1 and 3. A groundwater flow model will be developed to address the potential effects of pumping groundwater at both Sites 1 and 3 and the Eastern Plume. This modeling effort will be conducted to support the design of the remedial actions selected for both the Eastern Plume interim action and the Sites 1 and 3 remedial action.

Several groundwater treatment options to reduce VOC contamination in the Eastern Plume were considered. The greatest consideration was given to air stripping with vapor phase carbon (VPC) off-gas treatment and UV/oxidation. Both technologies are effective in treating VOCs. However, because the groundwater from Sites 1 and 3 contains components that are not effectively removed using air stripping and VPC (i.e., methylene chloride and vinyl chloride), UV/oxidation is the preferred groundwater treatment option for this interim remedial action. A schematic flow diagram for water treatment is presented in Figure 7.

The proposed treatment process includes removal of metals and VOCs from the water. Before VOC treatment, dissolved metals in the groundwater (i.e., iron and manganese) would be removed using a filtration process. The pretreatment process is conducted to remove metals from the groundwater that may interfere with the VOC treatment. In this process, a chemical would be added to precipitate the groundwater by passing the water through sand filters. The filters would be backwashed periodically to prevent clogging. The solid material cleaned from the filters would be pressed to remove excess water and then shipped to a hazardous waste disposal facility if determined to be hazardous, or to an off-site waste landfill if determined to be nonhazardous. The water extracted from the solids would be cycled through the on-site groundwater treatment system.

UV/oxidation destroys organic compounds in water by exposing them to a chemical oxidant (e.g., hydrogen peroxide) in the presence of UV light. The contaminated groundwater would be mixed with the oxidant and pumped into a reactor (or series of reactors) where water would be exposed to UV light. The combined effects of UV light and the oxidant promote rapid breakdown of organic molecules. In the oxidation process, organic contaminants are broken down into simpler, nonhazardous substances such as carbon dioxide, water, salts, acetone, sulfates, nitrates, and organic and inorganic acids. Some of these by-products have discharge requirements (e.g., acetone, sulfates, nitrates) that would need to be met. The effluent would be sampled to ensure that the water meets appropriate discharge requirements.

A treatability study would be conducted before the final design of the VOC treatment system to determine the appropriate oxidant and concentration necessary to destroy the VOCs. In addition, this study would provide information on the compounds and concentrations likely to be present as by-products in the effluent. The treatability study would also evaluate metals pretreatment and sludge characteristics so that suitable disposal options can be evaluated in the design phase.

Several options were evaluated for discharge of treated water:

- surface water (e.g., Mere Brook)
- groundwater (e.g., infiltration)
- Brunswick Sewer District's POTW
- Town of Brunswick storm sewer system

The preferred option for discharge is piping the water to tie into the base sanitary sewer system (Brunswick Sewer District POTW). The Navy would need to obtain permission from the Brunswick Sewer District to discharge treated effluent to the system. The POTW's NPDES permit does not currently have pretreatment standards for the compounds that may be detected in the treated water. Pretreatment standards are standards that apply to users of the POTW who contribute pollutants that interfere with or pass through the POTW. Pretreatment standards then become effluent limits on the user, in this case NAS Brunswick. These standards would be developed by the POTW to ensure that the POTW remains in compliance with its NPDES permit and sludge use and disposal practices. Regulations for land application of sludge have been set for the metals cadmium, chromium, copper, lead, mercury, nickel, and zinc for both maximum permissible concentrations and maximum loading limits (on a kilogram/hectare basis). A maximum permissible concentration level has also been set for PCBs.

The additional flow from the treatment plant would not cause the POTW to exceed its capacity. The design flow rate for the POTW is 3.85 million gallons per day

(mgd). Average flows are currently 2.8 mgd, or about 73 percent of capacity. The cost of discharging treated water to the POTW cannot be estimated because pretreatment requirements are not yet known. Flow from NAS Brunswick is currently metered, and there would be a fee for the increased flow.

Some variations to the components described may be necessary during the design and as a result of groundwater flow modeling, treatability studies, and discharge requirements. The purpose of the interim remedial action is to initiate an early response action for the Eastern Plume. The Navy, the USEPA, and the MEDEP will review the collected monitoring data and reevaluate the effectiveness of the interim action. If the interim action is deemed effective and meets the requirements of the final ROD for Sites 4, 11, and 13, the interim action could become part of the overall remedy. If modifications need to be made to the collection or treatment systems to meet the requirements of the final ROD, those modifications would be incorporated into the final ROD for Sites 4, 11, and 13.

XI. STATUTORY DETERMINATIONS

The interim remedial action selected for implementation at NAS Brunswick for the Eastern Plume is consistent with CERCLA and, to the extent practicable, the National Contingency Plan. The selected interim remedy is protective of human health and the environment, attains ARARs for the limited scope of the action, and is cost-effective. The selected interim remedy also satisfies the statutory preference for treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element. Additionally, the selected interim remedy uses alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

A. THE SELECTED INTERIM REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT

The interim remedy at this site will permanently reduce the risks posed to human health and the environment by eliminating, reducing, or controlling exposures to human and environmental receptors through treatment; more specifically, protection is provided by containment of the plume to prevent the migration of contaminated groundwater to currently uncontaminated areas, and by permanent reduction of contaminant concentrations in the water through treatment and off-site disposal of the sludge produced by metals pretreatment. The selected remedy will treat extracted groundwater to levels that are protective of human health, posing human health risks that are within the 10^{-4} to 10^{-6} incremental cancer risk range and that are within the Hazard Quotient of 1.0 for noncarcinogens. Finally, implementation of the interim action will not pose unacceptable short-term risks or cross-media impacts; there will be little danger to workers or the community during treatment and the contaminants removed will be destroyed.

B. THE SELECTED INTERIM REMEDY ATTAINS ARARS

This remedy will attain all applicable or relevant and appropriate federal and state requirements that apply to this limited scope interim action. Generally, ARARs for the selected interim remedial action are a subset of those found in Tables 2-1, 2-2, and 2-4 of Section 2.0 of the FS (E.C. Jordan Co., 1992a). Because the FS considered permanent remedial alternatives and the remedy selected is an interim remedy, some of the ARARs outlined in the FS do not apply to this interim action. ARARs that do apply to this interim action are listed in Appendix A and are discussed below.

When considering interim remedies, it is appropriate to analyze compliance only with those laws and regulations that are applicable, or relevant and appropriate, to the

limited scope of this interim action. The selected interim remedy would meet the following federal and state ARARs for the treatment of groundwater, discharge of the treated water, and disposal of treatment process sludges:

Chemical-specific ARARs

- Safe Drinking Water Act (SDWA) - MCLs and non-zero MCLGs
- Resource Conservation and Recovery Act (RCRA) - MCLs
- Maine Drinking Water Rules
- Clean Water Act (CWA) - Ambient Water Quality Criteria (AWQC)
- Maine Regulations Relating to Water Quality Criteria for Toxic Pollutants

The following chemical-specific policies, criteria, and guidelines were also considered:

- Maine Department of Human Services Rule 10-144A, CMR Chapter 233 - Maximum Exposure Guidelines (MEGs)
- USEPA Risk Reference Doses (RfDs)
- USEPA Human Health Assessment Group Cancer Slope Factors (CSFs)

Location-specific ARARs

- Maine Natural Resources Protection Act
- Natural Resources Protection Act
- Maine Standards for Classification of Minor Drainages
- Maine Standards for Classification of Groundwater
- Maine Site Location Development Law and Regulations

Action-specific ARARs

- Resource Conservation and Recovery Act (RCRA) - General Facility Standards
- RCRA - Preparedness and Prevention
- RCRA - Contingency Plan and Emergency Procedures
- RCRA - Miscellaneous Units
- Maine Hazardous Waste Management Rules
- Occupational Safety and Health Administration (OSHA) - General Industry Standards
- OSHA - Safety and Health Regulations
- OSHA - Recordkeeping, Reporting, and Related Regulations
- Clean Water Act (CWA) - Pretreatment Standards for POTW Discharge
- CWA - National Pollutant Discharge Elimination System (NPDES)
- Maine Water Pollution Control Law: Conditions of Licenses
- Maine Water Pollution Control Law: Certain Deposits and Discharges Prohibited
- Underground Injection Control Program
- Maine Rules to Control the Subsurface Discharge of Pollutants by Well Injection

The following policies, criteria, and guidelines (i.e., TBCs) will also be considered during the implementation of the remedial action:

- MEDEP, Bureau of Water Quality Control, Policy Number 10: "The Discharge of Hazardous Substances to Groundwater of the State"

Federal and State Drinking Water Regulations. The chemical-specific ARARs identified for the Eastern Plume can be applied to the interim remedy in two manners. In the instance of drinking water standards, MCLs and other guidance and criteria to be considered (TBCs) were used in the development of target cleanup levels for the remediation of groundwater at the site. Drinking water standards may also be used separately, or in conjunction with surface water standards, in the development of discharge limits for treated groundwater.

In the development of groundwater cleanup levels, the groundwater in the aquifer underlying the site is classified by the state as GW-A, a drinking water source. The quality and safety of drinking water sources is regulated by the SDWA and Maine Drinking Water Rules. MCLs are enforceable standards under the SDWA that represent the maximum level of contaminants that is acceptable for users of public drinking water supplies. MCLs are relevant and appropriate because, while the groundwater on and off site is not currently used as a drinking water source, the groundwater underlying NAS Brunswick potentially could be used as a drinking water source in the future.

Target cleanup levels for groundwater within the Eastern Plume were developed based on results of the baseline risk assessment. Federal and state MCLs were the first order of standards used in establishing cleanup levels. For those contaminants for which no MCLs were available, other criteria and guidelines (i.e., TBCs) were used. TBCs used during the risk assessment and in establishing cleanup levels included Maine MEGs, USEPA RfDs, and USEPA CSFs.

The objective of the interim remedial action is to prevent further migration of the Eastern Plume. As an interim action, not all ARARs will be attained. Attainment of groundwater standards and risk-based target cleanup levels will be addressed as part of the ROD for the final site remedy.

Federal and State Water Quality Criteria. In developing discharge limits for treated groundwater, drinking water standards and surface water standards identified under chemical-specific ARARs may be applicable to the interim remedy depending on the choice of discharge option. The interim remedy considers three options for discharge of treated groundwater. The Navy's preferred option is discharge of treated water to the Brunswick POTW. Under this option, discharge limits would be based on factors regulated by the POTW's NPDES permit, pretreatment regulations, and water pollution control laws, which will be discussed under action-specific ARARs. Because final discharge from the POTW would be to the Androscoggin River, federal AWQC and Maine Water Quality Criteria are ultimately applicable to this discharge option.

Pretreatment standards are being developed with the Brunswick POTW. Both the Pretreatment Standards and CWA NPDES will be attained upon successful establishment of pretreatment standards for discharge from the groundwater treatment plant.

Another option for the discharge of treated groundwater would be groundwater reinjection. As required by Underground Injection Control Programs, to be discussed under action-specific ARARs, federal and state MCLs and MEGs would apply to the development of discharge limits. To reinject groundwater, MCLs and MEGs would be attained through treatment of contaminated groundwater.

The final option for discharge of treated groundwater would be directly to a surface water source on NAS Brunswick. This action would be governed by NPDES and Water Pollution Control Regulations, to be discussed under action-specific ARARs. However, these regulations would require development of discharge limits that comply with federal and state Water Quality Criteria. Compliance with NPDES and Water Pollution Control regulations would be through treatment of contaminated groundwater to final discharge limits and regular monitoring of effluent.

State Location-specific Regulations. All the location-specific ARARs that apply to the interim remedy are related to piping that will need to cross Mere Brook. The State of Maine location-specific ARARs relate to work conducted within 100 feet of a stream or wetland. While no significant invasive work will be conducted close to Mere Brook, construction activities to run piping over the brook are an element of the interim remedy.

The Maine Natural Resources Protection Act provides that activities adjacent to streams must not cause unreasonable soil erosion, cause unreasonable harm to significant wildlife habitats, unreasonably interfere with natural water flow, lower water quality, or unreasonably cause or increase flooding. Chapter 305 of the MEDEP regulations provides further standards for erosion control and soil excavation. Implementation of the selected interim remedy would not impact the drainage or natural flow of Mere Brook. Because the pipeline will cross Mere Brook at an existing roadway bridge, minimal effects are expected. However, soil erosion controls will be employed during excavation along the pipeline.

Portions of the Maine Site Location Development Law, and associated regulations, apply to this site. The law and regulations provide that new development, which handles hazardous waste, cannot have an adverse effect on the natural environment or pose an unreasonable risk of discharge to a significant groundwater aquifer. Applicable portions of Chapter 375, which set forth the no adverse environmental effect standards regulation of natural drainageways, runoff, erosion, sedimentation

control, and groundwater quality, will be attained by the interim remedy. As mentioned, implementation of the selected interim remedy would not impact the drainage or natural flow of Mere Brook. Soil erosion controls will be employed during excavation along the pipeline to minimize soil entering Mere Brook. Groundwater extraction will remediate groundwater and prevent further impact to the environment.

Federal and State Hazardous Waste Regulations. The applicability of RCRA and Maine Hazardous Waste Regulations depends on whether the wastes are RCRA-hazardous wastes as defined under these regulations. To date, there is no information available (i.e., manifests) to indicate that RCRA-regulated materials were disposed of at Sites 4, 11, and 13. However, because toxic constituents are present in the source materials and groundwater in the Eastern Plume, many portions of the federal and state hazardous waste regulations are relevant and appropriate to the interim remedy.

RCRA General Facility Standards, Preparedness and Prevention, and Contingency Plan and Emergency Procedures will be attained during construction and operation of the groundwater treatment plant. The treatment plant, which will be secured to prevent access by unauthorized personnel. The facility will be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment. During remedial construction, safety and communication equipment will be installed at the site, and local authorities will be familiarized with site operations. Contingency plans will be developed and implemented during site work and treatment plant operation. A program will be developed for handling, storage, and recordkeeping, in accordance with Maine Hazardous Waste Management Rules.

During treatment of contaminated groundwater, sludges containing some toxic constituents will be produced. A component of groundwater treatment includes laboratory analysis of this sludge, including Toxicity Characteristic Leachate Procedure (TCLP) testing. If the sludge fails TCLP testing, this material will be considered hazardous. As a characteristic hazardous waste, RCRA regulations, including Land Disposal Restrictions will apply and the sludge will be treated and disposed of in a RCRA Subtitle C facility.

Because toxic constituents are present on site, OSHA regulations protecting worker health and safety at hazardous waste sites are applicable to the implementation and long-term operation of the interim remedy. Site workers will have completed training and will have appropriate health and safety equipment on site. Contractors and subcontractors working on site will follow health and safety procedures.

Federal and State NPDES, Water Pollution Control, and Underground Injection Regulations. As mentioned, many action-specific ARARs will regulate the discharge of treated groundwater. The three discharge options for the interim remedy include: (1) Brunswick POTW, (2) reinjection to groundwater, and (3) direct discharge to surface water. Discharge of treated groundwater to the Brunswick POTW is the Navy's preferred option; however, final approval has not been obtained from the POTW. CWA Pretreatment Standards for POTW Discharge would be attained through treatment of the groundwater to these standards. Indirectly, CWA NPDES is an applicable regulation because the final discharge is to the Androscoggin River, and the Brunswick POTW has a current NPDES permit.

If discharge to the POTW is not acceptable, a second alternative is to reinject treated water back to groundwater. The federal Underground Injection Control Program and Maine Rules to Control the Subsurface Discharge of Pollutants by Well Injection are applicable to this discharge option. These regulations would require and be attained through establishment of standards for the treatment of groundwater that attain federal and state drinking water standards and guidance values.

The third discharge option would be to send treated groundwater directly to a surface water source on NAS Brunswick. The CWA NPDES and Maine Water Pollution Control Laws would apply to this method of discharge. Under this option, an NPDES permit would need to be obtained. In the course of obtaining that permit, discharge limits for the treatment plant effluent would be established. Federal and state water quality criteria would be used in the development of final discharge limits.

C. THE SELECTED INTERIM REMEDIAL ACTION IS COST-EFFECTIVE

The selected interim remedy is cost-effective; that is, the remedy affords overall effectiveness proportional to its costs. The Navy evaluated the overall effectiveness of the interim action by assessing the relevant three criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs. The costs of this remedial alternative are:

Estimated Capital Cost: $1,223,000
*Estimated Operation and Maintenance Costs (net present worth): $1,845,000**
*Estimated Total Cost (net present worth): $4,223,000**

*Net present worth costs are based on a 10 percent discount factor and five years of operation.

D. THE SELECTED INTERIM REMEDY UTILIZES PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected interim remedy uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The interim action was evaluated for the balance of trade-offs in terms of: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility, and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and state acceptance. The interim remedial action provides the best balance of trade-offs among these criteria prior to determination of a final remedy.

E. THE SELECTED INTERIM REMEDY SATISFIES THE PREFERENCE FOR TREATMENT WHICH PERMANENTLY AND SIGNIFICANTLY REDUCES THE TOXICITY, MOBILITY, OR VOLUME OF THE HAZARDOUS SUBSTANCES AS A PRINCIPAL ELEMENT

The principal element of the selected interim remedy is the extraction of groundwater and treatment with UV/oxidation. This element addresses the primary threat of the Eastern Plume--discharge of contaminated water to Harpswell Cove. The interim remedial action satisfies the statutory preference for treatment as a principal element by destroying contaminants in the extracted groundwater with UV/oxidation.

This interim ROD will be followed by a final ROD that will determine what further actions, if any, will be necessary to meet the preference for treatment which will permanently and significantly reduce toxicity, mobility, or volume of hazardous substances.

XII. DOCUMENTATION OF NO SIGNIFICANT CHANGES

The Navy presented a Proposed Plan (preferred alternative) for the interim remedial action for the Eastern Plume on December 12, 1991. The interim remedial action consisted of the same components described in this ROD. No significant changes have been made to the interim action described in the proposed plan and presented to the public.

XIII. STATE ROLE

MEDEP has reviewed the interim remedial action and indicated its support for the selected remedy. As party to the FFA, the state has also reviewed the RI, Remedial Action, FS, and Proposed Plan to determine if the selected remedy is in compliance with ARARs. MEDEP concurs with the selected remedy for the Eastern Plume at NAS Brunswick. A copy of the letter of concurrence is presented in Appendix C of this ROD.

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
BACSE	Brunswick Area Citizens for a Safe Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSF	cancer slope factor
CWA	Clean Water Act
DCA	dichloroethane
DCE	dichloroethylene
DNAPL	dense nonaqueous phase liquid
DRMO	Defense Reutilization and Marketing Office
FFA	Federal Facility Agreement
FS	Feasibility Study
gpm	gallons per minute
IAS	Initial Assessment Study
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MEDEP	Maine Department of Environmental Protection
MEG	Maximum Exposure Guideline
mgd	million gallons per day
MSL	mean sea level
NAS	Naval Air Station
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OSHA	Occupational Safety and Health Act
POTW	publicly owned treatment works
ppb	parts per billion

RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
ROD	Record of Decision
SDWA	Safe Drinking Water Act
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethylene
TCLP	Toxicity Characteristic Leachate Procedure
TRC	Technical Review Committee
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
VOC	volatile organic compound
VPC	vapor phase carbon

E.C. Jordan Co., 1990a. "Draft Final Remedial Investigation Report NAS Brunswick"; Portland, Maine; August.

E.C. Jordan Co., 1990b. "Phase I Feasibility Study Development and Screening of Alternatives NAS Brunswick"; Portland, Maine; August.

E.C. Jordan Co., 1991a. "Draft Final Supplemental Remedial Investigation Report NAS Brunswick"; Portland, Maine; August.

E.C. Jordan Co., 1991b. "Focused Feasibility Study Sites 1 and 3 NAS Brunswick"; Portland, Maine; October.

E.C. Jordan Co., 1992a. "Feasibility Study NAS Brunswick"; Portland, Maine; March.

E.C. Jordan Co., 1992b. "Focused Feasibility Study Site 8 NAS Brunswick"; Portland, Maine; March.

R.F. Weston, Inc., 1983. "Initial Assessment Study of Naval Air Station, Brunswick, Maine"; Westchester, Pennsylvania; June.

APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

TABLE A-1
CHEMICAL-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: EASTERN PLUME
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
GROUNDWATER/ SURFACE WATER				
Federal	SDWA - MCLs (40 CFR 141.11 - 141.16)	Relevant and Appropriate	MCLs have been promulgated for several common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	Groundwater at NAS Brunswick is not a current source of drinking water; therefore, MCLs are not applicable, but may be relevant and appropriate. To assess the potential risks to human health due to consumption of groundwater, contaminant concentrations were compared to their MCLs.
	SDWA - MCLGs (40 CFR 141.50 - 141.51)	Relevant and Appropriate	MCLGs are health-based criteria. As promulgated under SARA, MCLGs are to be considered for drinking water sources. MCLGs are available for several organic and inorganic contaminants.	The 1990 National Contingency Plan states that non-zero MCLGs are to be used as goals. Because groundwater at NAS Brunswick is not a current source of drinking water, MCLGs are not applicable, but may be relevant and appropriate. Contaminant concentrations in groundwater were compared to their MCLGs.
	RCRA - Subpart F Groundwater Protection Standards, Alternate Concentration Limits (40 CFR 264.94)	Relevant and Appropriate	This requirement outlines standards, in addition to background concentrations and MCLs, to be used in establishing clean-up levels for remediating groundwater contamination.	Most of the MCLs promulgated under RCRA are the same as SDWA MCLs. The standards set forth under RCRA do not reflect recent changes and additions to SDWA MCLs. Because groundwater is not a current source of drinking water; RCRA MCLs are not applicable, but may be relevant and appropriate.
	Federal AWQC	Applicable	Federal AWQC include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) water quality parameters. AWQC for the protection of human health provide levels for exposure from drinking water and consuming aquatic organisms, and from consuming fish alone. Remedial actions involving contaminated surface water or groundwater must consider the uses of the water and the circumstances of the release or threatened release; this determines whether AWQC are relevant and appropriate.	AWQC will be applicable if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW, although the Navy has not yet received approval from the POTW. AWQC may be considered during development of pretreatment standards because the POTW discharges its effluent to the Androscoggin River.

continued

TABLE A-1
CHEMICAL-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: EASTERN PLUME
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
Federal Guidance and Criteria To Be Considered	USEPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are the levels considered unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Because there are only a limited number of promulgated standards for contaminants in soil and water, USEPA RfDs were used to characterize risks due to noncarcinogens in various media.
	USEPA Human Health Assessment Group Cancer Slope Factors (CSFs)	To Be Considered	Carcinogenic effects present the most up-to-date information on cancer risk potency derived from USEPA's Human Health Assessment Group.	Because there are only a limited number of promulgated standards for contaminants in soil and water, USEPA CSFs were used to compute the individual incremental cancer risk resulting from exposure to certain compounds.
State	Maine Drinking Water Rules (10-144A CMR Chapters 231-233)	Relevant and Appropriate	Maine's Primary Drinking Water Standards are equivalent to federal MCLs. When state levels are more stringent than federal levels, the state levels may be used.	Groundwater at NAS Brunswick is not a current source of drinking water; therefore, State Drinking Water Standards are relevant and appropriate. Contaminant concentrations in groundwater were compared to State standards to assess the potential risks to human health due to consumption of groundwater.
	Maine Regulations Relating to Water Quality Criteria for Toxic Pollutants (MEDEP Regs, Chapter 584)	Applicable	This rule limits the concentrations of certain materials allowed in Maine waters to prevent the occurrence of pollutants in toxic amounts as required by state and federal law. Except if naturally occurring, ambient levels of toxic pollutants shall not exceed the Clean Water Act AWQC. Where AWQC do not exist, the Board of Environmental Protection shall adopt site-specific numerical criteria.	This rule will be applicable if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW, although the Navy has not yet received approval from the POTW. AWQC will be considered during development of pretreatment standards. This rule is potentially applicable in development of pretreatment standards if AWQC do not exist for any contaminants present in groundwater.

continued

TABLE A-1
CHEMICAL-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: EASTERN PLUME
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
State Criteria and Guidance To Be Considered	Rules Relating to Testing of Private Water Systems for Potentially Hazardous Contaminants (10-144A CMR Chapter 233, Appendix C)	To Be Considered	Appendix C outlines Maximum Exposure Guidelines (MEGs) for organic and inorganic compounds. MEGs include health advisories, which are maximum allowable concentrations of specific contaminants in drinking water.	MEGs have been considered for chemical compounds for which there are no promulgated standards. MEGs may be considered if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. MEGs may potentially be considered during development of discharge limits for reinjection of treated groundwater.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
CMR = Code of Maine Rules
CPF = carcinogenic potency factor
FS = feasibility study
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MEG = Maximum Exposure Guidelines
MEDEP = Maine Department of Environmental Protection
MRSA = Maine Revised Statues Annotated
NAS = Naval Air Station
OSWER = Office of Solid Waste and Emergency Response
RI = remedial investigation
RCRA = Resource Conservation and Recovery Act
RfD = reference dose
SARA = Superfund Amendments and Reauthorization Act
SDWA = Safe Drinking Water Act
USEPA = U.S. Environmental Protection Agency

TABLE A-2
LOCATION-SPECIFIC ARARs, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: EASTERN PLUME
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
State	Maine Natural Resources Protection Act (38 MRSA, Section 480-A through S)	Applicable	This act outlines requirements for certain activities adjacent to any freshwater wetland greater than 10 acres or with an associated stream, brook, or pond or adjacent to a coastal wetland. The activities must not unreasonably interfere with certain natural features, such as natural flow or quality of any waters, nor harm significant aquatic habitat, freshwater fisheries, or other aquatic life.	Because piping will need to be extended across Mere Brook, this regulation is applicable. Remedial activities will need to meet the substantive requirements of this Act.
	Natural Resources Protection Act, Permit by Rule Standards (MEDEP Regs, Chapter 305)	Applicable	This rule outlines prescribed standards for specific activities that may take place in or adjacent to wetlands and water bodies.	Because piping will need to be extended across Mere Brook, this regulation is applicable. Activities involving disturbance of soil material within 100 feet of the normal high water line, will be designed to incorporate all applicable standards.
	Maine Standards for Classification of Minor Drainages (38 MRSA, Section 468)	Applicable	Mere Brook is classified as a Class B water under the state water quality standards. Class B waters are defined as suitable for drinking water (after treatment), fishing, recreation in and on the water, and as habitat for fish and other aquatic life.	These regulations apply to activities conducted adjacent to Mere Brook. Remedial construction should not result in the degradation of water quality classification. These regulations may also potentially apply if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. The designated uses of the waters receiving either direct discharge or POTW effluent must be considered and protected in developing either discharge limits or pretreatment standards.
	Maine Natural Resources Protection Act (38 MRSA, Section 480-A through S)	Applicable	A permit application must be submitted and approved by the Maine Bureau of Land Quality Control and Section 480-D performance standards met when conducting activities adjacent to any freshwater wetland greater than 10 acres or with an associated stream, brook, or pond.	Substantive requirements of this regulation apply to activities conducted adjacent to Mere Brook. However, a permit is not required for the selected remedy since the administrative permit requirement are waived for remedial activities conducted on-site at federal Superfund sites.

continued

TABLE A-2
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE

ROD: EASTERN PLUME
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
	Maine Standards for Classification of Groundwater (38 MRSA, Section 470)	Applicable	This law requires the classification of the state's groundwater to protect, conserve, and maintain groundwater resources in the interest of the health, safety, and general welfare of the people of the state. Under the Maine standards, groundwater is classified as GW-A.	This regulation will apply if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If discharge to groundwater is employed, the classification and uses of groundwater will evaluated during development of discharge limits.
	Maine Site Location Development Law and Regulations (38 MRSA Sections 481-490; MEDEP Regs, Chapters 371-377)	Applicable	This act and associated regulations govern new developments, including those that handle hazardous waste. New developments cannot adversely affect existing uses, scenic character, or natural resources in the municipality or neighboring municipality.	Those regulations concerning No Adverse Environmental Impact (i.e., Chapter 375) are applicable to implementation of the interim remedy. In particular, standards for protection of groundwater would apply to construction and groundwater treatment activities. However, any licenses required, by reference, will not need to be obtained since permits are not required for actions conducted on-site at federal Superfund sites.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirements
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
CWA = Clean Water Act
MRSA = Maine Revised Statutes Annotated
MEDEP = Maine Department of Environmental Protection
NAS = Naval Air Station
RI/FS = Remedial Investigation/Feasibility Study
RCRA = Resource Conservation and Recovery Act

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TABLE A-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: EASTERN PLUME
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
Federal			
RCRA - General Facility Standards (40 CFR 264.10-264.18)	Relevant and Appropriate	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	The waste material at Sites 4, 11, and 13 have not been formally defined as a RCRA-regulated waste; therefore, only sections of the facility standards are relevant and appropriate. All other relevant general requirements will be incorporated into the construction and operation of the groundwater treatment plant.
RCRA - Preparedness and Prevention (40 CFR 264.30-264.37)	Relevant and Appropriate	This regulation outlines requirements for safety equipment and spill-control for hazardous waste facilities. Part of the regulation includes a requirement that facilities be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment.	Because toxic constituents are present within the Eastern Plume groundwater, preparedness and prevention requirements are relevant and appropriate to the implementation of the selected remedy. During remedial construction, safety and communication equipment will be installed at the site, and local authorities will be familiarized with site operations.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50-264.56)	Relevant and Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Because toxic constituents are present in Eastern Plume groundwater, contingency plans and emergency procedures are relevant and appropriate to the implementation of the selected remedy. Plans will be developed and implemented during site work including installation of extraction wells, and implementation of site remedies. Copies of the plans will be kept on-site.
RCRA - Miscellaneous Units (40 CFR 264.600-264.999)	Relevant and Appropriate	These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, surface water, and wetlands that may have adverse effects on human health and the environment.	Because the selected remedy includes a groundwater treatment plant, the general design, performance, and operating requirements of Subpart X are relevant and appropriate. However, a permit is not required for remedial actions conducted on-site at federal Superfund sites.

continued

TABLE A-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: EASTERN PLUME
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
RCRA Land Disposal Restrictions (40 CFR 268)	To be determined	Land disposal of RCRA hazardous wastes is restricted without specified treatment. It must be determined that the waste, beyond a reasonable doubt, meets the definition of one of the specified restricted wastes and the remedial action must constitute "placement" for the land disposal restrictions to be considered applicable. For each hazardous waste, the LDRs specify that the waste must be treated either by a treatment technology or to a concentration level prior to disposal in a RCRA Subtitle C permitted facility.	During treatment of groundwater, sludge containing hazardous constituents will be generated. The selected remedy includes provisions for analysis of this sludge, including Toxicity Characteristic Leachate Procedure (TCLP) testing. LDRs are potentially applicable if the sludge fails TCLP. The selected remedy does address handling and disposal of the sludge as a hazardous waste, if necessary.
OSHA - General Industry Standards (29 CFR Part 1910)	Applicable	These regulations specify the 8-hour time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous wastes operations are specified in 29 CFR 1910.120.	Because toxic constituents are present in Eastern Plume groundwater, OSHA regulations are applicable. Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below designated concentrations. Workers performing activities would be required to have completed specific training requirements.
OSHA - Safety and Health Standards (29 CFR Part 1926)	Applicable	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.	Because toxic constituents are present in Eastern Plume groundwater, OSHA regulations are applicable. All appropriate safety equipment will be on-site. In addition, safety procedures would be followed during on-site activities.
OSHA - Recordkeeping, Reporting, and Related Regulations (29 CFR 1904)	Applicable	This regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	Because toxic constituents are present in Eastern Plume groundwater, OSHA regulations are applicable. These requirements will apply to all site contractors and subcontractors, and must be followed during all site work.

continued

TABLE A-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: EASTERN PLUME
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
CWA - NPDES Regulations (40 CFR Parts 122, 125)	Applicable	This requirement implements the NPDES program that specifies the applicable effluent standards, monitoring requirements, and standard and special conditions for direct discharge.	NPDES requirements will be applicable if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. Both on- and off-site discharges from CERCLA sites to surface waters are required to meet the substantive CWA NPDES requirements, including discharge limitations, monitoring requirements, and best management practices. Brunswick POTW has a current NPDES permit. A permit would be required if treated groundwater is discharged on-site.
Underground Injection Control Program (40 CFR 144, 146, 147, 1000)	Applicable	These regulations outline minimum program and performance standards for underground injection programs. Technical criteria and standards for siting, operation and maintenance, and reporting and recordkeeping as required for permitting are set forth in Part 146.	This regulation will be applicable if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. Discharge of treated groundwater, by well injection, must be in accordance with all the criteria and standards in these federal regulations, as well as meet all state Underground Injection Control Program requirements. Treated groundwater must meet all SDWA standards prior to well injection.
CWA - Pretreatment Standards for POTW Discharge (40 CFR Part 403)	Applicable	This regulation specifies pretreatment standards for discharges to a POTW. If treated groundwater is discharged to a POTW, the POTW must have mechanisms available to meet the requirements of the National Pretreatment Program - Introduction of Pollutants which cause pass through or interference are prohibited. Discharges must also comply with any local POTW regulations. If hazardous waste is discharged to the POTW, the POTW may be subject to RCRA permit-by-rule.	This regulation is applicable since the Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If treated groundwater is discharged to a POTW, the treated water must meet all discharge limitations imposed by the POTW.

continued

TABLE A-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: EASTERN PLUME
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
State			
Maine Rules to Control the Subsurface Discharge of Pollutants by Well Injection (MEDEP Regs, Chapter 543)	Applicable	This regulation prohibits the injection of hazardous waste into or above water-bearing formations via a new Class IV well. The subsurface discharge into or through a Class IV well that would cause or allow the movement of fluid into an underground source of drinking water that may result in a violation of any Maine Primary Drinking Water Standard, or which may otherwise adversely affect public health, is prohibited.	These regulations will be applicable if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. For discharge to the subsurface, groundwater must be treated to a target clean-up level less than or equal to the Maine MEGs to be recharged to the aquifer.
Maine Hazardous Waste Management Rules (MEDEP Regs, Chapters 800-802, 850, 851, 853-857)	Relevant and Appropriate	The rules provide a comprehensive program for handling, storage, and recordkeeping at hazardous waste facilities. They supplement the RCRA regulations.	Because these requirements supplement RCRA hazardous waste regulations, they are relevant and appropriate.
Maine Water Pollution Control Law: Conditions of Licenses (38 MRSA, Section 414-A)	Applicable	Regulates the discharge of any pollutants. Specifies that the discharge, either by itself or combined with other discharges, will not lower the quality of any classified body of water below such classification. The discharge will be subject to effluent limitations that require application of the best practicable treatment.	The substantive requirements of this regulation will apply if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If treated water is discharged directly to surface water the effluent must receive the best practicable treatment before discharge.
Maine Water Pollution Control Law: Certain Deposits and Discharges Prohibited (38 MRSA, Section 420)	Applicable	No person, firm, corporation, or other legal entity shall place, deposit, discharge, or spill mercury or toxic or hazardous substances, either directly or indirectly, into the inland groundwater or surface waters, tidal waters, on the ice, or on the banks thereof, so that the same may flow or be washed into such waters, or in such manner that the drainage therefrom may flow into such waters.	This regulation will apply if treated groundwater is discharged to surface water. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If discharge to surface water is employed, Best Management Practices will be used when handling wastes.

continued

TABLE A-3
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ROD: EASTERN PLUME
NAS BRUNSWICK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE REMEDIAL PROCESS
State Guidance and Criteria To Be Considered			
MEDEP, Bureau of Water Quality Control, Policy Number 10, "The Discharge of Hazardous Substances to Groundwaters of the State"	To Be Considered	The Bureau will deny applications for waste discharge licenses for the discharge to groundwaters of substances designated by the Board to be hazardous when such substances are present in concentrations exceeding groundwater levels which occur naturally in the area. Exemption may be granted if the groundwater is treated to reduce the concentrations of pollutants discharged to below the level considered safe for drinking water.	This policy will need to be considered if treated groundwater is discharged back to groundwater. The Navy's preferred discharge option is to the Brunswick POTW; however, the Navy has not yet received approval from the POTW. If treated water is discharged to the subsurface, the minimum level of groundwater treatment would be required to provide adequate protection if no other means of disposal is feasible. This policy would only be considered after application of federal and state underground injection control regulations.

Notes:

AHERA = Asbestos Hazard Emergency Response Act
CAA = Clean Air Act
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
CMR = Code of Maine Regulations
CWA = Clean Water Act
DOT = Department of Transportation (U.S.)
LDRs = Land Disposal Restrictions
FS = feasibility study
MEDEP = Maine Department of Environmental Protection
MEG = Maximum Exposure Guidelines
MRSA = Maine Revised Statutes Annotated
NAS = Naval Air Station
NESHAP = National Emission Standards for Hazardous Air Pollutants
NPDES = National Pollutant Discharge Elimination System
OSHA = Occupational Safety and Health Administration
POTW = publicly owned treatment works
RACT = Reasonably Available Control Technology
RI = remedial investigation
RCRA = Resource Conservation and Recovery Act
SDWA = Safe Drinking Water Act
TCLP = Toxicity Characteristic Leachate Procedure
$\mu g/m^3$ = micrograms per cubic meter
VOC = volatile organic compound

APPENDIX B

RESPONSIVENESS SUMMARY

APPENDIX B

RESPONSIVENESS SUMMARY

OVERVIEW

At the time of the public comment period, the U.S. Navy had selected a preferred alternative for interim remediation to address groundwater contamination at the Eastern Plume at NAS Brunswick. This preferred alternative was selected in coordination with the USEPA and the MEDEP. Other members of the TRC for this project were also involved in discussions and planning of the groundwater extraction and treatment alternative. Technical details of the alternative have been discussed, and no fundamental objections to its selection have been raised.

The sections below describe the background of community involvement with the project and the U.S. Navy's responses to verbal and written comments received during the public comment period.

BACKGROUND OF COMMUNITY INVOLVEMENT

Prior to the public comment period in December 1991 and January 1992, there were several presentations to the public regarding the RI/FS activities at NAS Brunswick. Two meetings to inform the public on the general status and process for the RI/FS occurred in February and March of 1990. A technical forum occurred in August 1990 where the status and understanding of site-specific studies was also presented to the public. In November 1991, newspaper announcements were placed for a public meeting presented by the U.S. Navy in Brunswick to discuss the results of the RI/FS and the Preferred Alternative.

Local input to the selection of the preferred remedy for interim remediation has come predominantly through the TRC, established by the U.S. Navy. Meetings held approximately quarterly since early 1988 have brought together local representatives of the towns of Brunswick, Harpswell, and Topsham. The TRC also has included representatives from the Brunswick-Topsham water district and a local citizens group (i.e., BACSE). This involvement has facilitated remedial planning by the U.S. Navy and has alerted affected local groups to the proposed activities.

SUMMARY OF COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD

During the public comment period, written comments were received from citizens and several special interest groups. At the public meeting on December 12, 1991, several questions and comments were also raised.

1. Comment (written): Groundwater modeling is proposed to simulate pumping and determine effects on the plume from the remediation efforts at Sites 1 and 3, I am concerned about the possible interactions between the two sites and would encourage you to back up the modeling results with significant on-site monitoring once the proposed plans are implemented. In addition, monitoring should take place outside the plume edge to insure that the contamination is not advancing during groundwater extraction. It is anticipated that the leading edge of the plume could reach Harpswell Cove in 1996 and the remedial action will take 2 years and 5 months to implement. Considering the elapsed time before actual construction begins, it is realistic to assume that pumping will begin sometime in early 1995. Therefore, it is essential that monitoring outside the plume edge be performed in the interim prior to implementation to predict any potential impacts to Harpswell Cove. The results of the groundwater model should also be used in the placement of the extraction wells in the eastern plume.

   Response: The groundwater modeling program is designed to answer several questions including the interaction between the groundwater at Sites 1 and 3 and the Eastern Plume. The modeling will also provide information on the potential location and pumping rates for extraction wells. The remedial action at the Eastern Plume will also include a Remedial Action Monitoring Plan. The Remedial Action Monitoring Plan will describe a monitoring program that will evaluate the effectiveness of the remedial action and will specify sampling locations, intervals, and compounds to be analyzed. This monitoring plan will support the model by sampling monitoring

wells located downgradient of the existing plume (i.e., wells in the path of the plume that have tested clean) to make sure that the extraction wells are located to effectively capture the advancing plume. The Remedial Action Monitoring Plan will be reviewed by regulators and the public during the construction process. The Remedial Action Monitoring Plan will not be finalized until the design effort is complete. This will allow the Remedial Action Monitoring Plan to incorporate the most appropriate design.

2. Comment (written): The proposed method of discharge is to the Brunswick Sewer District. Although I feel this is the preferred option, I do have a concern over removing water from one watershed (Harpswell Cove) and discharging it to another (Androscoggin River/Merrymeeting Bay). The effects on both watersheds should be addressed prior to implementation of this option. The report states that "the treated water would meet pretreatment requirements or other applicable standards before entering the sewer system." At the December 12, 1991 public meeting, it was stated that the water would be cleaned up to MCL levels prior to discharge to the sewer system. POTW pretreatment standards and National Pollutant Discharge Elimination System (NPDES) permit requirements (if surface water discharge is implemented) are usually far less stringent than MCLs. The report leaves these cleanup levels as an option, however since MCLs were stated as the cleanup level prior to discharge at the public meeting. I would hold you to using the MCL values. Also, please address the discharge requirements for acetone, sulfates, and nitrates generated as byproducts during the groundwater treatment. The groundwater should also be tested for radon prior to treatment. If discharge to the POTW is not feasible, public comment should be solicited for the other options of groundwater recharge or surface water discharge.

Response: With regard to the amount of water that normally flows into the Casco Bay estuary; an overall water balance for the Harpswell cove watershed area was performed using a general area of the watershed area (ft^2) x an average infiltration rate of 18-inches/year. Of the approximately 4,151 gallons per minute (gpm) flowing into this watershed, the Eastern Plume and Site 1 and 3 extraction rates (approximately 130 gpm) represents less than 3 percent of the overall flux into the system. When the Sites 1 and 3 extraction is completed (approximately 1 to 2 years) the Eastern Plume extraction represents less than 2 percent of the overall flux. Given the significant area over which the Kennebec/Sheepscott bay watershed occurs, the addition of this volume of water is expected to be negligible compared to the overall flux through the watershed area.

The POTW's current NPDES permit does not have effluent standards for many of the contaminants that will be in the NAS Brunswick treated water. For preliminary design and cost-estimating purposes, discharge limits equal to MCLs were assumed. However, in order to discharge to the POTW pretreatment, standards for a user such as a military installation (NAS Brunswick) will have to be established. These pretreatment standards are limitations that will be placed on the effluent from the NAS Brunswick treatment system such that the introduction of the NAS Brunswick effluent to the POTW waste stream will not cause the POTW to be in violation of its NPDES permit. The design of the treatment plant will be determined by the pretreatment requirements (these pretreatment standards may be determined by Ambient Water Quality Criteria [AWQCs], MCLs, or some other appropriate rationale). The pretreatment standards will be developed to be protective of receptors in the Androscoggin River, human or environmental.

The POTW will be required to submit a pretreatment program as an amendment to its NPDES permit. This program (which will include the standards themselves and a compliance schedule) will be submitted to the Wastewater Management Branch of USEPA Region I and be subject to approval. Pretreatment standards may include limitations on compounds such as acetone, sulphates, nitrates and any other possible by-products of the treatment system as well as the contaminants originating from Sites 1 and 3 groundwater. Treatability tests conducted during the design of the system will provide information on effluent constituents and their concentrations. The process of applying for pretreatment standards and an amended NPDES permit will require cooperation between the Navy and POTW officials.

If discharge to the POTW of treated groundwater is not chosen as the discharge option, the Navy will use one of the other discharge options including upgradient infiltration or discharge to surface water. These other discharge options are included in the Proposed Plan for the Eastern Plume and additional public comment is not required. The final choice for discharge of treated groundwater may also be evaluated using the design groundwater model.

Radon testing is not anticipated to be included in the Remedial Action Monitoring Plan. The presence of radon would not be the result of site-related contamination.

3. Comment (written): More information on the extent of contamination of the solid residue from the groundwater treatment and its ultimate disposal site is needed. If it is not declared a hazardous waste, will disposal options include the Brunswick sanitary landfill or land application? I encouraged you to solicit public comments prior to any decision on a disposal site.

Response: The metals sludge from the pretreatment process will be tested for characteristics (i.e., ignitability, corrosivity, reactivity, and toxicity) of Resource Conservation and Recovery Act (RCRA) hazardous waste. It will either be disposed of in a secure hazardous waste landfill or a landfill for non-hazardous solid waste depending on the results of the tests. It is not likely that the sludge would be suitable for land application.

4. Comment (written): While we understand that the purpose of the interim remedial action is to begin to clean up contaminated groundwater in the Eastern Plume, it is not clear how the interim measures fit with the final remedial actions, including source removal. How will the potential for DNAPLs (dense nonaqueous phase liquid contaminants) be evaluated? The implementation of the interim groundwater extraction should provide an opportunity to gather data concerning water levels and water chemistry that can be used to design the final remedial measures.

Response: Although the proposed remedial action at the Eastern Plume is currently a interim action, it may be consistent with the final proposed action for the downgradient groundwater operable unit. The Draft Final FS (E.C. Jordan Co., 1991a) describes a series of remedial alternatives for the source area. The range of proposed alternatives for the source area varies from no action through source removal and treatment. The presence or absence of dense nonaqueous phase liquids (DNAPLs) was evaluated as part of the RI study, and DNAPLs are not observed in the Eastern Plume area.

Additional data concerning water levels and water chemistry will be gathered as part of the Remedial Action Monitoring Plan (see Response to Comment 1).

5. Comment (written): According to the plan, the southern limit of the plume is "believed to be in the vicinity of New Gurnet Road." What measures will be taken to more closely define the extent, both vertically and horizontally, of the contaminant plume?

Response: Based on sampling results from the fall of 1990 reported in the Draft Final Supplemental RI Report (E.C. Jordan Co., 1991a), the southern limit of the Eastern Plume was determined to be in the vicinity of New Gurnet Road, and the vertical and horizontal distribution of contamination within the Eastern Plume was well characterized. Monitoring wells established along the plume boundaries, and downgradient of the plume will allow future characterization of the plume. A Remedial Action Monitoring Plan will be developed to evaluate the effectiveness of the remedial action and monitor potential contaminant migration. The Remedial Action Monitoring Plan will receive regulatory and public review.

6. Comment (written): The Plan indicates that the main potential effect of the proposed remedial action of Sites 1 and 3 on the Eastern Plume remediation will be the diversion of clean groundwater upgradient of the sites toward the southern portion of the Eastern Plume, and that design-level groundwater modeling studies will quantitatively evaluate this interaction. What if the model does not show this interaction? How and where will field data be gathered to test the potential effect?

Response: The effects of the remedial action at Sites 1 and 3 on the Eastern Plume will be evaluated using field data and the design-level groundwater model. These modeling results will be included in the evaluation of final locations and pumping rates for extraction wells. Additional field data are not anticipated to be required to finalize design of the Eastern Plume groundwater extraction system; however, treatability studies will be performed on contaminated

groundwater from both Sites 1 and 3 and the Eastern Plume. The treatability studies will provide input for both extraction rates and groundwater treatment design.

The long-term Remedial Action Monitoring Plan will include provisions for assessing the field data and modeling results to evaluate the interaction between the extraction program at the Eastern Plume and the diversion of groundwater from Sites 1 and 3.

7. Comment (written): There are not enough data points to substantiate that groundwater does not flow from the clay into the underlying bedrock at the facility. Furthermore, while the clay may have a relatively low permeability, it cannot be assumed to be a continuous impermeable barrier to contaminant migration. Additional hydrogeologic data is needed to better characterize the current clay-bedrock flow regime and how it will be affected by the proposed remedial action at Sites 1 and 3 and the Eastern Plume.

Response: Extensive explorations have been conducted at the site to characterize the geology and hydrogeology, including the clay-bedrock flow regime. The site characterization included 55 cone penetrometer test explorations and 119 monitoring well/piezometer explorations. The data collected at the base indicate that an upward gradient exists between the bedrock aquifer and the overlying aquifer in the unconsolidated sediments. Although existing data indicates that an upward vertical component of flow may exist at the site, it is estimated to be minimal (Draft Final Supplemental RI Report, E.C. Jordan Co., 1991a). Investigations conducted at the site indicate that the clay unit ranges in thickness from 20 to 60 feet and permeability tests conducted on shelby tube samples obtained from this unit indicate a hydraulic conductivity on the order of 10^{-7} cm/sec. Upward vertical gradients were also observed to

exist between the overburden soils located above the clay and bedrock unit located below the clay. Although the bedrock has been shown to occur above the clay in two locations, the bulk of the observations demonstrates that this is the exception. The large extent and low permeability of the clay will minimize upward seepage. As part of the design modeling task, sensitivity analyses will be utilized to evaluate the amount of upward vertical seepage through the clay. However, given the very low hydraulic conductivity of the clay, potential seepage is anticipated to be only a very small fraction of the water available through surface recharge of precipitation and the total water mass balance.

8. Comment (written): What is the hydrogeologic relationship between the "coarse sand" shown on Figure 6 and the "sand" or "deep sand" shown on Figure 5?

Response: The hydrogeologic relationship between the coarse sands shown in Figure 6 and the deep sand shown in Figure 5 is that they represent the same hydrogeologic unit. Figure 5 shows this hydrogeologic unit in cross section, and Figure 6 shows a longitudinal section of this hydrogeologic unit.

9. Comment (written): How were the locations of the extraction wells and the pumping rates determined?

Response: The location and pumping rates for the extraction wells were developed from the results of groundwater modeling presented in the Draft Final FS (E.C. Jordan Co., 1991a), and the location of the deep pockets of contaminated groundwater within the Eastern Plume. The design-level groundwater model will further refine the well locations and extraction rates.

10. Comment (written): Since groundwater cannot be effectively isolated between cleanup sites, and since there is evidence that plumes from several sites are already merging,

the treatment of all discharged groundwater should be based upon the presumptive presence of toxic materials currently identified as being present at <u>any</u> of the sites.

Response: The interaction between Sites 1 and 3 and the Eastern plume will be evaluated with a design-level groundwater model. The current understanding of the interaction of contamination from Sites 1 and 3 and the Eastern Plume indicates that the two plumes do not interact. With the construction of the slurry wall at Sites 1 and 3, a potential exists for uncontaminated groundwater to flow into the southern portion of the Eastern Plume. This interaction will be evaluated with the groundwater model. Considerable time has been spent studying the nature and distribution of contamination at the various sites at NAS Brunswick. This information has been used to evaluate risk to human health and the environment, and to set target cleanup levels. This information is site-specific and will be used to set target cleanup levels as appropriate for each site. Because extracted groundwater from Sites 1 and 3 and the Eastern Plume will likely be combined in the treatment process, treatability studies will be conducted on the combined flows in order to design the system to treat contaminants from both plumes.

11. Comment (written): We note with concern that the proposed treatment criteria are essentially based upon standards for drinking water (the EPA standard, which is less stringent than those of many states), although it is generally recognized that the criteria for the protection of plant and animal life are more stringent. Since we know that toxic elements accumulate and become more dangerous as they move up the food chain, it is illogical to use drinking water standards. We do not drink the waters of the Androscoggin - they are used by simple and then increasingly complex organisms that reach us only much later in the food chain. Moreover, even minute quantities of some of the toxic materials, like

DDT, can impair reproductive cycles of animal life and impair or destroy aquatic organisms. Because shellfish, as filter feeders, absorb the contents of large quantities of water every day, they are particularly sensitive to the presence of toxic substances in the water and should be used to establish the water treatment levels. Consideration should also be given to toxicity levels for other indicator organisms, such as daphnids and stoneflies which are a basic component of the wildlife food chain.

Response: The actual cleanup levels for contaminants in the groundwater from the Eastern Plume will be determined based on the final disposal of the treated water. Three discharge options were developed and discussed in the Proposed Plan for the Eastern Plume and the Focused Feasibility Study for Sites 1 and 3 and include: upgradient recharge, discharge to surface water, or discharge to the POTW. Each discharge option has specific requirements that must be met prior to the implementation of the proposed alternative.

Because the cleanup levels for upgradient recharge were known (i.e., drinking water standards), these values were used to develop and cost the proposed remedial alternative. The actual proposed discharge to the POTW is likely to be subject to similar discharge limits, although the POTW has not yet agreed to accept the water or set specific discharge limits.

If the treated water is to be discharged to Mere Brook or the storm sewers, federal and state water regulations pertaining to discharge requirements and water quality standards would apply. Treated groundwater would have to comply with the limits set under the Clean Water Act (CWA) NPDES permit program (40 CFR Parts 122 and 125), and Maine Regulations relating to Water Quality Criteria (MEDEP Regulations, Chapter 584) and

Antidegradation (38 MRSA Section 464(4)). NPDES requirements and the Maine Antidegradation statute set the requirements that discharged waters must meet. However, these requirements are stated as limits and restrictions for various pollutants that will be incorporated into the final discharge permits. The regulations do not provide promulgated standards outlining allowable concentrations of contaminants in discharge waters. The limits of the Antidegradation policy and corresponding regulations allow the state to set site-specific discharge limits that address drainage areas of water sources, discharges that cause waters to be unsuitable for the designated use of their class, pH, color, and temperature of the receiving waters.

A definitive determination of the discharge options for this option cannot be made at this time because the terms of the final discharge permit will be based on site-specific considerations and set by regulatory agencies in consideration of CWA, NPDES and state requirements. Final discharge standards cannot be predicted because they are established through a process that evaluates broad requirements that will address the resources attributed and related to Mere Brook.

If treated water is to be discharged to the Brunswick POTW, pretreatment standards under the CWA apply (40 CFR Part 403). CWA Section 307(b) authorized the National Pretreatment Program to regulate the introduction of pollutants from non-domestic sources into POTWs. The goal of the program is to prevent discharges to POTWs that would interfere with the operation, pass through, or be incompatible with the POTW.

The POTW's current NPDES permit does not have effluent standards for many of the contaminants that will be in the NAS Brunswick treated water. For preliminary design and cost-estimating purposes, discharge limits equal to MCLs were assumed.

However, in order to discharge to the POTW pretreatment, standards for a user such as a military installation (NAS Brunswick) will have to be established. These pretreatment standards are limitations that will be placed on the effluent from the NAS Brunswick treatment system such that the introduction of the NAS Brunswick effluent to the POTW waste stream will not cause the POTW to be in violation of its NPDES permit. The design of the treatment plant will be determined by the pretreatment requirements (these pretreatment standards may be determined by AWQCs, MCLs, or some other appropriate rationale). The pretreatment standards will be developed to be protective of receptors in the Androscoggin River, human or environmental.

The POTW will be required to submit a pretreatment program as an amendment to its NPDES permit. This program (which will include the standards themselves and a compliance schedule) will be submitted to the Wastewater Management Branch of USEPA Region I and subject to approval. Pretreatment standards may include limitations on compounds such as acetone, sulphates, nitrates, and any other possible byproducts of the treatment system as well as the contaminants originating from Sites 1 and 3 groundwater. The process of applying for pretreatment standards and an amended NPDES permit will require cooperation between the Navy and POTW officials.

12. Comment (written): The State of Maine amended 38 MRSA Section 420 to adopt EPA's national water quality criteria. Inasmuch as these criteria impose more restrictive standards than EPA drinking water standards, they appear to be the legal minimum requirements for discharge of water to the Androscoggin River at Brunswick, Maine.

Response: The actual cleanup levels for contaminants in the groundwater from Sites 1 and 3 will be determined

based on the final disposal of the treated water. Three discharge options were developed and discussed in the Proposed Plan and the Focused Feasibility Study for Sites 1 and 3 and include: upgradient recharge, discharge to surface water, or discharge to the POTW. Each discharge option has specific requirements that must be met prior to the implementation of the proposed alternative. As stated in the response to Comment 11, discharged water will be required to comply with federal and state regulations applicable to the receiving water body.

13. Comment (written): Recommendation

Recommendation A: Recharge water into ground on the base.

Response: Upgradient infiltration of groundwater has been considered as a potential discharge option. The potential effectiveness of this discharge option will be evaluated with the design-level groundwater model.

This option is not preferred for discharge of treated water from the Eastern Plume, because a groundwater divide exists north of the Eastern Plume. Reinjecting water "upgradient" of the plume may actually recharge another aquifer system.

Recommendation B: If A is not possible, and discharge to the Androscoggin is required, then accomplish the following:

Recommendation B-1: Strengthen groundwater cleanup levels, based upon fish and wildlife species criteria.

The environmental standards needed to protect the fish and wildlife in our rivers are no longer a matter of speculation; there is adequate documentation in the criteria used in many states; i.e., New Jersey, Maryland and EPA also promulgates minimum requirements. We would hope to see the NAS

assume leadership in giving Maine waters the same level of protection.

Response: See response to Comment 11.

Recommendation B-2: Department of the Navy should fund some of the services of an independent toxicologist to review the final requirements from the mission requirement point of view of the Friends of Merrymeeting Bay because the subject matter of toxicant levels for fish and wildlife habitat is too complex and beyond the normal expertise of informed sports enthusiasts.

Response: Technical Assistance Grants (TAGs) are available for technical support to the public. The BACSE group has received such a grant and may have funds to support this study.

Recommendation B-3: Identify the specific legal authority and enabling legislation that permits piping large quantities of water which normally flow to the Casco Bay estuary into the Kennebec/Sheepscott Bay estuary.

Response: No specific legislation restricting or limiting the groundwater flow between watersheds were identified during the identification or ARARs. The Navy does not consider the discharge of treated water to the Kennebec/Sheepscott estuary to be significant. See response to Comment 2.

Recommendation B-4: Prevent the intermixing of sludge from the NAS cleanup with domestic sludge. This is of concern to us if the NAS cleanup wastewater is discharged through the Brunswick Sewage Treatment Plant, because the domestic sludge is, at this time, used by farmers in the Merrymeeting Bay watershed as fertilizer. In addition to the obvious environmental questions raised by this issue, there is a question of legal responsibility. The intermixing of the two sources in sludge could generate a nightmare of legal entanglements should one of the NAS toxicants be the source of a lawsuit.

Response: Sludge from the POTW used as a soil additive is subject to the MEDEP Rules for Land Application of Sludge and Residuals. These standards have been developed for several inorganic elements and polychlorinated biphenyls (PCBs). The standards specify maximum permissible concentrations (mass of contaminant per mass of sludge applied) and maximum loading limits (mass of contaminant per area applied). The pretreatment standards will therefore be developed so that the maximum permissible concentrations in the sludge from the POTW are not exceeded.

Sludge from the POTW will be completely separate from and a much different composition than the sludge from the metals pretreatment processes of the NAS Brunswick treatment plant. The POTW sludge has a much higher organic content (making it useful to farmers) than the metals sludge from the NAS Brunswick treatment plant and the two would not be mixed. The metals sludge from the pretreatment process will be tested for characteristics of RCRA hazardous waste. It will either be disposed of in a secure hazardous waste landfill or a landfill for non-hazardous solid waste depending on the results of the tests. Available options for disposal of the sludge from metals pretreatment will be evaluated during the design phase.

Recommendation C: We have received verbal assurance that there will be a pilot project for water treatment. We request that this pilot project be followed by a full-stop review and a public comment period.

Response: Pilot tests for the water treatment system will be developed during the pre-design phase. The specific pilot tests will be described in a design work plan. The design work plan will receive regulatory and TRC review.

14. Comment (written): Recommendation

Recommendation 1: The groundwater treatment include all toxicants currently identified as being present at any site.

Response: The groundwater treatment for the Preferred Alternative for the Eastern Plume was designed to specifically treat or remove the constituents detected in the groundwater downgradient of the source areas. The Preferred Alternative includes treatments for metals and VOC contaminants. The treatment option will be designed to meet the final discharge requirements for all constituents detected in the effluent.

Designing a treatment system for contaminants that are not detected at or likely to be present in the influent is not possible, as is suggested in the comment. Three areas of groundwater contamination have been detected at NAS Brunswick and include Sites 1 and 3, the Eastern Plume, and groundwater beneath Site 9. Similar contaminants of concern have been identified at Sites 1 and 3 and the Eastern Plume making it possible to design a single cost-effective and implementable groundwater treatment. However, the contaminants of concern at Site 9 include compounds that have different chemical and physical properties than those identified at Sites 1 and 3. This results from the different historical land use and disposal practices at these site. Because of the different properties of the contaminants of concern; separate and different treatment technologies need to be considered. Each site must be evaluated separately to ensure proper treatment and/or removal of the site-specific contaminants of concern.

The final treatment of contaminated groundwater at Site 9 will be decided using the same process as the Eastern Plume. The public will have the same opportunity to review and comment on the final plan.

Recommendation 2: The groundwater treatment levels be strengthened and be based upon fish and wildlife species criteria. The attached list of monitoring elements contains sample recommended water treatment levels based on these criteria, incorporating drinking water standards where appropriate (Table B-1).

Response: See response to Comment 11.

15. Comment (written): Our final interest concerns the overall biological and ecological threat posed by the sites. We applaud what appears to be a very thorough hydrogeological evaluation of the site but we believe the surface terrestrial and aquatic biotic components have been neglected. We wish to see a more complete analysis of the threat of dispersal of hazardous materials by biotic means through the food web and within and beyond the confines of the Mere Brook watershed and associated aquifers. An analysis of this sort is critical in evaluating the effectiveness of any containment or extraction/treatment remedial actions.

Response: The proposed long-term monitoring for the Preferred Alternative includes surface water and sediment sampling locations along Mere Brook; soil/sediment samples at the current leachate locations and groundwater samples from locations downgradient of the landfill areas. Analytical results from these samples will provide information regarding the transport of contaminants from the landfill to the Mere Brook environment. Current sampling results do not show the transport of contaminants beyond the region of Mere Brook directly adjacent to Sites 1, 2, and 3. Therefore, no contaminant migration is expected after the implementation of remedial actions.

A biological food chain model was used to provide an appropriate ecological cleanup level for mercury. This value (1 milligram per kilogram) will be used as part of the Remedial Action Monitoring Plan to

TABLE B-1
FRIENDS OF MERRYMEETING BAY CLEANUP RECOMMENDATIONS

ROD: EASTERN PLUME
NAS BRUNSWICK

MONITORING ELEMENT	MINIMUM CLEANUP LEVEL (micrograms per liter)	RATIONALE
Arsenic	5	1
Vinyl chloride	0.2	2
Methylene chloride	4.7	7
Chromium (total)	0.06	7
Lead	0.9	6
Nickel	0.04	7
Zinc	0.03	6
Mercury	0.03	7
1,1-DCE	6	4
1,1-DCA	0	5
1,1,1-TCA	200	2,3
1,2-DCE (cis)	70	2,3
1,2-DCE (trans)	100	2,3
Asbestos	10	5
PCE	0	5
TCE	0	5
Alcohol	data unavailable	--
PCB	0.014	7
2-Butanone	data unavailable	--
Xylene	0.8	8
DDD	0.01	8
DDE	0.0006	7
DDT	0.012	8
Cyanide	1	7
Oil	0.01	7

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continued

TABLE B-1
FRIENDS OF MERRYMEETING BAY CLEANUP RECOMMENDATIONS

ROD: EASTERN PLUME
NAS BRUNSWICK

MONITORING ELEMENT	MINIMUM CLEANUP LEVEL (micrograms per liter)	RATIONALE
Solvents	data unavailable	--
pH	6-8.5	2
Oxygen	>7 ppm	2
temperature	ambient	2

Sources for rationale:

1. University of Maine Coop Extension Service
2. State of Maine recommended levels
3. MCL (USEPA)
4. Current levels shall not be exceeded
5. MCLG (EPA)
6. ISBN 0 521 22495 (Pg. 291, based on application factor for fish)
7. EPA Region IV, Toxic Substance Spreadsheet data as modified by the State of Maine
8. Handbook of Acute Toxicity of Chemicals, U.S. Department of the Interior (modified for chronic criteria)

compare sampling results and evaluate the effectiveness of the remedial action and/or need for additional remedial actions.

16. Comment (verbal): Please explain the proposed discharge location shown on the map (see Figure 7 of the Eastern Plume Proposed Plan, December 1991).

Please explain why the target clean up level for 1,1-DCA is 3,500 parts per billion (ppb) when the maximum concentration in the Eastern Plume is 130 ppb.

Response: The discharge point on that map is a potential location where a connection could be made to the base sewer system.

The target cleanup level for the compound DCA changed midstream. The target cleanup level is not based on an MCL, as there is no MCL or MEG available for 1,1-DCA. The Navy had already identified this compound as being a contaminant of concern. The target cleanup level of 3,500 ppb was developed using current toxicity information in the literature.

17. Comment (verbal): How strong is the upward gradient in the bedrock groundwater?

Response: There are several bedrock monitoring wells with overburden monitoring wells adjacent to them. At these locations, there was a foot or two of upward gradient in that relationship.

18. Comment (verbal): With this foot difference, how far apart were those two points?

Response: The vertical distance between the two screened intervals is typically 20 to 40 feet and is a function of the clay thickness.

19. Comment (verbal): Do you feel that this upward gradient exists throughout the base area?

Response: Yes. See response to Comment 7.

20. Comment (verbal): The plan for the Eastern Plume is called interim. What do you anticipate would be the final solution, if there is to be something more done?

Response: The Navy has completed the feasibility study for the Eastern Plume. This area of contamination is understood to the point where it was appropriate to move forward. The Navy anticipates that the ultimate ROD for the groundwater will, in fact, be very close to, if not exactly, the proposed interim solution.

There is also a source area that is still contributing contamination to the plume, and if the source area is not remediated, there will always be a plume there. The Navy anticipates implementing a remedial action that will remediate that source area.

A final Proposed Plan and ROD for source control and management of migration will be prepared for the site, which will be subject to the same public and regulatory agency review and comments as the interim action.

21. Comment (verbal): How long will you be monitoring the Eastern Plume?

Response: Monitoring will continue until we've cleaned up the sites. It can go on for as short as five years or it could go on for 30 years, or more.

Once a remedy is selected and design of the system is begun, we will have a better idea of what the actual treatment system will look like. Then a Remedial Action Monitoring Plan will be developed. The purpose of this plan is to make sure that the system is performing as expected. The Remedial

Action Monitoring Plan is developed in the same manner as all other plans, with concurrence from the USEPA, the MEDEP, and TRC members.

The Remedial Action Monitoring Plan will set up a strategy to monitor the sites over a long period of time. In the Remedial Action Monitoring Plan, the target cleanup levels that are written in the ROD are addressed. The Remedial Action Monitoring Plan discusses the approach, the sampling frequency, and when remediation is to be considered complete.

If the USEPA concurs that the Navy has obtained the cleanup goal, then a delisting process is undertaken.

22. Comment (verbal): Did you identify any denser than water contaminants at Sites 1 and 3 or the Eastern Plume?

Response: We did identify various solvent compounds that do have densities greater than water. However, we never identified them at concentrations that would be indicative of the formation of an immiscible phase that would then have a density greater than water.

A solubilized plume, that is, a plume that contains solvent concentrations at the saturated limit, does not have a density difference great enough to allow for downward migration. In all of the investigations, there is no evidence for the presence of a separate phase.

23. General Comment (verbal):

What is the risk for the children coming in contact with any of the carcinogens? Can asthma be developed from the toxic waste at that base?

Response: There is currently no exposure to the contaminants in the Eastern Plume and, therefore, there are no risks to children. Future exposure to the contaminated groundwater is also considered

unlikely. This interim remedial action has been developed to limit contaminant migration and protect against future potential exposure.

Risks were evaluated specifically for Girl Scouts and Boy Scouts coming on the base. As mentioned earlier, Sites 1 and 3 has a unique current land use in that Boy Scouts or Girl Scouts that do access or come on base do not use that particular area. There is no exposure, and there likely will never be any exposure in that area. The risks from exposure at other sites (i.e., Site 8 and Site 9), were evaluated and are discussed in the respective Risk Assessment and Feasibility Study reports.

24. Comment (verbal): Have there been any studies on the community to see if any diseases due to exposure to toxins at the base are developing in the city at a faster rate than surrounding areas?

Response: There is an ongoing study by the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is a federal agency that is involved in the Superfund program at the NAS Brunswick. Representatives from ATSDR have attended a TRC meeting (April 11, 1991) and are involved in the remediation of the base. However, they have not reviewed information related to the Eastern Plume or initiated any studies related specifically to NAS Brunswick.

The role of ATSDR is to develop toxicological profiles of chemicals found at Superfund sites and to determine if a large enough population has been exposed. If so, ATSDR would conduct health studies and report to the USEPA. The public would have the opportunity to comment on the report.

25. General Comment (verbal):
Has there been any testing done at the old radar station off Old Bath Road or in the Topsham Annex? Unauthorized dumping may have occurred

there. Would you visit the site to see if there is anything going on?

Response: To our knowledge and during the Initial Assessment Study, we did not receive or identify any reports or knowledge of dumping or other activity at the old radar station. To date there have been no studies conducted at that site.

The Navy will discuss this area of concern with the base.

26. Comment (verbal): I heard that this present contamination on the base was just individuals dumping things.

Response: Sites 1 and 3 and the Eastern Plume are specific sites where there was a clear indication that some sort of disposal or leakage had occurred, or some practice that gave rise to environmental contamination.

27. General Comment (verbal):
I went to the Curtis Memorial Library on Tuesday, looked at the reference desk and found no study. It was not readily available.

Response: You need to go to the front desk and ask to see the information repository for the Navy. The person in charge of reference material will direct you to it.

28. General Comment (verbal):
Can we get an extension of time for comments?

Response: There is a legal and acceptable extension that's available. The comment period will be extended for one week.

APPENDIX C

MEDEP LETTER OF CONCURRENCE

STATE OF MAINE
Department of Environmental Protection

MAIN OFFICE: RAY BUILDING, HOSPITAL STREET, AUGUSTA
MAIL ADDRESS: State House Station 17, Augusta, 04333
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JOHN R. McKERNAN, JR.
GOVERNOR

DEAN C. MARRIOTT
COMMISSIONER

June 4, 1992

Thomas A. Dames
Captain, CEC, U.S. Navy
Commanding Officer
Department of the Navy, Northern Division
Naval Facilities Engineering Command
Building 77-L
Philadelphia Naval Shipyard
Philadelphia, PA 19112-5094

RE: Naval Air Station Brunswick Superfund Site, Brunswick, Maine

Dear Captain Dames:

The Maine Department of Environmental Protection (MEDEP) has reviewed the June 1992 Draft Record of Decision (ROD) regarding the Interim Remedial Action for the Eastern Plume for the Naval Air Station Brunswick Superfund Site located in Brunswick, Maine.

Based on that draft the MEDEP concurs with the selected interim remedial action. This action seeks to control and prevent further migration of the contaminant plume emanating from Sites 4, 11, and 13 until a final remedy for these sites and the Eastern Plume is chosen. This interim remedy will operate in conjunction with the remedial action selected for Sites 1 and 3. The interim remedial action involves the extraction, treatment and discharge of groundwater from the Eastern Plume area as outlined in the following:

I. Groundwater Extraction Wells

A. Groundwater extraction wells will be installed to remove contaminated groundwater from the designated plume area and to limit further migration of the plume towards Harpswell Cove.
B. The number of wells, pumping rates, and location of the wells will be determined during the design phase.

II. Groundwater Treatment

A. Extracted groundwater will be pumped to a central treatment plant.
B. Groundwater will be pretreated to remove inorganic compounds.
C. Groundwater will be treated to reduce or eliminate volatile organic compounds through the use of UV/oxidation technology.
D. Treatment levels will be based on the Public Operated Treatment Work's (POTW) National Pollution Discharge Elimination System permit and/or MCLs.
E. Treatability studies will be conducted prior to full-scale design.

III. Discharge of Treated Water

A. Discharge of treated water is expected to be to the base sanitary sewer system which connects to the Brunswick Sewer District, Public Operated Treatment Works (POTW).
B. Flow from the NABS treatment facility will not cause the POTW to exceed its capacity.

IV. Clean-up levels

A. Groundwater clean-up levels for contaminants have been set at the MCL.
B. In the absence of an MCL, groundwater clean-up levels have been based on a excess cancer risk level of 10^{-6} to 10^{-4} as set by USEPA policy or at a Hazard Index of 1.0 for non carcinogenic compounds.

V. Environmental monitoring

A. Monitoring wells will be sampled to confirm the effectiveness of the Interim action.
B. A monitoring program will be developed during the design phase and will require regulatory approval.

VI. Other remedial actions

A. Changes in the interim remedial action will be developed if necessary.
B. This interim action may be incorporated into or superseded by a comprehensive remedial action of the Site 4, 11, and 13 source areas.

This concurrence is based upon the State's understanding that:

A. The MEDEP will continue to participate in the Federal Facilities Agreement dated October 19, 1990 and in the review and approval of operational designs and monitoring plans.

B. Groundwater extraction wells established within the plume area will be maintained and sampled on a regular basis.

C. Selection and development of a final remedial action for the Eastern Plume source areas will continue.

The MEDEP looks forward to working with the Department of the Navy and the USEPA to resolve the environmental problems posed by this site. If you need additional information, do not hesitate to contact myself or members of my staff.

Sincerely,

Dean Marriott

Dean C. Marriott
Commissioner

cc: Alan Prysunka, Director, BHMSWC
Michael Barden, Director, DSIR
Mark Hyland, Director, FFU

APPENDIX D

ADMINISTRATIVE RECORD INDEX
AND
GUIDANCE DOCUMENTS

NOTE

Since the issuance of this Record of Decision, the Administrative Record has been restructured and its contents updated. For the current location of the documents and correspondence which supported this Record of Decision, please refer to the Master Index which accompanies the Administrative Record.

EASTERN PLUME

ADMINISTRATIVE RECORD

INDEX

Prepared for:
Naval Air Station Brunswick
Brunswick, Maine

SECTION I

INTRODUCTION

This document is the Index to the Administrative Record for the Record of Decision for the Naval Air Station (NAS) Brunswick National Priorities List (NPL) site (Eastern Plume). Section I of the Index cites site-specific documents, and Section II cites guidance documents used by Navy staff in selecting a response action at the site.

Although not expressly listed in this Index, all documents contained in the Record of Decision Administrative Record (Sites 1 and 3) are incorporated by reference herein, and are expressly made a part of the Administrative Record for the Record of Decision Administrative Record (Eastern Plume).

The Administrative Record is available for public review at NAS Brunswick Public Works Office, Brunswick, Maine. Questions concerning the Administrative Record should be addressed to Lt. Cmdr. Michael J. L'Abbe at NAS Brunswick Public Affairs Office (207) 921-2340, Brunswick, Maine.

The Administrative Record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

DATE	TITLE	AUTHOR	ADDRESSEE	DOC TYPE	PGS	FILE	REMARKS
10-Sep-91	EPA Comments on Draft Final Supplemental Remedial Investigation Report	EPA	NorthDiv	Letter	5	RI/FS	
20-Sep-91	DEP Comments on Draft FS	DEP	NorthDiv	Letter	8	RI/FS	
23-Sep-91	EPA and NOAA Comments on Draft FS	EPA	NorthDiv	Letter	35	RI/FS	
31-Oct-91	EPA Comments on Draft Proposed Plan Eastern Plume	EPA	NorthDiv	Letter	4	Proposed Plan	
6-Nov-91	DEP Comments on Draft Proposed Plan Eastern Plume	DEP	NorthDiv	Letter	3	Proposed Plan	
Dec 91	Proposed Plan Eastern Plume	EC Jordan	NorthDiv	Report		Proposed Plan	
Mar 92	Draft ROD Eastern Plume	EC Jordan	NorthDiv	Report		ROD	
2-Apr-92	EPA Comments on Draft ROD Eastern Plume	EPA	J. Shafer	Letter	13	ROD	
VOLUME 7D							
[illegible] 91	Draft Supplemental Remedial Investigation & Comments, Vol. I	EC Jordan	NorthDiv			RI/FS Report	
VOLUME 7E							
Apr 91	Draft Supplemental RI Report, Vol. 2	EC Jordan	NorthDiv			RI/FS Report	
VOLUME 7F							
Apr 91	Draft Final Supplemental Remedial Investigation	EC Jordan	NorthDiv			RI/FS Report	

SECTION II

GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at EPA Region I, Boston, Massachusetts.

General and Site-Specific EPA Guidance Documents

1. "National Oil and Hazardous Substances Pollution Contingency Plan," Code of Federal Regulations (Title 40, Part 300), 1985.

2. U.S. Environmental Protection Agency. Comprehensive Environmental Response Compensation and Liability Act of 1980, as Amended October 17, 1986.

3. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (Interim Final) (EPA/540/G-89/004, OSWER Directive 9355.3-1), October 1988.

4. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites (EPA/540/G-88/003), December 1988.

5. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Interim Final Guidance on Preparing Superfund Decision Documents (OSWER Directive 9355.3-02), July 1989.

6. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Ground Water Issue - Performance Evaluation of Pump-and-Treat Remediations (EPA/540/4-89/005), October 1989.

7. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A - Interim Final) (EPA/540/1-89/002), December 1989.

8. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Technology Evaluation Report: SITE Program Demonstration of the Ultrox International Ultraviolet Radiation/Oxidation Technology (EPA/540/5-89/012), January 1990.

9. "National Oil and Hazardous Substances Pollution Contingency Plan," Federal Register (Vol. 55, No. 46), March 8, 1990.

10. U.S. Environmental Protection Agency. Office of Communications and Public Affairs. Glossary of Environmental Terms and Acronyms List. (EPA 19K-1002), December 1989.